Mémoire

Pour la croissance de TechnoMontréal afin de soutenir la grappe des TIC et ses partenaires

« Le développement économique de Montréal passe par le domaine des TIC. Il est donc primordial de favoriser son développement et d'assurer une relève de qualité »
Stéphane Boisvert, président de la Coalition canadienne pour une relève en TIC et président de Bell Canada, groupe Grandes entreprises

Présenté à la Commission permanente du conseil d'agglomération sur le développement économique

Dans le cadre de l'étude publique du bilan de la grappe des technologies de l'information et des communications

Par la Coalition canadienne pour une relève en TIC
Le 29 avril 2009

COALITION CANADIENNE POUR UNE RELÈVE EN TIC

Pour la croissance de TechnoMontréal afin de soutenir la grappe des TIC et ses partenaires

TechnoMontréal : un joueur clé pour le Grand Montréal

Lancé en 2007, l'organisme TechnoMontréal est devenu un leader dans la croissance de la grappe des technologies de l'information et des communications (TIC) du Grand Montréal. L'approche de TechnoMontréal est complémentaire à celle de la Coalition canadienne pour une relève en TIC (ci-après la Coalition). En effet, la Coalition est une initiative multilatérale ouverte, pilotée par l'industrie, qui a pour mission d'assurer que les organisations puissent recruter les professionnels des technologies de l'information et des communications dont elles ont besoin, avec les connaissances, les compétences et le talent qui répondent aux exigences changeantes et variées de ce domaine, à l'échelle du Canada. Parallèlement, TechnoMontréal vise à soutenir la grappe des TIC à Montréal afin que les entreprises d'ici puissent s'y développer pleinement et que l'arrimage entre le secteur public et le secteur privé soit facilité. L'objectif global de la Coalition et de TechnoMontréal est le même; favoriser la croissance du secteur des TIC.

Par ailleurs, TechnoMontréal joue un rôle clé d'appui et de liaison pour affronter les enjeux majeurs qui nécessitent une large mobilisation des acteurs du milieu. Un de ces enjeux est le manque sévère de main-d'œuvre qui sévit dans le secteur des TIC, un enjeu au cœur des préoccupations de la Coalition. Dans l'économie de l'information d'aujourd'hui, le talent humain représente la plus grande ressource d'un pays. En effet, au cours des huit prochaines années, les employeurs du Canada devront recruter environ 150 000 professionnels en TIC en réponse à la croissance continue du secteur et aux départs à la retraite du personnel actuel. Quant on pense qu'aujourd'hui les employeurs ont déjà de la difficulté à embaucher suffisamment de professionnels en TIC en fonction de leurs besoins, la situation est alarmante.

Un virage important est en train de se produire. Les emplois dans le domaine des TIC deviennent de plus en plus complexes, exigeants et spécialisés. Ils deviennent par contre beaucoup plus intéressants, stimulants et diversifiés. Dans chaque domaine – depuis le divertissement jusqu'à l'environnement en passant par la santé – les TIC se trouvent à l'avant-garde du changement et de la créativité. Tout cela demande un nouveau genre de professionnel en TIC, beaucoup plus comme un individu complet à l'esprit universel qu'un technologue traditionnel.

À ce chapitre, l'approche de TechnoMontréal est encore une fois très complémentaire à celle de la Coalition. En effet, alors que la Coalition cible principalement les étudiants dès le secondaire pour leur faire découvrir les différentes possibilités de carrière en TIC, TechnoMontréal propose de positionner Montréal comme un centre de créativité et d'innovation afin d'attirer des entreprises, et par le fait même, des gens talentueux à s'installer dans la métropole pour qu'ils puissent y découvrir les emplois des TIC 2.0., en plus de sensibiliser le public (particulièrement les jeunes) par rapport au secteur des technologies de l'information et des communications.

Les TIC : un secteur en croissance au service de la prospérité économique

Les industries des technologies de l'information et des communications du Canada – principalement le matériel informatique et les logiciels, les télécommunications et les services professionnels connexes – comptent pour 140 milliards de dollars du PIB du pays. Voici quelques chiffres qui résument bien la situation. De 2002 à 2007, la croissance du PIB du secteur des TIC était de 5,1 % annuellement, contre 2,7 % pour l'économie globale. L'industrie est d'ailleurs la moins touchée par la crise économique étant donné sa très grande capacité d'innovation. Cette industrie est de plus un moteur de croissance. Il faut donc tirer profit de la crise économique actuelle en réaffirmant le positionnement du Grand Montréal sur le plan mondial. À cet égard, TechnoMontréal est un joueur important de la grappe des TIC puisque l'organisme vise à réunir les intervenants montréalais impliqués dans le soutien à l'innovation en plus d'établir le leadership mondial de la métropole en positionnant Montréal comme un centre de créativité et d'innovation. La croissance de TechnoMontréal va favoriser la croissance du développement économique de la Ville de Montréal pendant la crise et par la suite.

Les prévisions entourant le secteur des TIC estiment que ce secteur va se développer encore très rapidement puisqu'il s'imbrique dans une variété de domaines (énergie, sciences de la vie, santé, sécurité, affaires, médias, communications interpersonnelles, etc.). Cette croissance ne peut se baser que sur les connaissances, les habiletés et le talent; des enjeux centraux d'une économie du savoir florissante. Il est primordial de repenser les priorités de Montréal afin d'assurer que les TIC puissent y prendre la place stratégique qui leur revient. À cet égard, la création d'une grappe des TIC et l'apport de TechnoMontréal ne peuvent que contribuer au succès économique du Grand Montréal.

Le secteur des TIC dépense plus de 5,7 milliards de dollars par an en recherche et développement, soit deux fois plus que n'importe quel autre secteur, et 40 % de toutes les dépenses en R & D du secteur privé. C'est là tout un exploit pour une industrie qui ne représente que 5,5 % du PIB. Il est encore une fois évident qu'une grappe dynamique des TIC à Montréal est essentielle pour la santé économique de la ville. À cet égard, TechnoMontréal soutient les entrepreneurs en facilitant l'accès au capital et en soutenant les initiatives de financement pour la R & D et pour l'innovation, par exemple. L'accès au capital et les investissements dans le domaine des TIC constituent les principaux moteurs de croissance de la productivité, tant au niveau des entreprises que de l'économie dans son ensemble.

Au Canada, le secteur des technologies de l'information et des communications (TIC) emploie annuellement près de 1,1 million de Canadiens, soit davantage de personnes que ceux de l'agriculture, de la foresterie, de la pêche, de l'exploitation minière, du pétrole et du gaz, des services, et du secteur manufacturier de l'industrie des transports (incluant l'automobile), combinés. Il s'agit d'une main-d'œuvre fortement scolarisée où plus des deux tiers ont une formation postsecondaire. À Montréal, la grappe des TIC regroupe 5 000 entreprises dans des secteurs aussi variés que ceux de la fabrication, des logiciels, des services informatiques, des services de télécommunications, des services et médias numériques interactifs, de l'audiovisuel et du son numérique et des arts numériques, totalisant 120 000 emplois. Cependant, la vitalité de ce secteur réside dans la qualité de sa relève; or de 2002 à 2005, les établissements postsecondaires ont noté une diminution des inscriptions de 26 % dans les programmes en TIC. À terme, il n'y aura donc en 2010 que 4 002 diplômés, soit 893 de moins qu'anticipé. De façon complémentaire, la Coalition vise à renverser la vapeur et à stimuler la relève, de même que la grappe des TIC. Par l'entremise de TechnoMontréal, la grappe des TIC permet de regrouper et soutenir l'ensemble des acteurs du domaine des TIC de la métropole autour d'objectifs communs afin d'optimiser la compétitivité, la croissance et le rayonnement du secteur. Ces stratégies auront un impact sur la perception des TIC auprès des jeunes et par la suite sur la relève.

Et ce n'est pas tout. Les TIC sont essentielles à la prospérité et à la productivité de toutes les industries : médias et culture, édition, publicité, ressources naturelles, services financiers, soins de santé, construction, détail ou éducation. Ces industries « utilisatrices » emploient plus de 225 000 professionnels en TIC, dont la contribution est essentielle à la créativité, l'innovation, la satisfaction de la clientèle, la productivité, la sécurité et l'avantage concurrentiel.

Les emplois dans ces secteurs évoluent et le Canada doit intensifier ses efforts pour rester concurrentiel et gagner dans la conjoncture économique d'aujourd'hui. À Montréal, TechnoMontréal est un organisme essentiel à la préservation d'un réseau solide pour affronter ces défis.

La Coalition canadienne pour une relève en TIC : une initiative nationale pour contrer la pénurie de main-d'œuvre

Fondée en 2007 à l'instigation de Bell Canada, la Coalition canadienne pour une relève en TIC est une initiative qui vise à mieux faire connaître les technologies de l'information et des communications auprès du public, et plus particulièrement auprès des employés potentiels, afin de stimuler une relève de qualité. Tel que mentionné précédemment, la Coalition est une initiative multilatérale ouverte, pilotée par l'industrie, et à vocation pratique. Sa mission est d'assurer que les organisations canadiennes puissent recruter les professionnels des technologies de l'information et des communications qui possèdent les connaissances, les compétences et le talent pour répondre aux besoins changeants et variés de ce domaine passionnant. Ses membres incluent des entreprises, des établissements universitaires, des associations professionnelles, des organisations de l'industrie, et d'autres parties intéressées dans le développement des capacités en matière de TIC au Canada. Il est à souligner que la majorité des membres sont situés à Montréal et à Toronto, et que le siège social de la Coalition est basé à Montréal. Ceci résulte du dynamisme montréalais

dans le secteur des TIC qui a su attirer, par sa grappe industrielle, de nombreuses grandes entreprises.

En tant qu'entreprise innovante, Bell est bien au fait de la difficulté de recruter les meilleurs éléments de ce secteur et du rétrécissement du bassin de talents. La diminution des inscriptions en TIC pousse maintenant les compagnies à entreprendre des efforts plus intenses et plus désespérés pour recruter les meilleurs talents. L'ampleur du problème est sans contredit d'envergure nationale – il exige une réaction vigoureuse et concertée. Pour ce faire, nous avons besoin de la détermination, du plan stratégique et du leadership des secteurs tant privé que public. Ainsi, l'enjeu principal sur lequel se concentre la Coalition est la pénurie de main-d'œuvre en TIC. Il y a trois principaux canaux d'où provient la main-d'œuvre :

- La réorientation et les formations complémentaires
- L'immigration de professionnels
- L'inscription étudiante dans les établissements postsecondaires

Dans un premier temps, la Coalition a choisi de concentrer ses efforts pour contrer la baisse d'inscription dans les programmes postsecondaires en TIC. Les jeunes se sont détournés des programmes postsecondaires liés aux TIC dans les universités, les collèges et les CEGEP à la grandeur du pays. Au cours des cinq dernières années, les inscriptions à ces programmes ont chuté dans une proportion de 30 à 40 % et plus. Même les écoles commerciales ont de la difficulté à attirer des étudiants dans des programmes majeurs ou combinés en TIC. De plus, ce secteur reste encore largement masculin. Les filles sont beaucoup moins enclines que les garçons à entreprendre une carrière en TIC. Les femmes représentent seulement un quart de la main-d'œuvre en TIC, et environ un quart des étudiants inscrits à des programmes postsecondaires liés aux TIC.

En plus d'avoir de moins en moins d'étudiants se dirigeant dans le secteur des TIC, le facteur démographique contribue à aggraver le problème de la baisse des inscriptions. La croissance de la population âgée de 15 à 19 ans va culminer en 2009. Puis, la taille de ce groupe d'âge va diminuer continuellement, réduisant par le fait même le bassin d'étudiants potentiels.

Pourquoi les jeunes se désintéressent-ils des carrières liées aux TIC, non seulement au Canada, mais aussi dans bien d'autres pays? Bien qu'il y ait de nombreuses théories, il n'existait pas d'études ou de preuves concrètes au sujet de ce phénomène. Pour affronter efficacement cette problématique, la Coalition canadienne pour une relève en TIC a mandaté le Conference Board du Canada pour étudier cette question. Le Conference Board a questionné plus de 1 000 élèves à travers le Canada, leurs parents et les conseillers en orientation de leurs écoles. L'objectif de cette étude est de déterminer quels sont les facteurs qui influencent les jeunes dans leur choix de carrière. Aussi surprenant que cela puisse paraître, il s'agit de la première étude de ce genre au monde. Les résultats seront publiés d'ici quelques semaines. Selon les résultats préliminaires, cette étude donnerait un support tangible au point de vue de la Coalition sur la baisse des inscriptions.

Selon les résultats préliminaires, les principaux facteurs d'influence ne sont pas la facilité de se trouver un emploi, la sécurité d'emploi, les voyages d'affaires ou encore le niveau de difficulté de l'emploi. À l'adolescence, les facteurs qui ont le plus d'influence sur le choix de carrière sont le niveau de créativité, le facteur « cool », l'intérêt pour le domaine et le niveau de « fun » au travail. Or, l'explication habituelle pour justifier le désintéressement des jeunes par rapport au secteur des TIC est qu'ils sont simplement mal informés. Ils croient à tort qu'il n'y a pas d'emplois dans le domaine (en raison de la délocalisation et de l'effondrement des sociétés point.com), ou que les emplois en TIC sont ennuyeux (rester assis devant un écran d'ordinateur toute la journée). Selon cette théorie, tout ce que nous avons à faire, c'est corriger ces perceptions par une vaste campagne de marketing. Or, cette stratégie a été mainte fois essayée, mais sans succès. Le nombre d'inscriptions n'a pas augmenté.

La Coalition canadienne pour une relève en TIC croit plutôt que les jeunes prennent les meilleures décisions possible selon l'information à leur disposition. Dans certaines régions du pays, de nombreux professionnels en TIC sont sans emploi parce qu'ils ne possèdent pas les compétences recherchées par les employeurs, ce qui fait croire qu'il y a pénurie d'emplois. Les programmes postsecondaires ne font que commencer à s'adapter aux nouvelles exigences des employeurs; c'est donc dire que les étudiants ne peuvent pas toujours acquérir les compétences nécessaires pour un marché de l'emploi changeant. Nous reconnaissons aussi que les employeurs pourraient faire mieux en s'assurant d'offrir aux travailleurs en TIC de meilleures perspectives de développement personnel et de perfectionnement professionnel.

Investir dans les programmes de compétence

Pour affronter la pénurie de main-d'œuvre, la Coalition compte sur la participation des principaux acteurs du domaine des TIC (employeurs et établissements postsecondaires) afin d'améliorer les perspectives de relève. Dans un premier temps, la Coalition vise principalement deux approches pour montrer concrètement les changements et le dynamisme des carrières en TIC. D'une part, la Coalition a initié la création d'un programme universitaire uniforme canadien (*IT Management for Business*) qui correspondra davantage aux besoins de l'industrie pour les nouveaux emplois en TIC en assurant que l'élaboration du curriculum d'étude soit faite conjointement entre les entreprises et les universités. Ce programme sera annoncé à l'automne 2009 et devrait être ouvert aux inscriptions dès l'automne 2010. D'autre part, les employeurs doivent mettre en place une proposition de carrière en TIC plus stimulante où l'avancement dans l'entreprise est facilité grâce à une intégration des fonctions de gestion. Il s'agit d'une approche qui va bien au-delà d'un coup de marketing en rendant réellement les emplois plus accessibles et plus dynamiques, et en améliorant la formation. Une fois ces étapes complétées, la Coalition lancera une Semaine des TIC afin de faire la promotion de ces changements auprès des étudiants, des enseignants, des parents et des conseillers en orientations pour les informer des multiples carrières stimulantes et créatives qui existent dans le domaine des TIC. L'objectif sera donc une augmentation des inscriptions postsecondaires puis, à terme, une meilleure relève en TIC pour les besoins de cette industrie en constante évolution.

Conservons nos acquis et développons l'avenir

Afin de conserver les talents qui seront issus de cette nouvelle structure, il est primordial d'accroître et de stimuler le bassin d'entreprises et d'organismes en TIC du Grand Montréal, qui regroupe déjà 73 % des emplois québécois en TIC. C'est ici qu'interviennent TechnoMontréal et la grappe des TIC qui vont contribuer à maintenir et à élargir le bassin d'entreprise dans la métropole afin d'affirmer le leadership mondial de Montréal comme centre de créativité et d'innovation. En plus de permettre une meilleure rétention des cerveaux québécois, cela aura pour effet d'attirer des travailleurs compétents provenant d'ailleurs.

ANNEXES

Liste des membres
Pour nous joindre
Étude du Conference Board du Canada “Securing our Future”

Liste des membres

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Étude du Conference Board du Canada

“Securing our Future”

Report

Securing Our Future:
Components of a Comprehensive IT Workforce Development Strategy

Presented to
Bell Canada

Prepared by
The Conference Board of Canada

January 16, 2008

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Executive Summary

The IT Effect on Competitiveness

IT underpins much of Canada's economic performance and economic growth. At the centre of IT activity is the Information and Communications Technology (ICT) Sector. More than 251,000 IT workers are concentrated in the ICT sector, producing advanced technology goods and services that support economic activity across the economy and, in doing so, generate a significant contribution to GDP themselves. Beyond the ICT sector, a further 353,000 IT workers are embedded in every other sector of the economy where they, too, are major contributors to the competitiveness and growth of Canadian firms in the global marketplace. Altogether, there are more than 605,000 IT workers across all sectors of the Canadian economy, who make up 3.5 per cent of Canada's total workforce.

In the long run, labour force growth and productivity are two of the key drivers of economic growth. Information and Communications Technologies (ICTs) are a powerful agent for enabling people to increase their productivity and performance throughout the Canadian economy. IT workers, creating, producing and using ICTs throughout the economy have a vital role in modern economic performance and underpin most gains in productivity today. Understandably, Canada has an important national interest in maintaining the capacity of its ICT sector and in ensuring an adequate supply of IT workers to all sectors of the nation's economy.

The ICT sector contributed over $65 billion to Canada's GDP in 2006. Within the last decade, this important growth sector's contribution to GDP rose from 4.0 per cent to 5.9 per cent. High-value-added telecommunications services accounted for 41 per cent of the ICT sector's contribution to GDP in 2006. The ICT sector's 638,800 workers make up 3.9 per cent of Canada's total workforce.

IT workers as individuals are important contributors to economic production. In fact, each employed IT worker has a multiplier effect on the Canadian economy. For every IT worker employed, the impact to Canadian GDP is 1.75 times the sum of their wages earned and the profits generated as a result of work they perform.

The IT workforce tends to be younger and better educated than the workforce as a whole. IT workers also tend to be fully employed—at 2 per cent, their unemployment rate is only one-third of the 6 per cent unemployment rate for the Canadian workforce overall.

The Growing Demand for IT Workers

The IT workforce is set to grow to meet demand for the services they provide. Employers across the economy will be looking to fill 89,000 IT positions over the next three to five years. This will include hiring 58,000 workers for new IT positions and replacing 31,000 IT workers expected to leave the workforce due to retirement and other factors.

Challenges Associated with the IT Talent Gap

When trying to fill new positions and hire replacement workers for those leaving their jobs, IT employers are running up against a tightening labour market. This report identifies seven major factors that contribute to the IT talent gap: population aging; low fertility rate; declining enrolments in IT-related post-secondary programs; under-representation of several population groups; mismatch between the skills of available workers and the requirements of employers making hires; the need for flexibility and lifelong learning; and technology embeddedness and the growing need for multi-skilling.

The Decline in IT Graduates

Of the seven factors contributing to IT labour shortages, the most critical is that fewer qualified graduates are available to fill IT positions. Since the majority of new workforce entrants come from the education system, attracting more students into IT programs and making sure those programs are workplace relevant is mission critical. Enrolments in IT-related post-secondary programs have been declining since the dot-com crash of 2000. Significantly, between 2002 and 2007, enrolments in computer engineering, computer science and software engineering have declined by 22 per cent.

The Changing Nature of IT Jobs

IT workers who are entering the IT workforce will often find that their jobs require different skills than those they developed in the education system. As new hires, many of them will need to retool their skills to reach full productivity. Similarly, those who are already in IT jobs will often need re-skilling to accommodate changes in their jobs.

The Critical Undersupply of IT Workers

The immediate challenge facing IT employers is the anticipated undersupply of IT workers in the next three to five years. The most in-demand IT occupations are as follows:

- Managers: HR Managers; Computer and Information Systems Managers; E-Commerce Managers
- Engineers: Electrical and Electronics Engineers; Computer Engineers (excluding Software); Software Engineers
- Analysts: Information Systems Analysts and Consultants; Database Analysts and Data Administrators
- Programmers: Computer Programmers and Interactive Media Developers; Web Designers and Developers
- Technicians: Computer and Network Operators and Web Technicians; User Support Technicians; Systems Testing Technicians
- Other: Technical Writers; Graphic Designers and Illustrators.

The Economic Cost of Not Filling IT Positions

The Conference Board has calculated the economic impact to the Canadian economy of not filling the 89,000 IT positions that will open up in the next 3 to 5 years at over $10.6 billion, based on the average contribution of $119,335 made per worker annually to the economy. Clearly, if IT labour shortages are left unaddressed, they will have a significant negative impact on the Canadian economy. The impact of not filling IT positions would be even higher than $10.6 billion over the next 3 to 5 years if the supply chain effects of equipping IT workers to perform their role (e.g., accommodation, computer equipment, network and Internet connections) are considered.

The 89,000 positions will open up due to a combination of growth and replacement demand as IT workers retire or otherwise exit the workforce. If some of these jobs cannot be filled there will be a significant economic impact, affecting the whole economy, not just ICT employers. At the firm level, employers may be faced with turning down contracts, “staying small”, or offshoring work, all of which can have the effect of causing slower economic growth.

International Approaches for Engaging Target Populations to Alleviate IT Worker Shortages

The ICT sector and other employers are going to have to be very creative to obtain the number of IT hires required. One major strategy is to attract under-represented populations into IT careers. To achieve the level of employment needed, employers will need to make use of various approaches to attract workers from these under-represented populations. In this report, we include: youth, women, immigrants, mature workers, and displaced IT workers.

Examples are drawn from international practice of strategies employed by various stakeholders to alleviate IT worker shortages. These strategies may be useful to Canadian employers and policy makers. It is clear from our analysis of the international literature that different strategies are required for different target groups.

A Coalition for "Securing our Future"

A coalition of major IT employers has joined forces to address the IT labour shortage challenge. As part of a series of case studies that the Conference Board prepared, several members of the coalition participated in interviews to discuss the degree of coalition firms' reliance on ICTs and on IT workers; to quantify their demand for IT workers and the supply constraints they are experiencing; and to identify potential solutions. The insights provided by senior management within coalition firms pointed to the critical role of ICTs in the workplace.

The case studies reveal that ICTs perform eight critical functions, all of which add value by contributing to business performance:

- Strategic enablers of critical business functions;
- Differentiators of value;
- Dynamic tools for enhancing quality;
- A vehicle for increasing productivity;
- Strategic investments that contribute to operating efficiencies, help to reduce operating costs, and mitigate risks associated with dangerous working conditions;
- Drivers of innovation;
- A vehicle for creating a global presence; and
- A cross pollinator of business performance.

A Comprehensive Approach to Addressing the IT Labour Shortage

The recommended approach to address the IT labour shortage is a comprehensive one that involves increasing the supply of IT workers, improving transitions to work, creating additional demand for IT workers and effectively managing IT talent.

Key aspects of increasing the supply of IT workers in the talent pipeline include:

- Building ICT literacy within education curricula from elementary through to post-secondary;
- Promoting IT careers among male and female K-12 students in order to attract them into IT-related PSE educational programs (i.e. ensuring that students are aware that IT is a "rising star". IT is fast moving out of the back room and into the board room);
- Tapping unemployed or underemployed immigrant IT workers in Canada;
- Encouraging mature workers to remain in the workforce through flexible scheduling, part-time or contract work and other forms of modified work duties;
- Luring back former IT workers displaced during the dot-com crash and currently working in non-IT jobs; and
- Integrating into the IT workforce students who have graduated from IT-related programs since the dot-com crash.

But increasing the size of the IT talent pipeline is only part of the solution. Employers must do a better job of integrating IT employees into Canadian workplaces. The most effective way to increase absorption rates is to improve the transitions system feeding into the labour market by:

- Engaging more IT employers to participate in bridging programs (co-ops, mentorships, internships;
- Enhancing orientation for new hires, including critical skills development;
- Promoting lifelong learning within the IT workplace; and
- Establishing multi-firm linkages to retain IT talent within the ICT sector.

Increasing the uptake of information and communications technologies (ICTs) in the broad economy also needs to be part of the strategy for ensuring the long-term health of the ICT sector and the IT workforce. Helping SMEs understand the potential productivity gains that can come from deepening and intensifying their investments in ICTs will increase demand for IT workers. It will also encourage the education system to enhance their efforts to make IT-related programming relevant and attract more students into those programs.

Finally, employers will need to manage their IT talent effectively if they are to retain IT workers in short supply and ensure those workers are part of an evergreen succession strategy. This will require employers to create work environments that welcome diversity. It will also require employers to hire more immigrants and to be supportive of them as they go

through the process of having their credentials recognized in Canada.

As firms throughout the economy intensify and leverage their investments in ICTs to boost productivity and move up the value chain, we expect them to hire even more IT workers. They will need help in meeting their objectives of increasing productivity and competitiveness by hiring IT workers. Giving them the aid they require is crucial since the more successful these employers are in hiring the IT staff they need, the more vibrant the Canadian economy will be.

CHAPTER 1

Introduction: Convergence in the IT Talent Gap

Few corporate leaders would challenge the importance of technological innovation and scientific discovery for ensuring national competitiveness in the global market. Few government leaders of developed economies would question the role of information and communications technology as a key driver of national productivity. Indeed, the information and communications technology (ICT) sector and the information technology (IT) workers across sectors are largely responsible for creating the mediating instruments for growing a knowledge-based economy.

It should be noted that not everyone who works in the Information and Communications Technology sector is an IT worker. As in other sectors, managers, administrative support staff and other categories of workers are employed in the ICT sector. As well, it should be noted that there are IT workers in many sectors, not just in the ICT sector. To make the situation even more complex, not every worker who uses information and communications technologies (ICTs) in their job is an IT worker! In this report we are concerned with IT workers, whether they work in the ICT sector or in other sectors.

Eighty per cent of Canada's IT workers are employed in a variety of jobs in the following industry groupings:

- Professional, scientific and technical services;
- Manufacturing;
- Public administration;
- Information and cultural industries; and
- Finance and insurance.[1]

IT employers are raising alarm bells because they are currently experiencing an undersupply of IT workers and they believe that trend is set to continue unless measures are taken now to increase the supply of IT workers in the economy. Unemployment of IT professionals peaked at 6 per cent in mid 2002, but, since then, the unemployment rate for IT workers has remained consistently below the national average for the workforce as a whole, and declined to 1.9 per cent in 2006.[2] This is an unemployment rate below the natural rate of unemployment, which indicates a real labour shortage. The effects of shortages in IT occupations can have an inflationary pressure on wages for IT workers and can have potential negative impacts on innovation and productivity across the national economy.

Seven major factors contribute to the IT talent gap in Canada:

- Population aging;
- Low fertility rate;
- Declining enrolments in IT-related post-secondary programming;
- Under-representation of key population groups;
- Mismatch in the supply of skilled workers and the skill sets employers are looking for in in-demand jobs;
- The need for flexibility and lifelong learning; and

[1] Canadian IT Labour Market Initiative," (May 2007), Information and Communication Technology Council, p. 10.
[2] W.G. Wolfson, *Analysis of Labour Force Survey Data for the Information Technology Occupations 2000–2005* (Ottawa: Software Human Resource Council, 2006).), p. 8.

- Technology embeddedness and multi-skilling.

First, an important demographic trend is the aging of Canada's population and the growing rate of retirements. True, the IT workforce is younger overall relative to other sectors. But increasing retirement rates mean the loss of experienced workers, fewer mentoring opportunities for the next generation workforce, a declining labour force participation rate, and intensified competition to attract new entrants. Canada will not face these challenges alone. Nearly every major region in the world will experience a rise in the relative size of their older cohort.[3]

The second key factor contributing to the IT talent gap is Canada's low fertility rate. A major determinant of population growth is natural population increase, that is, the number of births less the number of deaths that occur each year. A fertility rate of 2.1 per cent would allow Canada to maintain the population at its current size without relying on immigration. Canada's fertility rate was only 1.54 births per woman in 2005.[4]

Canada will therefore be relying heavily on immigrant-based solutions to meet anticipated worker shortfalls, but Canadian employers are also expected to look at non-immigration-based solutions (such as enticing mature workers to remain in the workforce longer, investing more intensively in Machinery and Equipment and Information and Communications Technologies) to help alleviate their labour shortages.

The third critical factor impacting the IT talent gap is declining enrolments in postsecondary IT-related disciplines across most of Canada. Overall, enrolments have been falling for several years, due in part to the negative image resulting from the dot-com crash of 2000. Another factor influencing enrolment rates in some provinces such as Québec is that fewer people are in the prime university age cohort. Between 2002 and 2007, the contraction in actual and projected university enrolment in computer engineering, computer science and software engineering combined is estimated at 22 per cent, with a significant drop in computing disciplines expected to occur in 2006-2007.[5] In the meantime, other nations such as India and China are graduating growing numbers of IT professionals and Canadian firms are increasingly adopting offshore services.

Employers will face growing pressures to rejuvenate the workforce pipeline as older workers retire in record numbers over the next two decades. This situation presents opportunities for re-organizing or redesigning work processes and for attracting younger, skilled workers to the plethora of career opportunities that will become available to them. The vast majority of new entrants to the labour force come from the formal education system.

A fourth important factor contributing to IT talent shortages is the under-representation of several population groups in Canada's IT labour force. Nationally, women account for only 26 per cent of IT workers. Yet, women account for two thirds of the full-time enrolment growth in universities since 1971, a surge that has been driven by their growing participation in the Canadian labour market.[6] Immigrants with critical skills and excellent credentials are also under-represented. They face substantial barriers to entry into the labour market. These groups represent a vital source of potential untapped talent.

A fifth factor influencing the IT talent gap in Canada is the mismatch between the supply of skilled workers and the skill sets employers are looking for in in-demand jobs as a result of the constant changes in the nature of IT work. Nationally, the overall hiring requirement for the next three to five years is estimated at 89,000 IT jobs. This includes a net increase in IT occupational employment of about 58,000 jobs for the next three to five years and replacement demand of 31,000 over the next four years.[7] Because the nature of IT work is in constant flux as new technologies and other innovations are

[3] The Conference Board of Canada, *How Canada Performs: A Report Card on Canada* (Ottawa: The Conference Board of Canada, 2007)
[4] Ibid., p. 26. (chart updated for 2005).

[5] Michael Campbell Robinson Consulting Inc, *University Engineering Enrolment Survey* (Ottawa: Software Human Resource Council, 2005), p. 5.
[6] Association of Universities and Colleges Canada, *Trends in Higher Education, Vol. 1: Enrolment* (Ottawa, 2007). p. 5.
[7] John O'Grady, *Outlook for Canadian IT Occupational Employment*, (Toronto: Prism Economics and Analysis, Autumn, 2006). p. 1.

continuously introduced, the knowledge and skills requirements of new entrants to the IT job market may differ from the skills required from those who are retiring. Occupations may need to be redefined and/or redesigned and the tenure of workers who intend to remain in the workforce will depend on their ability to retool their IT skills to remain current.

Similarly, a sixth factor contributing to the IT talent gap in Canada relates to the qualities IT workers must possess. Flexibility and lifelong learning are essential for sustaining continuous innovation and for diffusing innovation through information technology within the ICT sector and across the economy. Flexibility and a commitment to lifelong learning are attitudes and habits of behaviour that must be nurtured to ensure that workers remain nimble and maximize their contribution to innovation and diffusion of information technology.

A seventh factor contributing to a shortage of IT workers is an increase across all sectors in employer demand for workers with IT skills, as businesses seek workers capable of multi-skilling and as inter-sectoral integration of technology skills intensifies. Increasingly workers require skills and competencies beyond traditional occupational classifications, including the ability to adapt to rapidly changing technologies and market demands. Organizations that adopt new technologies might find themselves in need of permanent IT staff which will increase labour market demand. Some will opt for multi-skilling of their current workforce to enable workers to cope with the new IT component of their jobs.

The convergence of these seven factors impacting the supply of, and demand for, IT workers presents a formidable challenge for the ICT sector and for employers of IT workers across sectors.

This study looks at the economic impact of IT talent shortages at an occupational level so that firms, industry segments and regions can assess their specific needs and challenges. The Conference Board of Canada has undertaken an assessment of the economic costs of not filling a particular IT position. In other words, we present a quantified estimate of the cost to the Canadian economy of not addressing the IT talent gap. The underlying premise is that failing to take measures to increase the supply of IT workers will have a negative impact not only on prospective employers of IT workers, but also on the economy at large. We have calculated the economic cost of not filling a single IT position for each of 15 occupations and present a weighted average for all IT occupations. With these calculations, it is possible to estimate the total economic impact of doing nothing to increase the supply of IT workers. Using the Conference Board's calculations, it will also be possible to keep tabs on the economic cost of whatever gap remains, as steps are taken to increase the supply of IT workers.

This paper explores a range of international strategies for alleviating IT talent shortages. This section focuses on approaches undertaken by several countries to address labour market shortages by targeting a range of population groups, including:

- Youth;
- Women;
- Immigrants;
- Mature workers; and
- Displaced IT workers.

The study also presents several best practice case studies implemented by companies in response to the challenges and changing priorities of IT work.
A critical analysis of findings from this research is captured through a set of recommendations for moving forward. What is clear from this research is the need for an employer-driven comprehensive workforce development strategy, developed collaboratively with key stakeholders in industry, education and government, and which integrates a range of solutions for "securing our future".

CHAPTER 2

Research Methodology

Four methodologies underpin this study:

- First, a literature review of recent publications focuses on the future of work within the ICT sector and IT employment across the Canadian economy.
- Second, a keystone of this research is an economic analysis examining the impact of IT labour shortages based on high demand occupations. The analysis draws several data sources, including The Conference Board of Canada, the Information and Communications Technology Council Annual Labour Force Survey and Statistics Canada Labour Force Survey special tabulations.
- A third important component involves an international scan of strategies deployed to address the IT talent shortage.
- The final section of the report includes case studies based on interviews with several major IT employers to gain insights regarding critical issues and strategies for addressing the IT talent gap.

CHAPTER 3

Canada's ICT and IT Labour Force

Distinguishing ICT and IT Jobs

The Information and Communications Technology (ICT) sector encompasses producer industries. John O'Grady of Prism Economics and Analysis estimates that the producer industries account for about half of all IT employment in Canada, although regional variations exist.[8] Following the Information and Communications Technology Council of Canada, for the purpose of this research ICT employment refers to all jobs in producer industries, including both IT jobs and non-IT jobs.

User industries encompass other sectors of the economy, such as the financial services sector and the public sector. They also account for about half of all IT employment, with regional variations. Again, following the Information and Communications Technology Council of Canada, for the purpose of this research, IT employment refers to information technology jobs across all sectors of the economy.

As Table 1 indicates, Canada's ICT sector employs 638,800 workers, of which 251,600 are in IT occupations. Other sectors of the economy employ 353,400 IT workers. In total, 605,000 IT workers are employed in the Canadian economy.

Canada's ICT Sector: Key Facts and Figures

The ICT sector is a significant contributor to the Canadian economy. According to the Canadian ICT Sector Profile[9] produced by Industry Canada, the country's information communications and technology sector contributed over $65 billion to national GDP in 2006. GDP is a measure of value added, that is, wages plus profits. The ICT sector represents 5.9 per cent of Canadian GDP, up from 4.0 per cent a decade ago. In 2006, the ICT sector's GDP grew by 4.8 per cent compared to 2.9 per cent for the overall economy. Telecommunications services, the largest component, accounted for 41 per cent of the ICT sector GDP in 2006.

Looking at the ICT sector more closely, we see that it is a growth sector. In 2006, the sector achieved revenues totaling $139 billion, with $77.7 billion in ICT services, $39.1 billion in ICT wholesaling and $22.2 billion in ICT manufacturing. This compares to total revenues of $96 billion in 1997, an increase of 45 per cent over the past decade. Expansion of high value added industries accounts for much of the growth in this sector. Over the last ten years there has been a shift from ICT manufacturing to ICT services. ICT manufacturing revenues declined 17 per cent since 1997. Telecommunication services and

[8] John O'Grady, *Outlook for Canadian IT Occupational Employment*, (Toronto: Prism Economics and Analysis, Autumn, 2006) p. 3.

[9] Information and Communications Technologies Branch, Industry Canada, *Canadian ICT Sector Profile* (Ottawa: The Government of Canada, 2007), (retrieved from http://srategis.ic.gc.ca/infotech October 10, 2007).

Table 1

Canada's ICT and IT Employment Breakdown – '000s of Workers

Sector	Industry	IT Workers	Non-IT Workers	Total	IT Intensity
ICT Sector	Computer Services	172.1	86.7	258.8	66.5
	Telecommunications	40.5	125.4	165.9	24.4
	Comp. & Electronic Equip. Manuf.	23.6	84.6	108.2	21.8
	Other ICT Industries	15.4	90.5	105.9	14.5
	Total ICT Industries	**251.6**	**387.2**	**638.8**	**39.4**
Non-ICT Sector	Non-ICT Professional Services	80.8	1009.0	1089.8	7.4
	Public Administration	55.7	781.6	837.3	6.6
	Finance & Insurance	46.6	693.9	740.5	6.3
	Non-ICT Manufacturing	39.3	1952.9	1992.2	2.0
	Educational Services	21.8	1136.6	1158.4	1.9
	Non-ICT Information Industries	13.3	193.3	206.6	6.4
	Utilities	8.5	113.6	122.1	6.9
	Other Non-ICT Industries	87.5	9611.1	9698.6	0.9
	Total Non-ICT Industries	**353.4**	**15492.1**	**15845.5**	**2.2**
Total		**605.0**	**15879.3**	**16484.3**	**3.7**

Sources: The Conference Board of Canada; Statistics Canada (Labour Force Survey, special tabulations)

computer systems design industries accounted for 62 per cent of growth in total sector revenues, indicating that the sector itself is moving up the value chain.

The ICT sector is comprised of nearly 32,000 firms. The majority are very small, with 81 per cent having 1 to 9 employees, 14.3 per cent having 10 to 49 employees, 2.6 per cent having 50 to 100 employees and only 2.4 per cent having more than 100 employees. The majority of firms, 79.5 per cent, are in software & computer services; 11 per cent are in wholesaling; 7.2 per cent are in ICT manufacturing; and 2.4 per cent are in communications services.

In 2006, the ICT sector overall accounted for 3.9 per cent of total Canadian employment. Between 1997 and 2006, total sector employment rose from 510,400 to 638,800 (based on the North American Industry Classification System—NAICS), an average annual increase of 2.3 per cent compared to 2.1 per cent for the national economy. Most of this growth occurred in the software and computer services industries.

Employment in ICT manufacturing has declined by 27 per cent since 2000.

In 2006, ICT sector employees received average earnings of $56,465, about 45 per cent more than the average earnings for workers in Canada.

The ICT workforce is generally highly educated. In 2006, 41 per cent of the ICT workforce had a university degree compared with 23 per cent for the nation.

ICT Labour Markets: Canada's Regional Clusters

Industry Canada identifies five major regional labour markets for the ICT sector. They include British Columbia; the Prairie and Northern Region; Ontario; Quebec and the Atlantic Region. Characteristics of these regions are summarized in Table 2. Variations exist across the regions in terms of market segments.

Table 2
Regional ICT Sector Labour Markets (as of 2002)

Characteristics	Regional Labour Markets				
	BC	**Prairie and Northern Region**	**Ontario**	**Quebec**	**Atlantic Region**
Major Employment Cities and Regions	Vancouver	Edmonton, Calgary Saskatoon, Regina Winnipeg, Northwest Territories	Ottawa, Greater Toronto Area (GTA), Waterloo Region, Hamilton	Montreal, Quebec City	Halifax, Fredericton Saint John, Moncton Sydney, Charlottetown Newfoundland & Labrador
Major Industry Segments	• wireless • photonics • new media	• wireless • telecomm. • new media • software	• telecomm. • photonics • software • wireless • micro-electronics • e-business • communications equipment • new media	• telecomm. • new media • photonics • software • e-business	• telecomm. • software • e-business • marine communications • new media
Per cent of Canada's ICT Industry Employment	10 per cent	13 per cent	50 per cent	22 per cent	5 per cent

Source: Table assembled based on data sourced from http://strategis.ic.gc.ca; http://strategis.ic.gc.ca/epic/site/ict-tic.nsf/print-en/h_it05838e.html; http://strategis.ic.gc.ca/epic/site/ict-tic.nsf/print-en/h_ito5840e.html; http ://strategis.ic.gc.ca/epic/site/ict-tic.nsf/print-en/h_it05864e.html.

Canada's IT Labour Market

There are more than 600,000 IT workers employed across all sectors of the Canadian economy. About 95 per cent of these jobs are full-time.[10] The unemployment rate for IT occupations in 2006 was 1.9 per cent, considerably below the national average.

The IT workforce is male dominated. Close to seventy-five per cent of IT occupations are held by males.

Only 10 per cent of IT workers are visible minorities, although in some areas of Canada, particularly Toronto, the workforce is more diverse.

Canada's IT workforce is relatively young, with 46 per cent less than 35 years old. Ontario and Quebec employ almost three-quarters of the IT labour force.[11]

The IT workforce is well educated. Half of all IT workers have a university degree and a further 27 per cent have a college or CEGEP diploma.[12]

Three occupations - computer programmer, information systems BA/consultant and software engineer - account for 40 per cent of IT workers in the private sector. IT workers are similarly concentrated in these occupations in the public sector, although the proportion of software engineers is lower and user support is more prominent.[13]

This research focuses primarily on labour force challenges for the total IT workforce encompassing those employed across all sectors of the Canadian economy, including within the ICT sector.

[10] W.G. Wolfson, *Analysis of Labour Force Survey Data for the Information Technology Occupations (2000–2005)* (Ottawa: Software Human Resource Council, 2006),. pp. 3–8.
[11] W.G. Wolfson, *Analysis of Labour Force Survey Data for the Information Technology Occupations (2000–2005)* (Ottawa: Software Human Resource Council, 2006), p. 3.
[12] Morley Gunderson, Lee Jacobs and Francois Vaillancourt, *The Information Technology (IT) Labour Market in Canada: Results from the National Survey of IT Occupations*. Ottawa: Software Human Resource Council, April 2005). p. 11.
[13] Morley Gunderson, Lee Jacobs and Francois Vaillancourt, *The Information Technology (IT) Labour Market in Canada: Results from the National Survey of IT Occupations*. Ottawa: Software Human Resource Council, April 2005). p. 9.

Key Factors Impacting the IT Labour Force Challenge

Employers of Canada's IT workers face ever-increasing competition for IT talent as many factors converge to create mounting labour market pressures. This has serious implications for the sustained growth of the ICT sector which depends on strategic solutions to resolve current and impending labour shortages. The impact of shortages of IT workers impacts Canada's entire economy.

1. Aging Population

Demography, the study of human populations, includes an analysis of changes in population size, age structure and ethnic composition. Demographics play a pivotal role in a nation's economic life and are critically important for business.[14] The most important demographic trend affecting Canada's future is the age composition of the population. Canada's population and labour force are aging and Canada will not face this challenge alone. The Conference Board of Canada reports that nearly every major region in the world will experience a rise in the relative size of their older cohort.[15]

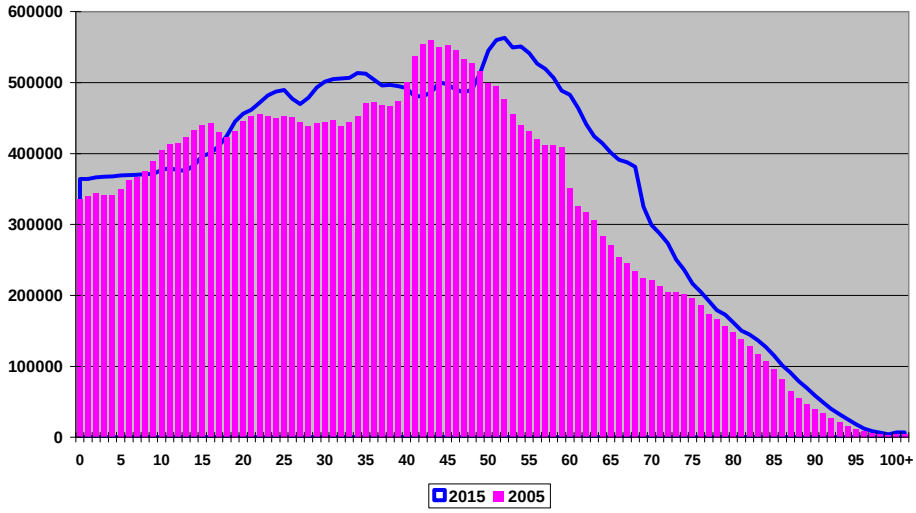
While the IT workforce is younger overall relative to other occupations, increasing retirement rates mean the loss of experienced workers and fewer mentoring opportunities for the next generation workforce, and a declining labour force participation rate. Despite the younger average age of the IT workforce, ICT and other sector employers still need solutions for balancing the supply and demand for IT workers.

2. Low Fertility Rates

A major determinant of population growth is the natural population increase, that is, the number of births less the number of deaths that occur each year. A fertility rate of 2.1 per cent would allow Canada to maintain the population at its current size without relying on immigration. Canada's fertility rate was only 1.54 births per woman in 2005.

The effects of these demographic trends can be seen in the significant shift in population distribution by age in Canada as illustrated in Figure 1.

Figure 1
Canada's Population Distribution by Age, 2015



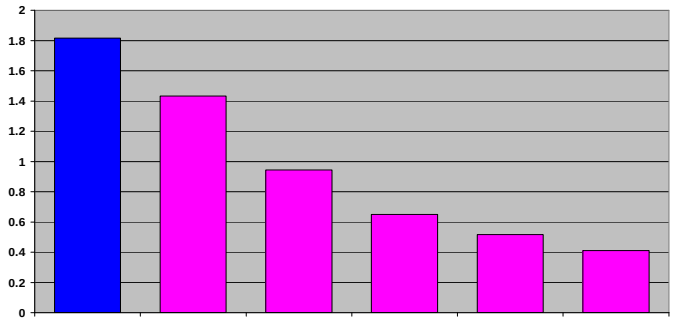
Source: Statistics Canada (Demography Division, Table 051-001 and special tabulations).

[14] David Foot, and Daniel Stoffman, *Boom, Bust & Echo: How to Profit from the Coming Demographic Shift* (Toronto: Macfarlane Walther & Ross, 2000).
[15] The Conference Board of Canada, *How Canada Performs: A Report Card on Canada* (Ottawa: The Conference Board of Canada, 2007).

The impact on labour force growth is also substantial. Figure 2 illustrates the contraction in growth that will occur over the next two decades, without significant increases in immigration.

Population and labour force growth are vital to economic growth. Roughly two-thirds of Canada's population growth now comes from net international migration, and according to population projections, net immigration may become the only source of population growth by about 2030. Within three years, by 2011, immigration is expected to account for all of Canada's net labour force growth.[16] Canada's success in attracting and retaining immigrants and other talent depends largely on the investments and policies made today to ensure that this country continues to be a great place to live and work. Ensuring an ample supply of talent and current skills within the ICT sector is critical for the sector's vitality and the quality of life and standard of living in Canada.

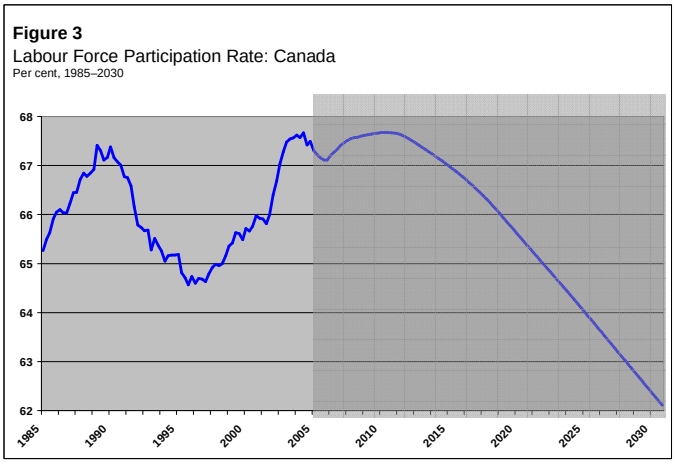
Figure 2
Labour Force Growth in Canada
Per cent change, compound annual growth



Source: The Conference Board of Canada

Labour force participation rates are set to fall drastically. (See Figure 3.) As a result, Canadian employers across all sectors will need to put more effort and resources into reaching out to immigrants and other international talent as well as other under-represented groups to encourage their participation in the IT workforce.

Figure 3
Labour Force Participation Rate: Canada
Per cent, 1985–2030



Source: The Conference Board of Canada

3. Declining Enrolments in Post Secondary IT Disciplines

Enrolments have been falling for several years, due in part to the negative image of the dot-com bust. Between 2002 and 2005, for example, the Computer Engineering, Computer Science and Software Engineering programs in universities experienced an 11 per cent decrease in enrolment.[17] The Association of Universities and Colleges of Canada suggests that undergrad enrolment in math, computer and information sciences has also been declining in recent years.[18] In the meantime, other nations such as India and China are graduating increasing numbers of IT professionals.

[16] Statistics Canada, *Portrait of the Canadian population in 2006: National Portrait* [online] (Ottawa: Author, December, 2007), [cited December, 2007] www.12statcan.ca/english/census06/analysis/popdwell/NatlPortrait1.cfm, p. 1

[17] Michael Campbell Robinson Consulting Inc., *University Engineering Enrollment Survey: A Summary of the Findings* (Ottawa: Software Human Resource Council. April 2005).

[18] Association of Universities and Colleges of Canada, *Trends in Higher Education, Vol. 1: Enrolment* (Ottawa; Association of Universities and Colleges of Canada, 2007).

Students also experience concern over job security as a result of growing trends such as outsourcing and offshoring. Canadian companies are increasingly outsourcing IT services to domestic and offshore providers, while the Canada-based IT outsourcing industry is servicing both domestic and foreign clients, especially call centre services.[19]
The decline in university enrolment has not been universal across the country. It has been most pronounced in Québec and Atlantic Canada, but enrolment has actually risen in British Columbia and Alberta. (See Figure 4.)

The Ottawa Region, Canada's advanced technology capital, has the second largest concentration of science and engineering employment out of 316 North American cities, surpassed only by Silicon Valley.[20] Total enrolment in science and technology courses at Ottawa's three major universities decreased by 21 per cent between 2001 and 2005.

In Canadian colleges, total enrolment has declined by eight per cent over the past three academic years, according to aggregated figures from 23 colleges.[21] Reductions are significant in programs such as computer engineering technology and computer science. Canadian colleges are projecting further employment declines in technology programs. Some of the reasons for declining enrolments include pervasive negative public perceptions—fallout from the dot.com bust; concerns about outsourcing and future job security; difficulty for new graduates finding jobs in the sector; and declining interest in science, math and engineering at a high school level.

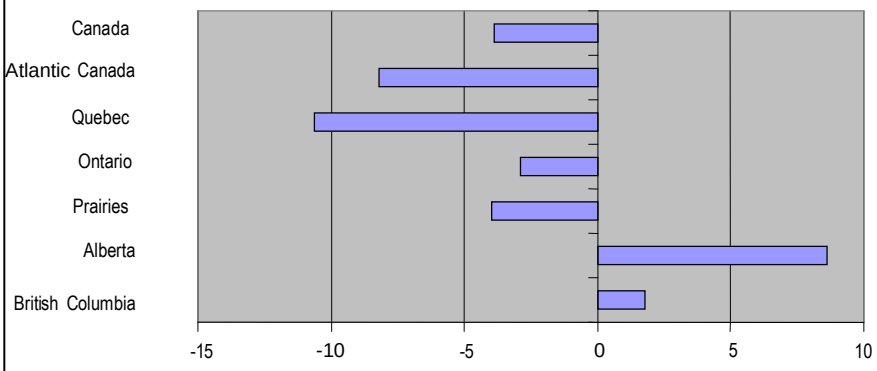
4. Under-Represented Populations

Another important factor contributing to IT talent shortages is the under-representation of several groups in Canada's IT labour force. Females occupy only 26 per cent of IT positions, yet the Association of Universities and Colleges Canada reports that women account for two thirds of full-time enrolment growth in universities since 1971, "a surge that has been driven by their growing participation in the Canadian labour market".[22]

Immigrants, despite many of them having valuable critical skills and excellent credentials, are also under-represented. They face substantial barriers to entry into the labour market, as do visible minorities in general.

Collectively these groups represent a vital source of untapped talent.

Figure 4
University Enrolment in IT Related Disciplines (Mathematics, Computer, and Information Sciences) is Declining
Average annual per cent change in enrolment, 2002 to 2005



Sources: The Conference Board of Canada; Statistics Canada (Culture, Tourism and the Centre for Education Statistics Division, Table 477-0013)

[19] David Ticoll, *Canada's Information Technology Labour Market 2005: Issues and Options*. (Ottawa: Software Human Resource Council. 2005).
[20] Ottawa Report (2007), p. 2 OCRI.
[21] *College Enrolment*, Michael Campbell Robinson Consulting Inc. (April 2007) p. 2.
[22] Association of Universities and Colleges of Canada, Trends in Higher Education Vol. 1 p. 5.

5. Mismatches in Talent Supply and Demand

The effects of shortages in IT occupations impact many sectors across the economy. In addition to the ICT sector, IT workers are employed in professional, scientific and technical services, manufacturing, information and cultural industries, public administration, and finance and insurance industry sectors, as well as in other sectors. Nationally, the overall IT hiring requirement for the next three to five years is estimated at 89,000 jobs for all sectors. This includes net IT job growth of 58,000 for the next three to five years and replacement demand of 31,000 jobs.[23]

Labour shortages are compounded by the increasing rate of adoption of information technology across the economy, in both services- and goods-producing sectors. Rapid changes in technology lead to mismatches between the skill base of retiring employees and the skill requirements of entry-level workers. They also impact many existing occupations. A critical challenge for IT work is that the speed of technological advancement at least in some instances renders current qualifications irrelevant for succession planning. Keeping pace with technological advancement presents significant challenges for balancing talent supply and demand.

6. Continuous Innovation, Workforce Development and Lifelong Learning

Organizations, large and small, experience the need to periodically up-skill their current workforce to cope with new IT components of their jobs and to access IT services, which contributes to demand for IT workers in the wider economy. Flexibility and lifelong learning are pivotal to the competitiveness of industries and essential for sustaining continuous innovation within the ICT sector and for diffusing innovation through information technology across economic sectors.

The nature of work continues to change at an accelerating pace. Traditional classroom education and training may not suit emerging, continuous demands for learning among students and workers, especially with respect to new technologies. Educational institutions must be prepared to consider flexible arrangements for course delivery, including part time learning, distance learning (e-learning) and mobile learning (m-learning). Mobile phones, iPods and MP3 players, for example, are popular media among students and have capabilities to support learning activities for discussions, debates and even iQuizes.[24]

Current post-secondary students are often "digital natives" who are able to seamlessly integrate technology into learning environments. At the same time, many competent and talented people already in the workforce may not have had as much exposure to emerging technologies. A supportive work environment in which employees receive ongoing training for new technologies can help ensure retention of critical talent.

7. Technology Embeddedness and Multi-skilling

The Internet, e-commerce, and other ICT developments impact the nature of work and require employees and students as future employees to obtain steadily higher levels of ICT literacy. As information and communications technologies become more intensely embedded within work processes, many industries are experiencing an increase in the share of information technology-skilled employment as a proportion of total employment. The integration of information technology in work processes can play an important role in improving quality and productivity. Effectively integrating information technology in the workplace has broader economic implications as well because there is a strong relationship between productivity and national economic prosperity.

ICT literacy and technology embeddedness are often central to reorganization or redesign of work processes that aim to enhance productivity and competitiveness. Increasingly companies require workers capable of multi-skilling. Many workers today require skills and competencies beyond

[23] John O'Grady, *Outlook for Canadian IT Occupational Employment*, (Ottawa: Information and Communications Technology Council, Autumn, 2006). p. 15.

[24] J. G. Caudill, J. G. "The Growth of m-Learning and the Growth of Mobile Computing: Parallel Developments", *International Review of Research in Open and Distance Learning*, Vol. 8. No. 2. (2007) p. 5.

traditional occupational classifications, including the ability to adapt to rapidly changing technologies and market demands. Small businesses in particular require workers who are flexible and willing to undertake a range of tasks that may span more than one traditional occupational classification. According to the National Survey of IT Occupations, "Multi-tasking is important in IT, with IT workers expected to do a wide range of tasks that constantly change. Task boundaries are not easily defined in broad-based, ever-changing job requirements."[25]

Similarly, just as technology is embedded in work processes, so is ICT increasingly integrated in post secondary programs. For example, university students across all disciplines need to master ICT skills in order to conduct research.

[25] Morley Gunderson, Lee Jacobs and Francois Vaillancourt, *The Information Technology (IT) Labour Market in Canada: Results from the National Survey of IT Occupations*. Ottawa: Software Human Resource Council, April 2005). p. 14.

CHAPTER 4

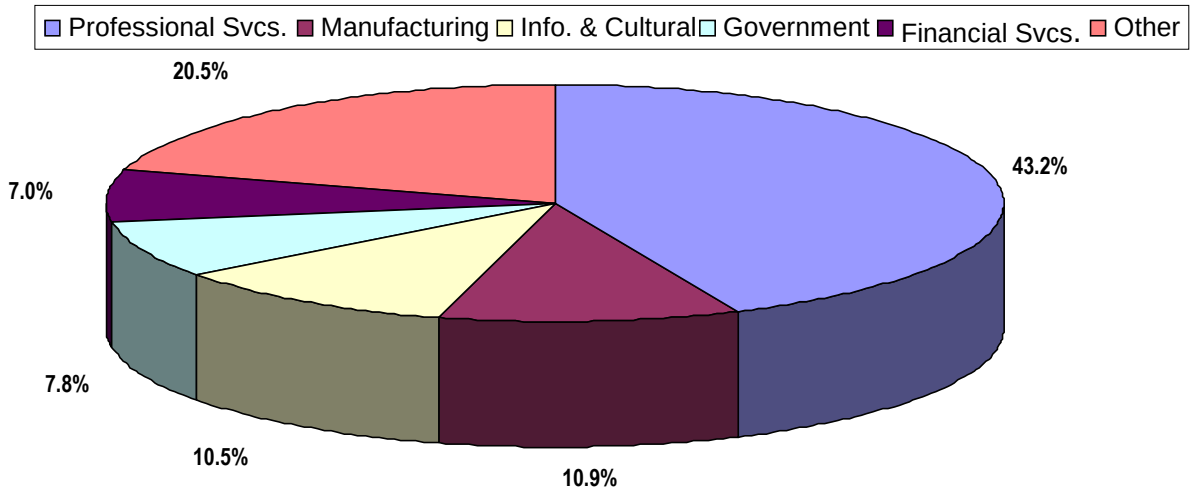
Economic Analysis: Costing Critical Talent Shortages

Characteristics of IT Workers

This chapter focuses on people who work in IT occupations throughout all sectors of the economy. These people are highly concentrated in IT-producing industries, but they can and do work in any industry. (See Figure 5.)

The Information and Communications Technology Council (ICTC) breaks IT occupations into six major groupings, managers, engineers, analysts, programmers, technicians and other IT workers. These major groupings can be subdivided further to create a group of 15 occupations. (See Table 3.) All told, these occupations account for more than 600,000 jobs across all sectors of the economy, which is equivalent to 3.5 per cent of Canada's total workforce.

Figure 5
IT Worker Breakdown by Industry
IT labour force by industry, per cent



Sources: The Conference Board of Canada; Statistics Canada. (Labour Force Survey, special tabulations)

Table 3
List of Identified IT Occupations

Occupation Group	Specific Occupation
Managers	HR Managers
	Computer and Information Systems Managers
	e-Commerce Managers
Engineers	Electrical and Electronics Engineers
	Computer Engineers (excluding Software)
	Software Engineers
Analysts	Information Systems Analysts and Consultants
	Database Analysts and Data Administrators
Programmers	Computer Programmers and Interactive Media Developers
	Web Designers and Developers
Technicians	Computer and Network Operators and Web Technicians
	User Support Technicians
	Systems Testing Technicians
Other	Technical Writers
	Graphic Designers and Illustrators

Sources: The Conference Board of Canada; Information and Communications Technology Council (Annual Labour Force survey Report, http://www.ictc-ctic.ca/uploadedFiles/ENGLISH/Labour_Market_Intelligence/LFS2006_layout_e.pdf

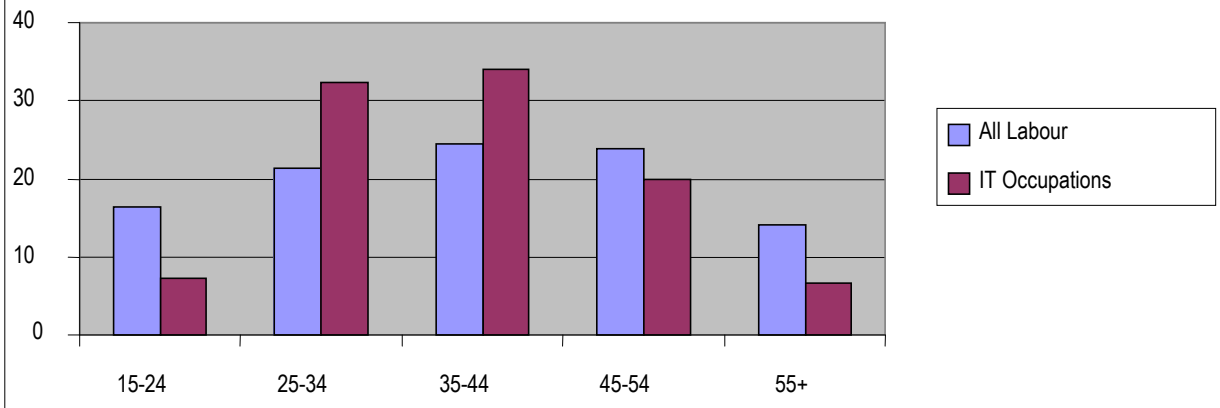
A number of characteristics are common to IT workers. IT workers are predominately male. Only 26 per cent are female, compared to 47 per cent for the workforce as a whole. Most IT occupations are close to this average; the outliers are engineers and 'other' IT workers. Only 11 per cent of engineers are women, while 41 per cent of 'other' IT workers are women.

Given that much of the labour force growth that has occurred in recent years has come from women entering the workforce, this situation has placed a supply constraint on the number of IT workers. And the labour market for IT workers is indeed tight. According to the ICTC, the unemployment rate for IT workers is currently very low at 2 per cent, which is one third of the average for all workers.[26]

Another characteristic of the IT labour force is age. As Figure 6 indicates, IT workers are younger than average. A below average share of IT workers are over the age of 45, and the share of workers over age 55 is particularly low. Thus, employers of IT workers are somewhat insulated from one of the biggest factors that will influence Canada's labour market in the coming years, namely the impending retirement of the baby boom generation.

[26] "The Canadian IT Labour Market Initiative," (May 2007), Information and Communications Technology Council.

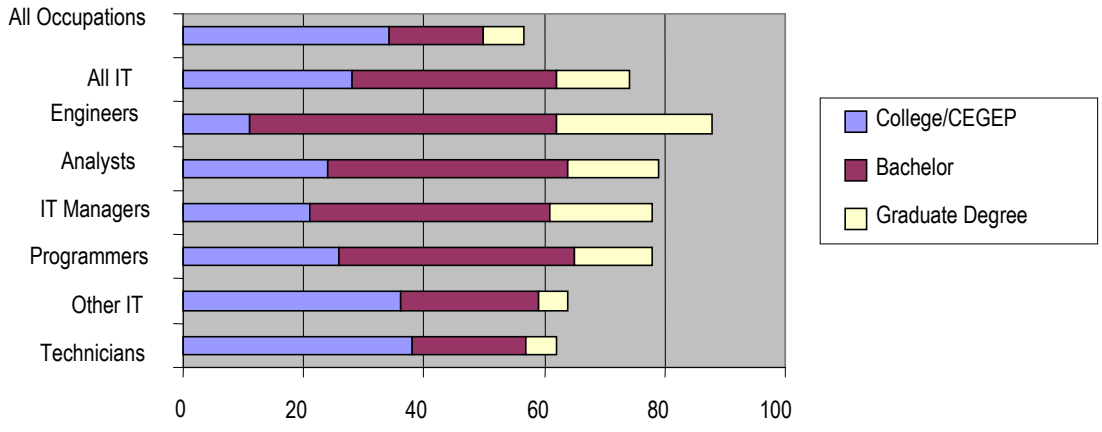
Figure 6
IT Workers Are Younger than Average
Share of labour force by cohort, per cent, 2006



Sources: The Conference Board of Canada; Statistics Canada; Information and Communications Technology Council (Labour Force Survey, December 2006, http://www.ictc-ca/en/content.aspx?id=426).

One other thing that is apparent when examining the share of IT workers by age cohort is that a very low share of IT workers is under the age of 25. The key reason for this is that the IT workforce is highly educated and people in this age cohort who will work in IT are usually still in school. In fact, as of 2005, 46 per cent of IT workers have at least a bachelor's degree, compared to 23 per cent for all occupations. (See Figure 7.) A further 28 per cent have a community college or CEGEP diploma.[27] Only technicians and other IT occupations have educational attainment rates that are close to the national average.

Figure 7
IT Workers Are Highly Educated
Share of occupational labour force by level of education, per cent



Sources: The Conference Board of Canada; Statistics Canada (Labour Force Survey, Table 282-0003); Information and Communications Technology Council (Annual Labour Force Survey Report, http://www.ictc-ctic.ca/uploadedFiles/ENGLISH/Labour_Market_Intelligence/LFS2006_layout_e.pdf)

[27] "Analysis of Labour Force Survey Data for the Information Technology Occupations, 2000-2005" (April 2006), Information and Communication Technology Council.

While a highly educated workforce brings a variety of undisputed benefits, it also presents new challenges for employers of IT workers. One such challenge is that high educational requirements essentially present a barrier to entry for new hires. In essence, potential employees are required to invest a significant amount of resources into their education before they can gain an IT position. This has the potential to be a problem if not enough people are entering university in the appropriate programs. This is exactly the situation that has been unfolding in Canada.

Enrolment in IT Related Programs

Enrolment in IT related disciplines at Canadian colleges and universities has been steadily declining since the end of the tech boom at the beginning of this decade. For example, data from Statistics Canada ends with the 2004/05 school year, but a decline is clear with nationwide enrolment in math, computer and information sciences at universities down 4 per cent from its peak. Thus, at the end of the 2004/5 school year there were 41,000 students enrolled in these programs with 8,000 of them in graduate school. This is down from a peak of more than 46,000.

A more recent report from the Association of Universities and Colleges of Canada suggests that undergrad enrolment in the 2006/2007 school year in math, computer and information sciences stood at about 27,000, with graduate enrolment at about 7,000.[28] This would indicate that enrolment has continued to decline over the past two years.

It is important to note that the decline in enrolment has not been universal across the country. It is most pronounced in Québec and Atlantic Canada, while enrolment has actually risen in British Columbia and Alberta. (See Figure 4.) Thus, an important question to ask is what, if anything, are the private and public sectors doing in those two provinces to buttress enrolments?

The single biggest factor that has been driving the decline in enrolment is the "technology bust" of 2000 and subsequent slow employment growth since then. Since it takes a minimum of four years for a person to complete their university education, current enrolment is still being influenced by events that occurred in the first half of this decade.

Thus, although the unemployment rate for IT workers is presently well below the average for all workers, during the technology bust the rate tripled, rising from 2 to 6 per cent. Further, the unemployment rate for engineers (who account for an outsized share of the university graduates in the IT labour force) reached more than 12 per cent during the technology bust. This large increase in unemployment rates influenced people's education decisions for a number of years.

In addition, although IT job creation was strong in the 1990s, it has subsequently been weak, lagging behind the average for all job creation in Canada. In fact, average annual IT job creation has only been about 6,000 per year since 2001 and IT employment has only recently surpassed the peak that it reached at the height of the technology boom. With more than 10,000 people per year graduating with an IT- related degree in the first half of this decade, job creation and job openings were not even sufficient to employ all of the new entrants to the labour force, let alone absorb those who lost their jobs during the technology bust. Thus, it is likely that there are still a number of people currently in the workforce who are trained as IT workers, but working in different occupations.

Another factor to consider with respect to the decline in enrolment in IT-related programs in recent years is the underlying demographic pattern. Part of the reason for the decline in regions like Québec and Atlantic Canada is the fact that there are fewer people in the prime university age cohort (those aged 20 to 24). For example, between 2000 and 2006, the number of people in this cohort fell by 3.4 per cent in Quebec. In contrast, the population aged 20 to 24 rose by almost 17 in B.C. and Alberta over the same period.

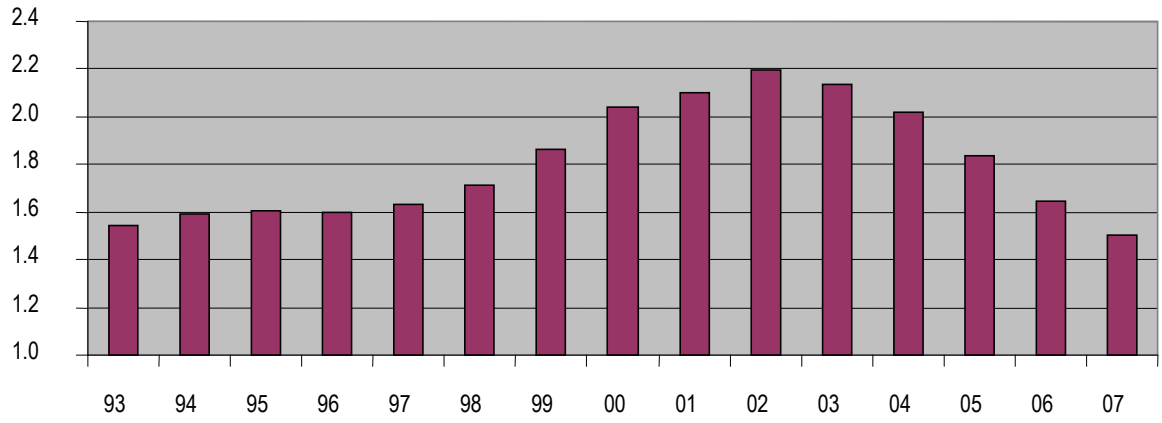
[28] "Trends in Higher Education: Vol. 1 Enrolment," (2007), Association of Universities and Colleges Canada .

Canada wide, the population in this cohort rose by 8.9 per cent between 2000 and 2006. Thus, enrolment rates in IT related programs—that is the share of the population taking a degree in math, computer or information science—did decline in the first half of this decade. In fact, the decline in the enrollment rate, that is the share of the population aged 20-24 enrolled in IT related programs, has been so large that is now back to where it stood prior to the tech boom.

Through most of the 1990s, the enrolment rate for mathematics, and computer and information sciences was little changed at around 1.6 per cent. However, the technology boom resulted in a big increase in the enrolment rate, which reached a peak when 2.2 per cent of the university age cohort was enrolled in IT related programs. (See Figure 8.) Since then, the enrolment rate has steadily declined, and it is now slightly below where it stood prior to the tech boom. Further, all indications are that the enrolment rate is not stabilizing. With the IT intensity of the labour force, that is the share of IT workers in the labour force, expected to increase in the coming years this steady decline in the enrolment rate is a cause for concern.

The underlying demographic trends will play an important roll for enrolment in the coming years. After rising steadily over the past decade, the population aged 20 to 24 is expected to experience little growth over the next 20 years. Thus the only way to increase the number of graduates in IT related programs is for stakeholders to find a way to increase enrolment rates, by drawing students away from other programs.

Figure 8
The Enrolment Rate Has Declined to Below its Pre-Tech Boom Level
University enrolment in math, computer and information science as a share of the population aged 20 to 24, per cent



Sources: The Conference Board of Canada; Statistics Canada (Culture, Tourism and the Centre for Education Statistics Division, Table 477-0013 and Demography Division, Table 051-0001).

Costs to the Economy of Labour Shortages

To sum up, the unemployment rate for IT workers is low, the number of graduates from IT related university programs is shrinking and retirements are expected to increase in the coming years. From this, it is apparent that labour markets for IT workers are currently tight, and that this situation is expected to persist in the coming years. As such, a shortage of available IT workers could potentially limit the growth of those industries that employ IT workers, as well as the entire economy in the coming years.

One way to assess the economic impact of labour shortages is to calculate the gap between potential supply and demand for those workers. However, in order to do this one must assume that large gaps are able to persist over time, without workers and businesses responding to the situation. In practice, this will not happen.

No economy can sustain gaps between labour supply and demand over a long period of time. Wage inflation, followed by a shift by companies away from using labour to becoming more capital intensive are some of the adjustment mechanisms that would prevent labour demand from exceeding supply. Other adjustment mechanisms could include stronger labour productivity or slower economic growth, as businesses are forced to forego opportunities or outsource more of their work to other countries. As such, any measure of a labour gap should best be looked upon as a measure of tightness.

Instead, in this paper we assess the economic costs of not filling a particular IT position. We calculate this for each of the 15 different occupations that have been identified as IT related, as well as present a weighted average for all IT occupations. In order to do this we assess the value added of each occupation.

The value added of a job to the economy comes in three forms. The first two are direct, and include the wages that a person earns, as well as the profits that a person generates for the organization for which they work. The last component of the value added that an additional job brings to the economy are the indirect effects, or induced effects.

Essentially these indirect or induced effects are derived when employees of the directly impacted industries spend their earnings, owners in those industries spend their profits, and the government spends the additional tax revenues generated by those earnings and profits. These purchases lead to higher employment, wages, income and tax revenues, and can be felt across a wide range of industries. In a sense, these indirect or induced effects can be thought of as the result of "multiplier effects" where $1 worth of additional income has a greater than $1 impact on the overall economy.

Wages

In order to conduct the wage portion of the analysis the Conference Board of Canada obtained median wage data by occupation from Statistics Canada. The range of wages for IT related occupations is quite large, from $36,400 for technical writers and user support technicians to $80,000 for computer and information systems managers. (See Table 4.) The median wage for all IT workers in 2006 was $57,100.

Workers in Canada can use their income in one of three ways. It can be spent or consumed, which immediately results in increased economic output. It can be taxed away, which has implications for government spending. Or it can be saved for future consumption, which can influence things like interest rates and investment. How these wages are used determine the indirect effect of those wages on the economy.

Table 4
Economic Cost of Not Hiring a Worker

Group	Occupation	Wages $	Profits Per Employee $	Indirect Effects $	Total $
Managers	HR Managers	69,997	11,615	61,441	143,053
	Computer and Information Systems Managers	79,997	11,615	69,130	160,742
	e-Commerce Managers	65,250	11,615	57,790	134,655
Engineers	Electrical and Electronics Engineers	69,014	11,306	60,833	141,154
	Computer Engineers (excluding Software)	65,998	11,306	58,514	135,818
	Software Engineers	75,005	11,306	65,439	151,751
Analysts	Information Systems Analysts and Consultants	60,005	10,862	53,190	124,057
	Database Analysts and Data Administrators	50,003	10,862	45,498	106,363
Programmers	Computer Programmers and Interactive Media Developers	55,994	11,078	50,322	117,393
	Web Designers and Developers	43,680	11,078	40,853	95,611
Technicians	Computer and Network Operators and Web Technicians	49,979	10,980	45,650	106,609
	User Support Technicians	36,400	10,980	35,208	82,589
	Systems Testing Technicians	45,760	10,980	42,406	99,146
Other	Technical Writers	49,998	8,864	44,582	103,444
	Graphic Designers and Illustrators	36,400	8,864	34,125	79,389
All IT Workers		**57,140**	**10,992**	**51,203**	**119,335**

Sources: The Conference Board of Canada; Statistics Canada (Labour Force Survey, special tabulations).

For Canada as a whole, 23 per cent of personal income over the 1997-2006 period went toward taxes. The remaining disposable personal income, which is personal income after taxes, was used for consumption and savings. Over the same period, consumers spent 96 per cent of this disposable income and saved the remaining 4 per cent. For the purposes of this analysis it is assumed that these ratios will hold for any unfilled IT positions.

Profits

For the profits portion of the analysis, the Conference Board of Canada calculated the average profit per employee for the different occupation groupings. This was done by taking the weighted average of before tax profits per employee by industry, where the weights are dependent on the share of IT in different industries. IT workers are found predominately in five industries, namely: professional, scientific and technical services, manufacturing, public administration, information and cultural industries, and finance and insurance. These five industry groups employ 80 per cent of Canada's IT workers. (See Table 5.)

Table 5
Industry Mix of IT Workers – Percentages by Category

Group	Prof. Sci. & Tech. Svcs.	Manufacturing	Public Administration	Information & Culture	Finance & Insurance	Other
	%	%	%	%	%	%
Managers	44	9	11	11	9	16
Engineers	36	33	3	10	2	16
Analysts	54	6	11	6	9	14
Programmers	52	11	8	7	8	14
Technicians	28	10	11	10	7	34
Other	56	15	3	12	2	12
All IT Workers	**44**	**13**	**8**	**9**	**6**	**20**

Source: Information and Communications Technology Council (Annual Labour Force Survey report, http://www.ictc-ctic.ca/uploadedFiles/ENGLISH/Labour_Market_Intelligence/LFS2006_layout_e.pdf.

In order to calculate these figures, industry profit and employment data were obtained from Statistics Canada. Profits per employee were calculated for each industry, and the weights for each occupation were determined by the shares provided in Table 5. This results in the calculation of profits per worker for the six major groupings of occupations. We should note that for the purposes of this analysis, the profit per employee for public administration is assumed to be zero.

The results from these calculations are presented in Table 4. Profits per IT employee range from a high of $11,615 for mangers to a low of $8,864 for other IT workers. The average for all IT workers is $10,992. Profits per employee are by far the highest in the finance and insurance sector, and occupation groups with a higher concentration in that industry experience higher than average profits per employee. The manufacturing industry also has a level of profits per employee.

Like wages, profits can be used in a variety of ways. They can be used to undertake new investments, they can be taxed away, or they can be paid out as dividends. Investment directly influences economic output, while taxes influence government spending. Dividends are ultimately paid out to individual shareholders, where they are a form of income that can be used in the same ways as earned wages. Again, how these profits are used determines what their indirect effects on the economy are.

For all Canadian businesses, 37 per cent of profits, over the 1997-2006 period, went toward taxes. For the four IT intensive industries the tax share of profits ranged from 26 per cent in the finance and insurance industry to 46 per cent in the information and culture industry. After tax profits can be used (now or in the future) to undertake new investments or paid out as dividends. For Canada's business sector, dividends represented, on average, 34 per cent of after tax profits over the 1997-2006 period. For the purposes of this analysis, the effective tax rate is allowed to vary by industry, but the dividend/investment breakdown is assumed to be the same for all industries.

Indirect Impact

The results of the analysis show that employment in IT-related industries has substantial indirect benefits for the economy. These benefits are derived from IT employees spending their earnings, business owners spending the profits that their employees generated, and the government spending their additional tax revenues generated by those wages and profits. These purchases lead to further increases in employment, wages, income and tax revenues, and can be felt across a wide range of industries.

The second to last column in Table 4 summarizes the indirect impacts on the economy. The indirect effect

ranges from $34,125 for graphic designers and illustrators to nearly $70,000 for computer and information systems managers. The average for all IT workers is $51,203. This is equivalent to about 75 per cent of the direct benefits of employing an average IT worker, implying a multiplier of 1.75 for IT workers.

The economic cost of not hiring an IT worker could be even higher given that the calculations used in this analysis do not include the indirect effects relating to the supply chain, for example, office facilities to accommodate and equip the IT worker.

Total Impact

The total impact of a job to the economy can be thought of as the value added to the economy of that job. The direct value added to the economy comes from the wages a worker earns and the profits that an employee generates for the organization for which they work. The indirect value added is derived from the additional spending generated by those earnings and profits.

Table 4 shows that the total benefit or impact of IT-related jobs on the economy is large, averaging $119,335 per worker. At the high end of the spectrum, the inability to fill a position for a computer and information systems manager costs the economy $160,742 per year. Of this, the direct effect of this unfilled position on the economy is $79,997 in lost wages and $11,615 in lost profits. Even the inability to fill lower paid positions can have an important impact on the economy with the total effect being far larger than the wage the worker would be paid. For example, the inability to fill a position for a graphic designer or illustrator would cost the economy nearly $80,000. This loss is 220 per cent of the salary of a graphic designer or illustrator.

Based on the average cost of $119,335 per worker annually, the Conference Board has calculated the economic impact to the Canadian economy of not filling the 89,000 IT positions that will open up in the next 3 to 5 years at over $10.6 billion. These positions represent a combination of anticipated growth and replacement demand as IT workers exit the workforce. While it is unlikely that all of these jobs would remain unfilled in the Canadian economy, the point is that there is a significant economic impact of not filling them. The negative economic impact manifests economy wide, not just among IT employers. At the firm level, employers may be faced with turning down contracts, “staying small”, or offshoring work. All of these can have the effect of causing slower economic growth.

CHAPTER 5

Building Economic Advantage: The Role of the Information Technology Workforce in Productivity Growth

A considerable source of concern in Canada in recent years has been the gap in GDP per capita between Canada and the United States. The single biggest factor contributing to this gap is the fact that the amount of output produced for each hour of work in this country significantly lags that of the United States. In fact, in 2002 Canadian real GDP per capita was $4,779 less than in the United States, and labour productivity accounted for $4,352 of this gap.[29]

Because of the importance of productivity, many experts have tried to answer the question "What are the determinants of productivity"? Industry Canada, Statistics Canada and the Centre for the Study of Living Standards have all undertaken or sponsored important research on Canada's productivity performance in an attempt to find the root causes of the Canada-U.S. gap.

ICTs are an important element in productivity improvement. Fuss & Waverman[30] recently examined the role of computers and telecommunications in improving productivity performance. Their indicators of ICT technology diffusion include the spread of PCs, the spread of telephones including mobile phones, and the spread of digitalization of telecom networks. They conclude that "the greater ICT capital in the U.S. and its diffusion "explain" some 50 % to 60 % of the Canada-U.S. productivity gap."

According to the study, Canada lags the U.S. in the medium and large business sectors, government and education.

One lesson that emerges from the considerable body of literature is that no one factor single-handedly explains the productivity gap between the two countries. The drivers of productivity fall into three broad categories, firm-specific factors, the business and policy environment and global forces.

Firm-specific factors relate to the physical capital and human capital within firms, as well as to the innovation and technological change that does not come directly from capital and labour. Examples of the latter include the increased efficiency that comes from reorganizing production processes and more efficient management practices.

Another layer of productivity determinants relates to the business and policy environment within which firms operate. For example, the industrial structure, the degree of competition, and the openness of the economy to trade and investment set the context for improving productivity. These factors can directly influence productivity or indirectly influence it through their effect on firm-specific variables.

Finally, a third layer relates to trends in the global economy. Canada has some influence over several of these trends, such as the trade liberalization agenda. Others, such as global commodity prices, are essentially beyond our control. All of these trends

[29] "Performance and Potential 2003-04 Defining the Canadian Advantage," (October 2003), The Conference Board of Canada, p. 59.
[30] Fuss & Waverman (2006).*Canada's Productivity Dilemma: The Role of Computers and Telecom*. p. 47.

have a major influence on how firms operate and, hence, can have an impact on productivity.

Physical Capital

Investment in ICTs at the firm level are affected by the availability and expertise of IT workers. Any future shortages of IT workers are likely, therefore, to influence corporate investment decisions. Shortages could induce businesses to invest more in ICT capital, but if they lead to increased use of offshore outsourcing, those investments may not be made in Canada.

A growing number of academic studies report that ICT investment has a positive effect on economic performance.[31] However, there may be a considerable lag between the outlay of ICT investment and payback in the form of productivity gains. For example, one study found that the returns from ICT investment in the United States are two to five times greater over periods of five to seven years than over a one-year period.[32]

Within Canada, numerous recent studies suggest that sectors that produce or use ICT intensively have higher productivity growth. For example, a study by John Baldwin and David Sabourin for Statistics Canada provides micro-econometric evidence that the adoption of many new advanced technologies has been associated with greater growth in productivity and market share in the manufacturing sector during the 1988-97 period.[33], Andrew Sharpe of the Centre for the Study of Living Standards found that increases in production growth in the service sector in the United States (particularly in wholesale and retail trade) can be attributed to high levels of ICT investment in these sectors.[34]

Human Capital

Evidence abounds that education brings private (personal) and social returns. Higher levels of education are associated with higher earnings (which are a measure of marginal productivity), lower unemployment, and a generally higher quality of life.

Human capital, as measured by educational achievement, appears to be directly associated with an economy's ability to undertake innovation. In a comprehensive compendium of research on productivity published for Industry Canada, Steven Globerman writes that there is a "fair degree of consensus" that the adoption of new technology and the benefits derived from that adoption are a function of the general educational level of the workforce.[35]

Richard Harris argues that human capital improvement acts as an engine of productivity growth in two ways. First, it facilitates knowledge spillovers, described by Harris as what happens when higher-skilled workers transmit what they know to others, who then pass them on to others, and so on. The second way is that higher skills facilitate product and process innovation as well as the adoption of new technologies.[36]

As Canada scores generally well on standardized tests, this link between human capital and productivity is mostly good news for the country. However, some areas require further attention. For example, an examination of differentiation by field of study suggests that we should be concerned about Canada's relatively poor showing on the proportion of graduates with math, science or engineering backgrounds—where Canada ranks only twelfth among 17 OECD countries.[37]

[31] Donald Siegel, "The Impact of Computers on Manufacturing Productivity Growth: A Multiple-Indicators, Multiple-Causes Approach," The Review of Economics and Statistics, vol. 79, no. 1 (1997), pp. 68-78.
[32] Erik Brynjolfsson and Lorin M. Hitt, "Beyond Computation: Information Technology, Organization Transformation and Business Performance," Journal of Economic Perspectives, vol. 14, no. 4 (2000), pp. 23-48.
[33] John Baldwin and David Sabourin, "Impact of the Adoption of Advanced Information and Communication Technologies of Firm Performance in the Canadian Manufacturing Sector," Research paper (Ottawa: Statistics Canada, 2001).
[34] Andrew Sharpe, "Why Are Americans More Productive than Canadians," International Productivity Monitor, vol. 6 (Spring 2000), pp. 19-37.
[35] Steven Globerman, "Linkages Between Technological Change and Productivity Growth," in Productivity Issues in Canada (Calgary: University of Calgary Press, 2002), p. 304.
[36] Harris, "Determinants of Canadian Productivity Growth: Issues and Perspectives," Discussion paper, (Ottawa: Industry Canada, 1999).
[37] "How Canada Performs: A Report Card on Canada," (June 2007), The Conference Board of Canada, pp. 81-96.

Canada's ranking on its Ph.D. graduation rate is also strikingly low—sixteenth among 17 countries. In addition, Canada ranks a modest eighth in scientific articles per million people, even though it ranks second in higher-education R&D spending as a percentage of GDP. Thus, while Canada's graduation rates are generally very good, the skewed distribution of graduates by field of study away from high-demand science and technology subjects, and the low number of Ph.D.s graduating, and the relatively low creative output of highly skilled people in science and technical disciplines give cause for concern.

Overall, our education system does not stimulate enough students to complete post-graduate degrees, especially in the science and technical disciplines that underpin innovation. This helps to explain Canada's comparative weaknesses in high-level academic achievement and our declining relative performance in innovation.

Innovation

The Conference Board's innovation framework provides an analytical basis for the evaluation of innovation systems. The framework distinguishes four discrete knowledge activities—creation, diffusion, transformation and use—that play a critical role in innovation. Supported by the appropriate policy environment, these four activities interact to produce economic or social value.

Using this framework, Canada ranks only fourteenth among 17 comparator countries in the OECD in terms of innovation.[38] Canada scores poorly across three of the four dimensions of the innovation framework. Transformation is the only innovation dimension on which Canada scores well. Broadly speaking, Canada is poor at commercializing and exploiting our science and technology ideas.

Once again it is often labour related issues that are hindering Canada's innovation performance. For example, Canada has a shortage of the skilled people who drive innovation, with only 7.2 researchers per 1,000 employees, compared with 16.5 per 1,000 in top-ranked Finland. Given our low ranking in terms of the proportion of graduates with science and technology backgrounds it is not surprising that our intensity of researchers is low.

Canada is also in the middle of the pack with respect to our investments in knowledge—R&D, higher education and software. OECD statistics show that, over the past decade, Canada's investment in knowledge as a percentage of GDP increased by a meager 0.1 per cent, while Denmark and Sweden's growth has been 1.8 and 1.7 per cent, respectively. This does not bode well for Canada's future, as the return on such investments is often deferred. Of particular concern is Canada's low business investment in R&D—where Canada ranks fourteenth among 17 OECD countries.

Given this situation, it is not surprising that innovation has contributed little to Canada's GDP growth. Supporting this is work completed by University of British Columbia economist Erwin Diewert, who investigated the relative contribution of total factor productivity (TFP) to economic growth. TFP is the portion of productivity that can not be explained by changes in the amount and quality of labour and capital. This "extra" growth is often described as the effect of innovation.

Diewert's analysis shows that the main drivers of economic growth between 1962 and 1998 were the growth in labour and capital inputs. He concludes that growth in TFP has not been a very large contributor to overall Canadian output growth.[39] If Canada is to change this situation, it must become more successful in capturing the effects of innovation. Inducing more people to enter IT related post secondary programs would be one way to improve Canada's innovation performance, and subsequently its productivity growth and its standard of living.

[38] "How Canada Performs: A Report Card on Canada," (June 2007), The Conference Board of Canada, pp. 53-66.

[39] Erwin Diewert, "Productivity Trends and Determinants in Canada," in Productivity Issues in Canada (Calgary: University of Calgary Press, 2002).

CHAPTER 6

Maximizing IT Human Resources Capacity: International Approaches for Targeting Specific Talent Pools

Canada's ICT Sector is facing increasing labour market pressures regarding IT employees, while employers across the Canadian economy are also experiencing the impacts of a tightening labour market for IT occupations. These observations suggest that a *comprehensive* employer-driven approach is needed. Key stakeholders—business, government and education—must working proactively and collaboratively to mitigate future labour market pressures and increase the supply of talent available for IT in-demand occupations.

Common elements for a successful comprehensive strategy exist across a broad range of international approaches for increasing the size and quality of the IT talent pool. Our research shows that industry leadership and multi-sectoral collaboration are essential. Businesses must engage with several levels of government, educational institutions, labour and other organizations to develop comprehensive strategies for addressing labour market shortages. It is also clear from our research that governments must provide policy tools and other resources to support industry's efforts to effectively tap into various pools of talent, if businesses are going to be successful in their efforts to bring larger numbers of IT workers on board.

Education and training programs that respond to workplace needs are essential to ensure that knowledge and skills requirements of employers in both the private and public sectors are met.

Youth represent a large pool of potential talent. More attention must be paid to making careers in IT attractive to youth while they are still in school—and the earlier the age the better—so that they can make course and program choices and seek work experience and certification before they graduate and enter the career market.

Attracting and integrating under-represented groups into the IT workforce could substantially alleviate labour market pressures as well. Beyond effective marketing and communication strategies, recruitment, selection, orientation processes as well as work processes and schedules must be tailored and targeted to attract women.

Immigrants represent an important source of labour market growth, including recent immigrants as well as immigrants who have been in Canada for several years and are under-employed because their credentials are not recognized.

Mini Case Study: Imagine the Challenge

Engaging young Canadians in developing ICT skills is an important goal for the ICT sector. The *Imagine the Challenge* program, established with seed money from Industry Canada's GrassRoots Program, sought to encourage young Canadians to develop their ICT skills through an interactive international project. As part of the project, nearly 400 students from Kindergarten through Grade 9 researched the geography, culture and history of Australia. They interacted with an athlete running 5,000 KM across Australia, as well as with other students and teachers in Australia via the Internet. The project was successful in helping teachers deliver curricula as well as in getting students excited about ICTs.

Students participating in the project learned about Australia by using ICTs, e.g., by maintaining a website or making a documentary film. The project helped teachers and students make the connection between ICT skills and their day-to-day activities in the classroom. In the process, the students learned about ICT resources such as email, the Internet, bandwidth, digital cameras, video cameras, conference calls and supporting software. Imagine the Challenged showed young Canadians that ICTs can help people overcome vast distances to communicate with, and learn from, others.

The project was also successful in getting teachers to collaborate with each other across subject lines and help each other with ICTs. In many cases, students were helping teachers develop their ICT skills. Teachers interviewed as part of Conference Board case study relating to *Imagine the Challenge* reported that their experience of using ICTs on the Australia project was an important factor in getting them to build the use of ICTs into subsequent projects.

Imagine the Challenge is an example of a project that starts building the ICT skills of youth and their interest in IT careers at an early age.

Mature workers also represent a vital source of experienced talent and important knowledge reserve.

Former IT employees who moved on to other areas of employment following the technology bust are also potential sources of talent.

Various approaches may be needed for different target groups, but employers cannot afford to overlook these vital sources of IT talent and develop strategies to reach out to these populations. This requires a shift in our understanding and approaches to supporting and engaging under-represented working groups.

Creating a welcoming environment for each of these groups to enter IT careers will be critical for building a productive, innovative and prosperous workforce. This section of the report includes a synthesis of ideas relating to international approaches for targeting specific populations from which to access critical IT talent resources. Creative strategies and initiatives that encourage higher labour force participation, especially by under-represented populations could substantially increase the size of Canada's IT workforce and contribute to higher productivity within the ICT industry and across the economy.

As information technology continues to be more deeply embedded within the Canadian work place, a comprehensive strategy for developing the full range of abilities from ICT producers to IT users will become increasingly important for maximizing growth in potential output.

Attracting Youth: Education and Training Solutions

The vast majority of new entrants to the labour force come from the formal education system.

Most developed countries have established organizations to lead education and skills development activities (including outreach into the education system and providing support to employers seeking to upgrade the skills of their current workforce). For example, sector councils in Canada were developed as a collaborative effort to address human resource issues and to identify and act on critical skills needs.[40] Along with government, education and industry partners, sector councils play an important role in developing career awareness strategies and optimizing performance within the sector. The Information and Communications Technology Council (ICTC) was established in 1992

[40] http://www.hrsdc.gc.ca/en/hip/hrp/corporate/init_sector.shtml (retrieved September, 24, 2007).

to address the human resource needs of the ICT sector.[41]

Canada: Information and Communications Technology Council (ICTC) Initiatives

Formerly known as the Software Human Resources Council, ICTC strives to build career awareness and improve standards, education and employment within the ICT sector. ICTC's Board of Directors is made up of corporate executives and owner–operators of small businesses, as well as educators and government representatives. The Council receives funding from the Government of Canada through Human Resources and Social Development Canada (HRSDC) and Industry Canada.[42]

Key activities undertaken by ICTC include promoting careers in the ICT sector for new entrants and promoting life-long learning as a key to successful career development. *ICTC Career Awareness* [43] was designed for youth and adult learners to provide tools for exploring career opportunities. Other major initiatives include two information web sites, DiscoverIT.org and Uni-SearchIT.org. DiscoverIT.org site was designed for students, but is also useful for educators, parents and businesses. Students can use the site to create a career plan, assess their skills, and learn about the ICT labour market, including occupational profiles and salary ranges. The site provides information about bursaries, scholarships and schools. Educators can make use of tools and IT activities available on DiscoverIT.org.

ICTC has also developed Uni-Search-ITy, a searchable database of IT programs in post-secondary institutions in Canada. This site offers links to universities and colleges and other post-secondary institutions across Canada that offer information technology programs. At a high school level, ICTC works with educators to develop the *Focus on Information Technology Program* (FIT) for students in grades 11 and 12. FIT provides a head start on post-secondary education goals by giving students a foundation of technical, business and interpersonal skills. FIT provides both national and industry certifications.

ICT Professional Development includes three programs designed for ICT students, individuals in career transition and internationally educated professionals. *Career Focus* helps industry create meaningful work experience for under-employed or unemployed graduates of science or other IT-related disciplines. This Canada-wide wage subsidy program offsets the hiring cost to industry for entry-level positions. *ITProfessional* is a post-graduate interactive learning experience offered through colleges. It provides technical, business and interpersonal skills within business simulation models and includes a three-month work term. The *IEP Initiative* promotes labour mobility and diversity in the ICT sector, focusing on foreign credential recognition and work experience to improve workforce integration.

These programs and tools developed by the sector council are directed at promoting IT as a career choice and facilitating entry into high school and post-secondary programs. Often, by the time students enter high school, especially grades 11 and 12, they are already formulating career plans and selecting courses to accommodate those career paths. It is critical that youth become aware of opportunities in the IT field as early as possible, preferably in elementary years.

The ICTC is planning to increase it capacity as an organization through partnerships and other opportunities. ICTC will continue to focus its actions on four pillars: skills definition, labour market intelligence, career awareness and professional development. Priority projects within these four areas will enable sector knowledge to be transferred into action; to positively position the ICT industry as a career of choice for secondary school students; to update competencies and increase the number of education systems delivering nationally recognized curriculum; and to increase the supply of people with the skills, knowledge and competencies demanded by industry.

[41] http://www.ictc-ctic.ca/en/content.aspx?id=32 (retrieved September, 24, 2007).
[42] http://www.ictc-ctic.ca/en/content.aspx?id=32 (retrieved September, 24, 2007).
[43] http://www.ictc-ctic.ca/en/content.aspx?id=38 (retrieved September, 24, 2007).

United States: The Secretary's 21st Century Workforce Initiative

In 2001, the U.S. Department of Labor created the Office of the 21st Century Workforce with the mission "to ensure that all American workers have the opportunity to equip themselves with the necessary tools to succeed in their careers". [44] The initiative was designed to facilitate changes in education and training for all industries, including ICT, where there is increasingly a requirement for "higher skill sets and higher education". This initiative provides ten resources over the internet:

- Advanced distributed learning;
- America's career infonet;
- America's job bank;
- America's service locator;
- CareerOneStop;
- Employment & Training Administration;
- The Job Accommodation Network (JAN);
- Monthly Labor Review Online: Labor Force Archives;
- Occupational Information Network; and
- The Office of Disability Employment Policy.

The *Employment & Training Administration*[45] (ETA) hosts the *Office of Workforce Investment*[46] (OWI) which is responsible for providing national leadership, oversight, policy guidance, and technical assistance to youth and adults. Employment and training programs are funded under the Workforce Investment Act.

Workforce Investment Boards have been established in communities across the United States to develop and deliver education and training initiatives in collaboration with a wide range of partners. For example, the Three Rivers Workforce Investment Board (TRWIB) is an employer-driven policy-making entity that supports and oversees the local workforce development system in Pittsburgh and Allegheny County. One of their initiatives, the Educators and Employers Engaged for Excellence (E4), seeks to improve career education by connecting employers, educators and youth. E4 provides young people with quality-workplace experiences to enhance their education and discover opportunities for careers. The initiative helps educators to achieve curriculum requirements, provides youth with practical experiences, and raises the profile of employers in the region. Employers benefit from enhanced visibility and the opportunity to effectively position their organizations with the "up and coming workforce". [47]

United States: Improving ICT Literacy

In 2001, the Educational Testing Service (ETS) in the United States convened an international panel to study the importance of information technologies and their relation to literacy. The panel consisted of experts from education, government, NGOs, business and labour. The United States, Canada, France, Australia and Brazil were included in the ICT Literacy Panel. Their research focused on the need for a measure of ICT literacy across countries, businesses, schools and other organizations. A second goal was the development of a Framework for ICT Literacy. This is a formidable challenge given that ICT skills essential for living, learning and working in the new economy are continuously emerging. An overriding objective of the panel was "to better ensure the inclusion of all segments of society and reduce digital, social, cultural, economic, and technological divides".[48]

As a result of the ICT Literacy Panel's work, the National Higher Education Information and Communication Technology (ICT) Initiative was established to "address the critical need for diagnostic information about ICT proficiency in higher education".[49] The initiative involves a consortium of the Educational Testing Service (ETS) and seven colleges and universities in the United States. They include California community colleges; UCLA; University of Louisville; University of North Alabama; University of Texas System; California State University; and University of Washington. Together, these higher education institutions enroll approximately one-quarter of the 15 million college

[44] http://www.dol.gov/21cw/office.htm
[45] http://www.doleta.gov/etainfo/mission.cfm
[46] http://www.doleta.gov/etainfo/wrksys/WIOffice.cfm
[47] http://www.trwib.org/practices/youth/e4/
[48] *Digital Transformation: A Framework for ICT Literacy*, (Educational Testing Service: 2002) p. 13.
[49] http://www.cni.org/tfms/2004b.fall/abstracts/handouts/CNI_smith_innovative.doc

students in the U.S. This initiative marked the first time that a comprehensive assessment of ICT proficiencies has been developed in partnership with higher education.

The ICT Literacy Assessment, now called the *iSkills*, measures seven ICT skills required of post secondary students. The test assesses knowledge of technology as well as the ability to solve problems within a technology environment.[50] ICT literacy is increasingly important for work in an information-rich, technologically advanced society.

Germany: Innovation and Jobs in the Information Society: An Action Programme

Germany is also experiencing the pressures of an IT workforce shortage. For example, the German labour market is currently experiencing a shortage of 75,000 media and IT specialists.[51]

Germany has one of the most developed ICT infrastructure networks within Europe, with ICT per capita expenditure consistently surpassing the European Union (EU) average.[52]

In Germany, the number of students enrolled in computer science programs dropped by 30 per cent from 2000 to 2006 with only 27,000 'beginners'.[53] Typically 50 per cent of these students do not complete the program. The anticipated number of graduates expected to enter the labour market in over the next four to five years will not be sufficient to replace retiring IT professionals in Germany and will not alleviate the growing shortages of skilled talent.

Germany's strategic plan to deal with the ICT labour market shortage is multi-faceted and includes innovative policy initiatives coupled with changes in education and training systems.

In 1999, Germany developed a program called "Innovation and Jobs in the Information Society of the 21st Century".[54] The program provided the foundation for major initiatives in ICT training. Germany's action program includes developing and enhancing programs for schools, universities and vocational training to increase ICT skill levels of the German population.

As part of this program, Germany has implemented an initiative to provide basic ICT training to all teacher trainees. Germany is using 1,400 ICT specialists to work in schools to support teachers in integrating ICT in the curriculum. A key objective is to increase the number of people who have qualifications in math, science, engineering and design programs as well as ICT skills and experience.[55]

In 2002, Germany reorganized its continuing education and training systems in ICT. In conjunction with the Federal Institute of Vocational Training, the German government developed a recognized and certified ICT training program that could quickly adapt to the innovation cycles of the ICT sector.[56]

Germany has also designed solutions aimed at non-traditional or under-represented labour pools. An element of their strategy includes efforts to encourage women to enter the ICT field. Presently women make up less than 20 per cent of Germany's ICT workforce. The program provides specific measures for training women teachers and schoolgirls on the Internet. Initiatives include "Schools on to the Network" and a Girl@Net network where female students can create their own websites and participate in competitions. [57]

Additional mechanisms include outsourcing and the encouragement of workforce mobility within the European Union. Awareness campaigns target the public (school children), promoting the benefits of working in the ICT field. Efforts are also directed at

[50] www.ets.org/ictliteracy (retrieved October 29, 2007).
[51] *Innovation and Jobs in the Information Society of the 21st Century: Action Programme by the German Government*, Federal Ministry of Economics and Technology, 1999, p. 33.
[52] http://www.eeproductcenter.com/showPressRelease.jhtml?articleID=595122
[53] http://www.union-network.org/uniibitsn.nsf/$webDocuments/E25FF0E65121AFA1C1257248005758DE?Opendocument
[54] *Innovation and Jobs in the Information Society of the 21st Century: Action Programme by the German Government*, Federal Ministry of Economics and Technology, 1999.
[55] http://ec.europa.eu/enterprise/ict/policy/ict-skills/es-br.pdf
[56] http://ec.europa.eu/enterprise/ict/policy/ict-skills/es-br.pdf
[57] *Innovation and Jobs in the Information Society of the 21st Century*, 1999 p. 29.

encouraging immigration of skilled, foreign IT workers.

An important initiative implemented by the German government is the "IT Immediate Action Plan" which is aimed at addressing IT talent shortages. The target group extends from school aged children to unemployed adults, including foreign professionals. One of the goals of the action plan is to develop 250,000 IT professionals by up-skilling the German workforce and by attracting IT specialists from abroad. The plan includes the development of public and private partnerships and includes funding for an increased number of training spaces for IT and media professionals.[58]

Ireland: ICT Ireland and Forfás Initiatives

ICT Ireland

Conceived in 2001, ICT Ireland is the representative body for the high technology sector in Ireland. The organization represents six industry sectors within the overall ICT sector. One of the strategic imperatives of ICT Ireland is to ensure that the country has "the skills necessary for a vibrant and sustainable ICT sector." [59]

In April 2003, ICT Ireland launched a major report "Creating a World Class Environment for ICT Entrepreneurs". The report highlights a series of recommendations which could double the number of people employed in indigenous ICT companies from the current level of 30,000 to 60,000 by 2010.[60] One of the key recommendations includes the formation of a business coalition to encourage greater support from the multinational sector for the indigenous sector. Representatives from Intel, Microsoft and IBM joined forces with representatives from SMEs to explore ways in which the sector can be supported and new partnerships forged. One critical way is to ensure that systems are in place to promote and support critical skills development.

ICT Ireland has also been instrumental in the development of the Champions Programme, a national education campaign to encourage students in secondary schools to consider ICT as a career. The program offers students in second and third level studies an opportunity to meet with representatives from industry and learn more about ICT opportunities, including job links to companies with ICT vacancies.

Forfás

Forfás is Ireland's national policy and advisory board for enterprise, trade, science, technology and innovation[61]. Operating under the auspices of the Department of Enterprise, Trade and Employment, Forfás's mission is to inform and to build coalitions which will influence and promote competitiveness and support creative and dynamic management in the establishment and growth of innovative companies in Ireland.

In 2005, Forfás sponsored the Expert Group on Future Skills Needs (EGFSN) [62] to conduct a study into the education requirements of the Irish workforce to upgrade 45 per cent of the workers one level within the National Framework of Qualifications by 2020. Recommendations on this and other initiatives are reported in the *Forfás Annual Report 2006*.[63] Initiatives recommended for meeting skills shortages in the workforce (including ICT) were:

- Encouraging education and training providers to keep up-to-date with developments within the industry;
- Establishing the *Careers and Labour Market Information in Ireland* information program;
- Establishing a new employment permit system (green card scheme);
- Developing a national skills database upon which to provide policy advice; and
- Establishing a national science awareness program to attract youth and others to careers in science and related fields.

[58] http://ec.europa.eu/enterprise/ict/policy/ict-skills/es-br.pdf
[59] http://www.ictireland.ie/ibec/press/presspublicationsdoclib3.nsf/wvICTNews/CF5E7BFE56D4E37A80256D1A0059F4D6?OpenDocument (Retrieved October 16, 2007).
[60] Creating a World Class Environment for ICT Entrepreneurs, 2003, p. 9.
[61] http://www.forfas.com/about/mission.html (Retrieved October 15, 2007).
[62] http://www.forfas.ie/publications/forfas_annrpt05/forfas_annrpt05_english_webopt.pdf (Retrieved October 16, 2007).
[63] http://www.forfas.ie/publications/forfas_annrpt06/forfas-annual-report-2006-english.pdf (Retrieved October 16, 2007).

The Department of Enterprise, Trade and Employment's *National Skills Strategy*[64] supports initiatives to increase skill levels for all sectors of Ireland's economy. An area of emphasis is the requirement for ICT initiatives as companies incorporate ICT into their operations. Many of the recommendations are similar to those of the EGFSN study described above.

Ireland: Advisory Council for Science, Technology and Innovation

The Advisory Council for Science, Technology and Innovation (ACSTI), formerly the Irish Council for Science, Technology and Innovation (ICSTI), was established in 2005 by the Irish government to advise on all aspects relating to the strategic direction of science, technology and innovation (STI) policy. Its role encompasses policy relating to education, scientific research, and state spending on STI. A panel report published by the former ICSTI in 2005, discusses the growth and contribution of ICT in the Irish economy and the need for continued growth in this critical sector.[65] While the panel painted an optimistic picture of the growth in ICT, they also recognize that talent shortages have become a major concern in the industry. The panel concluded that: "ICT-related research is inadequate, both in quantity and quality: we are not encouraging sufficient professionals to pursue a career in research and there is no Irish centre internationally recognised as having world class expertise …There is a severe shortage of skilled manpower today. Throughput is being increased at undergraduate level, but further resources are needed to increase considerably the number of graduates with expertise in specific disciplines."[66]

The panel suggested that the expertise required for a sustained ICT workforce exists at several levels, from ICT users to world class experts. It recommended the establishment of a centre of excellence, referred to as the Centre for Advanced Informatics, led by a small number of world renowned experts in ICT. The panel also recommended changes to the education system at all levels to ensure ICT visibility at the early stages of education as well as promotion of ICT in later years.

Women in IT

Canada: Promoting Post Secondary Enrolment of Women in Science and Technology

Canada is falling behind in turning out science graduates. The Organisation for Economic Co-operation and Development (OECD) reports that enrolment at Canadian post-secondary institutions is stagnating, while it is thriving elsewhere. In terms of the number of citizens holding university degrees and college diplomas, Canada topped the rankings of all OECD countries. However, with 1,163 science grads per 100,000 employed people aged 25 to 34, Canada fell below the OECD average of 1,295. [67]

A recent study by the Canadian Advanced Technology Alliance - Women in Technology (CATA WIT) and University of Ottawa Telfer School of Management examines the gender imbalance in IT careers. The study concludes that "For many Canadian women, the high tech sector is still a man's world". Concerns among women include "dismissive attitudes about women's career aspirations and feeling marginalized in an industry that honours technical and engineering roles – roles in which women are under-represented."[68] As a result, some women with excellent credentials are opting out of the technology sector.

64 http://www.skillsstrategy.ie/pdfs/eqfsn070306_skills_strategy_report_webopt.pdf (Retrieved October 16, 2007).
65 http://www.forfas.ie/icsti/statements/tforesight/ict/sector.htm (Retrieved October 16, 2007).
66 http://www.forfais.ie p. 7

67 *Education at a Glance*, OECD, 2007.
68 *Women Still Under-Represented in Advanced Tech Sector*, http://www.cata.ca/Media_and_Events/Press_Releases/cata_pr11010703.html

Mini Case Study: iSisters and Tungasuvvingat Inuit Technology Mentoring Program

In 2001, iSisters was founded as a Canadian charitable organization by a group of teachers who wanted to contribute to their community. iSisters work as mentors to broaden the career options of disadvantaged women through technology training. iSisters has partnered with the Tungasuvvingat Inuit Community Centre to help unemployed and underemployed Inuit women find jobs by developing their ICT and employability skills.

With support from Industry Canada, iSisters opened an Employment Learning Centre equipped with computers donated by IBM, as well as software and Internet tools needed to support ICT learning and skills. A certified teacher acts as an on-site technology mentor and program designer in the Learning Centre.

iSisters' technology program has helped unemployed and underemployed Inuit women overcome several obstacles in developing their ICT skills. For example, many women have found it difficult to attend learning sessions because of a variety of issues including child care and transportation. Further, many of iSisters' clients have limited formal education and difficulty in communicating in English. Accordingly, iSisters has had to arrange for basic skills upgrading in order to facilitate technology training.

The iSisters' program has been successful in enhancing the employment potential of Inuit women by developing their ICT skills. Participants have also improved their English language skills and enhanced their personal self-confidence. Graduates of the iSisters' program now work in the ICT sector or hold IT jobs. This has been beneficial to Inuit women and the firms who have hired them as well as to the Canadian economy, which benefits from having all individuals employed at their full potential.

Women currently occupy only 26 per cent of jobs in the ICT sector in Canada. The number of women at decision-making levels in science, engineering and technology-related fields remains low compared to their male colleagues.

For several years, the University of Alberta has operated the Women in Scholarship, Engineering, Science and Technology (WISEST) program to investigate ways to encourage women to consider careers in science, engineering and technology. WISEST provides opportunities for high school students to participate in research, conferences and other summer learning initiatives designed to stimulate interest in related careers. WISEST also conducts research into the recruitment and retention of women in these careers.[69]

Research undertaken through this program suggests that family members, especially parents, friends and people in the field are all important influences. Female role models as teachers, colleagues and supervisors also provide a positive influence.

Often high school students feel uncertainty about career choices because they don't have sufficient work and life experiences to make such important choices. Common first year programs and general science programs enable students to mature and learn more about areas that interest them. Opportunities to transfer courses across post secondary institutions are also very important. Articulation agreements and other credit transfer arrangements across institutions are essential given the tremendous cost of time and money students invest in education[70].

Work experience is particularly important for influencing career decisions for both men and women. First-hand exposure to a career through work internships and co-ops is invaluable. Informal training is a valued source of learning among IT workers. The ability to obtain a good job after graduation is an important factor influencing career selection.

Women in IT who leave their positions often do so for conditions that accommodate work-family balance.[71]

[69] http://www.wisest.ualberta.ca/aboutus.cfm

[70] *I Liked Science ,But Now What Do I Do? Young Women's Perspective Following High School*. University of Alberta. P. 3.

[71] Morley Gunderson, Lee Jacobs and Francois Vaillancourt *The Information Technology (IT) Labour Market in Canada: Results from the*

Ireland: Women in Technology and Science (WITS)

Women in Technology and Science (WITS) is an association founded in 1990 to actively promote women in technology and science in Ireland. Membership is open to women throughout Ireland who work, or are studying science, engineering or technology. "The association has members from a broad range of scientific, engineering and technological backgrounds including teachers, computer experts, technicians and journalists. WITS members range in age and experience from third level students to some of the country's most senior scientists and academics"[72].

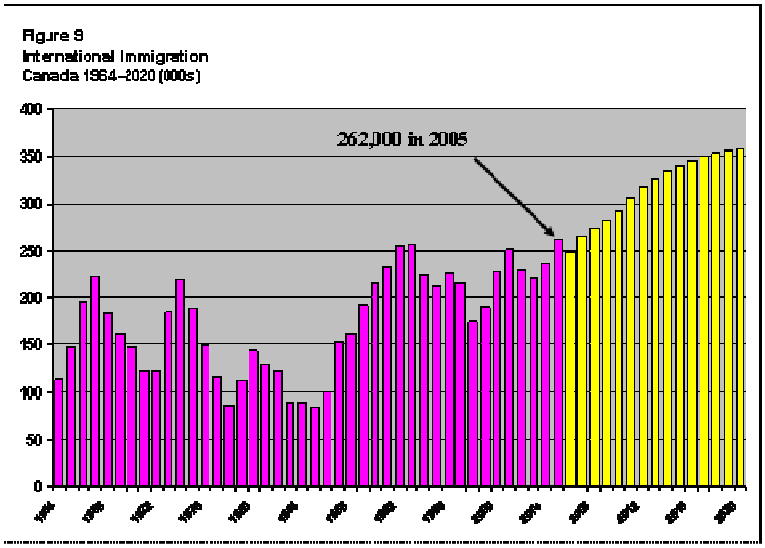
One initiative of the WITS organization is the WISER WORKFORCES *An all-island pilot project for Women in Science and Engineering to Re-enter the Workforce*. This is a pilot project, combining educational and mentoring resources. The purpose of the project is to identify, re-train and support technically qualified women to return the workforce following career breaks. The Open University of Great Britain will deliver the all-island programme in Ireland.

Global Reach: New and Recent Immigrants as a Source of IT Skilled Workers

Canada: Immigrants as a Source of Population Growth

Immigration accounted for more than 60 per cent of Canada's population growth during the period 2001 to 2006 compared with 46 per cent from 1990 to 1995. By 2030, immigration will account of 100 per cent of net population growth in Canada. Immigrants currently make up seventy per cent of Canada's labour force growth. By 2011, they will account for all of the *net* growth in our workforce. These trends present opportunities and challenges for employers who want to make the most of immigrant talent available to them.

Over the next ten years, immigration will account for over 17 per cent of new entrants to the labour force—new entrants from the formal education system will account for the remaining 83 per cent.[73] To ensure an adequate supply of talented workers to fuel economic growth and sustain our standard of living and quality of life, Canada will need to bring in over 300,000 immigrants annually after 2011. Immigration is forecast to peak at just under 360,000 annually in 2025. (See Figure 9.) Canada's success in attracting and retaining immigrants and other international talent depends in large part on forward-looking businesses playing an active role.



Canada: Immigrants' Education and Skills

The good news for Canadian employers is that immigrants are educated and skilled. In 2006, 55 per cent of immigrants were in the economic class, which includes skilled workers, entrepreneurs, the self-employed, investors and Provincial / Territorial Nominees. New immigrants have significant skill levels. In 2006, 46.6 per cent of immigrants report having significant occupational skill levels, including:

National Survey of IT Occupations. Ottawa: Software Human Resource Council, April 2005). p. 10.

[72] http://www.witsireland.com/

[73] Citizenship and Immigration Canada, *Multi-Year Levels Planning Consultations Backgrounder* (Ottawa, Citizenship and Immigration Canada, 2007), p. 2.

Mini Case Study: Skills for Change

Each year Canada admits thousands of highly-skilled IT professionals into the country. In making the transition to employment in the IT field in Canada, many of these professionals face barriers relating to their language skills or to their lack of understanding of the IT industry in Canada. In 1993, Skills for Change, along with their partner Digital Equipment, created a program to help internationally educated engineers in the GTA integrate better into the Canadian workforce. Since then, Skills for Change has broadened its mandate to help other categories of Internationally Educated Professionals, including accountants, engineers, doctors and IT professionals to gain access to learning and training opportunities that facilitate their integration into the professional workplaces in Canada.

Skills for Change comprises two related initiatives. The first is the Sector Terminology, Information and Counseling Program, which was developed in partnership with the Ontario Ministry of Training, Colleges and Universities to address the specific employment issues of skilled immigrants. This program is a six-to-twelve-week full-time employment preparation program that focuses on providing skilled newcomers with knowledge relevant to their sector.

The second initiative supported by Skills For Change is a Mentoring for Employment Program which involves a partnership between internationally trained newcomers, Skills for Change and professionals working in the GTA who volunteer their time. mentoring relationships provide immigrants with information, guidance and support and networking contacts in the sector in which they intend to work.

Skills for Change has had considerable success in helping highly-skilled new Canadians integrate into the workforce. More that 360 participants complete the program annually. Sixty-five per cent of participants find employment in their profession within three months of completing the program.

- Professionals—24.1 per cent;
- Skilled and technical—11.2 per cent;
- Managerial—6.3 per cent; and
- Intermediate and clerical—5.0 per cent.[74]

Canada: Immigrants' Education and Skills

The good news for Canadian employers is that most immigrants are educated and skilled. In 2006, 55 per cent of immigrants were in the economic class, which includes skilled workers, entrepreneurs, the self-employed, investors and Provincial / Territorial Nominees. New immigrants have significant skill levels. In 2006, 46.6 per cent of immigrants report having significant occupational skill levels, including:

- Professionals—24.1 per cent;
- Skilled and technical—11.2 per cent;
- Managerial—6.3 per cent; and
- Intermediate and clerical—5.0 per cent.[75]

Moreover, immigrants are very well educated. Very recent immigrants are more than twice as likely as Canadian born to have a university degree.[76] And 66.3 per cent of new immigrant workers in 2006 have postsecondary education, including 41.4 per cent with university degrees:

- Doctorates—2.3 per cent;
- Master's degrees—12.7 per cent;
- Bachelor's degrees—51.3 per cent;
- Non-university diplomas—31.5 per cent; and
- Trades certificates—12.3 per cent.[77]

The opportunity for employers is to better utilize the skills and talents of immigrants. Despite their skills and education, recent arrivals are statistically:

- Overrepresented in sales and service occupations compared to Canadian born (23.3 per cent vs. 18.4 per cent);
- in business, finance and administrative occupations (15.7 per cent vs. 19.5 per cent); and
- Overrepresented in processing, manufacturing and utilities (12.3 per cent vs. 5.7%).[78]

The most recent data shows that even after four years in the Canadian labour market:

[74] Citizenship and Immigration Canada, *Facts and Figures 2006*.
[75] Citizenship and Immigration Canada, *Facts and Figures 2006*.
[76] Statistics Canada, *The Canadian Immigrant Labour Market in 2006: First Results from Canada's Labour Force Survey* (September 2007).
[77] Citizenship and Immigration Canada, *Facts and Figures 2006*.
[78] Statistics Canada, *The Canadian Immigrant Labour Market in 2006*.

- Only 47 per cent of employed immigrants report being in a high-skill job;
- Only 37 per cent have a job in their intended field;
- Only 29 per cent hold a job similar to the one they held before immigrating; and
- Only 52 per cent are employed in a job related to their training or education.[79]

Immigrants report that the major hurdles they face when entering occupations that match their knowledge, skills, education, qualifications and experience are:

- Lack of Canadian work experience (50%);
- Lack of contacts in the job market (37%);
- Lack of recognition of foreign experience (37%);
- Lack of recognition of foreign qualifications (35%); and
- Language barriers (32%).[80]

An important solution for addressing the tight IT labour market is for employers to tap into this tremendous pool of talent - to provide immigrants with opportunities to demonstrate their skills, support them as they recertify (where this is an industry and a job requirement) and help them improve their language skills to job standard.

Canada: Maximizing the Potential of Internationally Educated Professionals

Internationally Educated Professionals (IEPs) are a critical source of talent for Canada's ICT sector, but they are currently under-represented. Even for these highly-skilled knowledge workers, navigating the process of immigration, settlement and employment is often difficult. Many barriers exist, including language, access to labour market information, lack of foreign credential recognition and lack of Canadian work experience. Immigrants generally do not have access to informal networks, which are very important in the recruitment processes within the ICT sector. Even those who are successful in finding professional positions often experience cultural barriers and social exclusion.

A recent survey of Greater Toronto Area employers undertaken by the Progress Career Planning Institute and funded by Citizenship and Immigration Canada revealed that 17% of organizations "believe they are strongly committed to cultural diversity and their actions show they are making good to excellent progress", but 70% of respondents admitted that while they are "committed to cultural diversity[,]…they struggle with meeting their cultural diversity goals based on a myriad of external barriers and challenges that stand in the way of realizing diversity goals".[81]

Clearly, there is more work to be done by employers to integrate internationally educated professionals into the Canadian workforce. This is true where it comes to diversity management as well.

What Employers Can Do on Their Own

Employers can take steps on their own to address credential recognition issues that may deter them from hiring immigrants into appropriate jobs, including IT jobs. They do not have to wait for government, education and regulatory bodies to take the lead. Indeed, more generally there are many things employers can do on their own to tap immigrant talent by helping immigrants get established in their organizations.

Where it comes to gaining access to and retaining internationally educated professionals by recognizing their credentials, the Conference Board has identified five broad areas where employers can take the lead:

- Recognizing in the hiring process what immigrants bring to the workplace, including their technical expertise, skills and competencies, educational qualifications, experience and business connections.[82]

[79] Statistics Canada, *Longitudinal Study of Immigrants to Canada, 2005* (April 2007).
[80] Statistics Canada, *Longitudinal Survey of Immigrants to Canada*, 2005 in *The Daily* (Ottawa: Statistics Canada, April 30, 2007), p. 6.
[81] Progress Career Planning Institute, *Strategic Workforce Planning and Internationally Educated Professionals: An Employer Perspective—Results from an Employer IEP Survey* conducted in the summer of 2007 (Toronto: Progress Career Planning Institute, 2007), p. 14.
[82] There are many examples of exemplary employer practices in this regard. For example, The City of Toronto developed the Profession to Profession Mentoring Immigrants Program in partnership with the Consortium of Agencies Serving Internationally Trained Professionals. In Halifax, Convergys is working with the Metropolitan Immigrant Settlement Association and Halifax Immigration Learning Centre to develop a skills training program to prepare immigrants for successful competition for jobs at Convergys. Teshmont Consultants LP, an engineering consultancy firm based in Winnipeg, hires foreign-trained engineers at an associate level

- Recognizing the skills and competencies immigrants demonstrate in the workplace, including recognizing immigrants' workplace training, learning and development.[83]
- Supporting the recertification of immigrants, including supporting immigrants as they prepare for professional, trades or other recertification.[84]
- Recognizing immigrants newly acquired professional, trades and other certification through promotion / job reclassification in the workplace and through pay increases commensurate with Canadian qualifications, and by celebrating immigrants' achievements in acquiring Canadian certification.[85]
- Supporting immigrants' post-secondary education and certification post-hire as a way to build employee engagement and ensure employee commitment to ongoing professional development and lifelong learning.[86]

Government Action

The provinces are starting to take action to ensure internationally educated professionals make smoother transitions into the workforce. For example, the Province of Ontario has just passed its Fair Access to Regulated Professions Act, 2006, which requires the provinces 34 regulated professionals to ensure their licensing processes are fair, clear, open and timely when it comes to certifying foreign-trained workers.

The Federal Department of Citizenship and Immigrant has launched the Foreign Credentials Referral Office to help internationally trained individuals who plan to work in Canada to get their credentials assessed and recognized more quickly.

Moreover, a primary goal Human Resources and Social Development Canada's Foreign Credential Recognition Program (FCR) is to improve the integration of internationally trained workers into Canada's work force. This program provides funding for projects that facilitate the assessment and recognition of foreign qualifications. Several initiatives have been undertaken to support the ICT sector and IT employers across sectors.

With funding from the FCR program, the Information and Communications Technology Council has developed an *Internationally Educated Professionals Integration Initiative*. The first phase of the initiative included comprehensive research, labour market analysis and identification of potential partners. The research involved a survey of 90 employers and 78 internationally educated ICT professionals in Canada in order to gain their perspectives regarding issues relating to the ICT labour market. The results are published in a report, *Building the IT Framework for Internationally Educated Professionals* (BIT). The survey found that only 33 per cent of IEPs identified themselves as working in their field of study and 55 per cent of all IEP respondents indicated that they were already over-qualified for their current roles.[87]

ICTC has also developed *Canada's Information and Communications Technology Sector Resource Guide for Internationally Educated ICT Professionals,* funded by the FCR program. The guide provides information about federal and provincial resources for immigrants, credential evaluation/assessment services, settlement and integration services,

until their professional designation through the Association of Professional Engineers and Geoscientists of Manitoba is approved. Other approaches taken by employers to recognize in the hiring process what immigrants bring to the workplace include administering tests that are relevant to positions sought (Iris Power Engineering Inc.) and hiring immigrants on contract and testing t heir credibility or ability to demonstrate skills in real workplace situations (LEA Group).

[83] Recognizing skills and competencies immigrants demonstrate in the workplace might involve, for example, giving immigrants "stretch" assignments so they have opportunities to show what they now and can do as a way of promoting immigrants or providing verification to professional regulatory bodies of immigrants' worthiness to be recertified in Canada. Girit Projects does an outstanding job of this.

[84] For example, St. Michael's Hospital in Toronto participates in Creating Access to Regulated Employment (CARE), a program that offers services, courses and tuition bursaries to help internationally trained nurses obtain their Ontario nursing license. Deloitte recognizes that immigrants seeking recertification in Canada as Chartered Accountants can perform certain accounting functions while working towards their Canadian designation.

[85] AMEC Earth & Environmental Ltd. Hires foreign-trained engineers as technicians and ensures they get experience working with engineers and project managers until they get their PEng. From the Association of Professional Engineers and Geoscientists of B.C. Apotex Inc. offers a Language of Business English course to maximize the contribution of immigrants and gives participating employees certificates of completion.

[8686] Examples of exemplary employer practice in this area include Teranet Inc., who offer a six-course communications program and invite employees to take one or more courses at hiring or during performance reviews and Cambrian Credit Union, which partnered with the Manitoba Government and other local credit unions to create a customer service training program for immigrants.

[87] http://www.ictc-ctic.ca/uploadedFiles/Professional_Development/ICTC%20-%20IEP%20Final%20Survey%20and%20Focus%20Group%20Report_oct06.pdf (retrieved October 26, 2007)

technology industry associations, and career and employment resources or IT professionals.[88] The goals of the IEP Integration Initiative include developing a nationally recognized, competency-based assessment and recognition tool; bridging and mentoring programs, and other resources for small- and medium-sized enterprises.

The Foreign Credential Recognition program has also invested over $4.5 million with the Association of Canadian Community Colleges to deliver oversees information services, with pilot offices established in China, India and the Philippines. FCR funding has been directed at helping international engineering graduates to become integrated into the labour market and is helping to achieve greater consistency in provincial assessment processes for engineers.

Under the Information Technology Workers' Program, the Canadian government is currently issuing temporary employment authorization visas through an expedited process to qualified professionals and skilled persons.[89] Qualified individuals must meet requirements in terms of education and employment experience to qualify for the work visa. Under this pilot project, job-specific validation was replaced by a national validation letter for specific occupations including:

- Management Information Systems Software Designer;
- Telecommunications Software Designer;
- Embedded Systems Software Designer;
- Senior Animation Effects Editor;
- Multimedia Software Designer;
- Software Developer – Services; and
- Software Products Developer.

Ireland: Immigration—Highly Skilled Workers

The tremendous growth of Ireland's ICT industry in recent decades has resulted in increased demand for highly skilled workers in a tight labour market. The Irish government announced new immigration schemes in 2007 to address the need for key talent resources for industries such as ICT. The schemes include green cards (to replace the more limited working visa) and an intra-company transfer option for "secondees from connected companies". The green cards apply to high earning individuals, (i.e. at least 60,000 pounds) and to a range of specified occupations for which the base salary is between 30,000 to 60,000 pounds, including information technology occupations. Recognizing the important talent resource of international students, the initiative allows for third level graduates of Irish educational institutions to apply to remain in Ireland for six months. Those successful in finding employment may apply for a green card or work permit as appropriate. [90]

Germany: Immigration Programs—ICT

As with many European nations, Germany is experiencing significant labour market shortages, especially highly skilled labour. In 2005, a new Immigration Act, the Residence Act was implemented in Germany. This act constitutes a comprehensive reform of the previous Aliens Act. It provides for highly qualified persons to be granted permanent residence and enables them to receive a settlement permit immediately. A residence title is issued only after a concrete job offer has been made. Immigration has become more centralized under one authority, the Federal Office for Migration and Refugees. The act provides for legal entitlement to an integration course for new immigrants and emphasizes the importance of language training.

The German Association of Information Technology Telecommunications and New Media Association represents more than 1,000 businesses, 800 of which are members. Members of the association generate revenues totaling 120 Billion Euros. IT employees are high in demand, and the Association estimates that 25 per cent of IT vacancies remain unfilled.[91]

Together Germany and the UK account for about half of Europe's IT industry Germany issues about 75,000 work permits (formerly called green cards) each year, with many going to IT skilled workers.

[88] http://www.ictc-ctic.ca/uploadedFiles/Professional_Development/ICTC_IEP_ResourceGuide.pdf
[89] http://www.ictc-ctic.ca/en/Content.aspx?id=102
[90] Ireland—Immigration Update: New Regime for Employment Permits, January 24, 2007. Price Waterhouse Coopers.
[91] http://www.bitkom.org/en/Defalut.aspx

Mature Workers: Benefiting from Experience

Canada: Labour Force Engagement of Mature Workers

The demographic shift towards an older population is leading to an aging workforce and large numbers of potential retirements of healthy and productive mature workers. The attraction and retention of mature employees is an important solution for alleviating growing labour market shortages.

In Canada, a relatively small number of employers have actually implemented attraction and retention strategies for mature workers to-date, however, increasingly employers are recognizing the value of mature workers and are developing strategies to engage them. In growth economies such as Alberta and British Columbia, employers are already facing significant challenges meeting labour force requirements. In Alberta, for example, the number of mature workers, 45 years of age and older, in the labour force grew by nearly 67 per cent over the past decade, and in British Columbia, the number of mature workers in the labour force grew by nearly 50 percent. Mature employees now account for almost 39 percent of the BC labour force. [92]

While most people retire between the ages of 60 to 65, given the right supportive conditions, many mature workers are opting to stay in the workforce longer. Many welcome the opportunity to work for employers who recognize their needs for alternative work arrangements, especially flexible work schedules, part-time or contract work and other forms of modified work duties. Increasingly mature workers are opting for telecommuting and seek opportunities for extended vacations or sabbaticals.

Graduated retirement schemes through which employees can gradually decrease time spent at work also appeal to mature workers. Other strategies include offering financial incentives, opportunities to mentor younger workers, opportunities for training, and targeted recruitment programs.

Successful recruitment and retention of mature workers is contingent on employers' ability to foster a workplace culture that is both accepting and respectful of mature workers needs and understanding of their desire for work-life balance. [93]

As older workers retire in significant numbers over the next two decades, employers will face growing pressures to rejuvenate the workforce pipeline. The upside of this situation is the possibility of thousands of job openings for younger workers and potential career advancement for experienced workers.

Finland: National Programme on Ageing Workers (FINPAW)

The Finnish National Programme on Ageing Workers (FINPAW) operated from 1998 to 2002. A collaborative initiative involving government, business and labour, the program is considered to be one of the most comprehensive and successful programs in the world focusing on mature workers. The objectives of the program were to expand employment of mature workers (those aged 45 to 64) and to reduce early retirement. The comprehensive approach to the program encompassed legal, institutional, attitudinal and incentive frameworks.[94]

This national program consisted of many elements, including training, education campaigns, research, and financial incentives. A popular aspect of the program was part-time pensions. As well, pension entitlement was based on a full working career or lifetime earnings as opposed to the final ten working years. As a result of the program, labour force participation rates for mature workers increased by 10 percent.[95]

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[92] *Mature Workers in Alberta and British Columbia: Understanding the Issues and Opportunities*, (August 2007), (http://employment.alberta.ca/documents/RRM/PC_mature_workers.pdf retrieved October 10, 2007).

[93] *Mature Workers in Alberta and British Columbia: Understanding the Issues and Opportunities*, (August 2007), (http://employment.alberta.ca/documents/RRM/PC_mature_workers.pdf retrieved October 10, 2007).

[94] *Mature Workers in Alberta and British Columbia: Understanding the Issues and Opportunities*, (August 2007), (http://employment.alberta.ca/documents/RRM/PC_mature_workers.pdf retrieved October 10, 2007), p. A1.

[95] *Mature Workers in Alberta and British Columbia: Understanding the Issues and Opportunities*, (August 2007), (http://employment.alberta.ca/documents/RRM/PC_mature_workers.pdf retrieved October 10, 2007), p. A1.

Germany: Job Seeking Senior Citizens in Internet Cafes

In Germany, workers aged 55 and over can reduce their working hours in half in return for a partial pension. Other incentives include work time credits which employees may accumulate for time off.[96]

The Job Seeking Senior Citizens in Internet Cafes initiative is part of the "Seniors Online" project of the Ministry of Foreign Affairs, North Rhine-Westphalia, Germany. IT courses are offered to help mature unemployed citizens acquire or improve their computer skills. Courses taught in internet cafes cover a range of IT topics including basic computer and internet skills, using search engines, searching job databases, electronic job applications, and strategies for self-employment.[97]

Other initiatives include "Innovative with Older Employees", a project that provided work-related ICT training for older workers and promoted the diffusion of ICT knowledge and skills among older employees in SMEs.[98]

Back to ICT: Skilled—But Otherwise Employed Workers

There are many potential sources of IT workers that employers can do a better job of tapping into. We noted above that more than 10,000 people per year graduated with an IT-related degree in the first half of this decade, and job creation was not sufficient to employ all of the new entrants to the labour force, let alone absorb those who lost their jobs during the technology bust. Thus, it is likely that there are a number of people currently in the workforce who are trained as IT workers, and possess the critical skills required by the industry, but working in different occupations.

These highly educated and multi-talented individuals represent a substantial potential resource. Recruitment strategies need to be broad enough in scope to reach these people and employment strategies need to provide the means for enticing them back into IT careers. It is important to note that this situation exists not only in Canada, but in many countries.

We also referred above to what employers can do to reach out to internationally educated professionals who are under-employed, and working in the "foreign credentials gap." Different approaches may be necessary for immigrants who have recently arrived in Canada than for immigrants who are underemployed because their skills, qualifications, education and experience acquired elsewhere have not yet been recognized by employers in Canada.

[96] *Mature Workers in Alberta and British Columbia: Understanding the Issues and Opportunities*, (August 2007), (http://employment.alberta.ca/documents/RRM/PC_mature_workers.pdf retrieved October 10, 2007), p. A1.

[97] http://local.mobhaile.ie/agenet/ICTinitiativesforolderworkers/tabid/14623/Default.aspx

[98] http://ec.europa.eu/enterprise/ict/policy/ict-skills/es-br.pdf

Mini Case Study: SaskTel

SaskTel is Saskatchewan's leading full-service telecommunications company, employing over 4,000 people. Competing in a communications based industry, SaskTel recognizes the value of raising the skill levels of its employees. To help its employees become familiar with, and make full use of, the new technologies that shape its business, SaskTel launched a learning program to develop employee ICT skills.

Three corporate learning initiatives were established: e-learning, a home computer purchase program and an Internet concession. The e-learning program helps develop employees' business-relevant knowledge especially as it relates to e-business. The home computer purchase program encourages employees to purchase home computers for domestic use with interest-free loans. SaskTel's Internet concession provides employees with a tax-free 40 per cent discount for Internet service. All three initiatives have helped employees to become more comfortable with technology, to develop their ICT skills and to see the relevance of ICTs to their jobs at SaskTel and to SaskTel as a business.

E-learning courses have proved very popular with SaskTel employees. On average, each employee takes more than one e-learning course a year. These courses help develop the ICT skills of SaskTel employees, which helps them to be more innovative as employees and broadens the ICT capacity of the company.

These initiatives have helped SaskTel to ensure that e-business has rapidly become adopted by employees.

Mini Case Study: Cisco Systems Canada Co.

Cisco Systems is a leader in providing networking solutions that connect computing devices and computer networks, allowing people to access information without worrying about differences in time, place or type of computer system. Not only has Cisco gained a reputation for technology and product leadership, Cisco is also recognized as an innovator in using technology to drive its own business performance.

At Cisco, skills training and education play an important role in defining the company's competitive advantage. Cisco creates an environment in which employees develop their workplace skills on the latest technologies, which helps the company remain competitive. Cisco has found that learning to use the Internet as an effective communications tool, as well as a core skills-development tool, is a key to its business success.

Cisco has invested heavily in its own e-learning curriculum. Cisco offers its employees a range of learning and development options—from business skills, to marketing skills, to technical and engineering skills. The company places a special emphasis on technical and technological competencies. In order to maintain its place at the forefront of cutting edge business practices, Cisco ensure that sales staff work through 8 to 12 CD ROMS every quarter. These CDs contain important product and service information and help develop employees' ICT skills.

Cisco has realized significant benefits from its e-learning program. The company has noticed that the quality of work completed by employees has increased and that their problem solving abilities have been enhanced. Using e-learning has also helped to reduce costs associated with delivering training. The company also finds that e-learning has helped their sales staff to be constantly attuned to how their products can meet the needs of their customers in a rapidly changing environment.

CHAPTER 7

A National IT Coalition: Working Together to Secure Our Future

Interviews with Coalition Members

Bell Canada Inc. has demonstrated a solid commitment to addressing the IT talent challenge by establishing a national coalition of major IT employers who will work collaboratively to develop insights for securing the future of Canada's IT workforce. The coalition has attracted representation from enterprises in virtually every major sector of the Canadian economy. Several members of the coalition participated in interviews with The Conference Board of Canada, including Hydro-Quebec, Pratt & Whitney Canada, Canadian Tire, Standard Life, Desjardins, Bank of Montreal, CN and others.

The purpose of these interviews was to determine the degree of coalition firms' reliance on ICTs and on IT workers; to quantify their demand for IT workers and the supply constraints they are experiencing; and to identify potential solutions. Coalition partners share a common interest in getting more out of their ICT investments and in taking the IT function out of the back room and putting it on the centre stage of their companies' operations. Their rationale for doing so is based on their conviction that ICTs make a critical contribution to their business performance. The case studies the Conference Board has prepared reveal eight types of value that ICTs generate for firms.

ICTs as a Strategic Enabler
Firms regard ICTs as a strategic enabler for most—if not all—critical business functions. Many coalition partners describe ICTs as the backbone of their operations, which rely on integrated processes.

ICTs as Differentiators of Value
ICTs are viewed as a differentiator of value. They help firms to define or enhance their value offer to their customers. An example of this is the ability to provide customers with consistent, high quality "one stop shop" services, regardless of whether they are dealing in person, on the telephone or on-line.

ICTs as a Dynamic Tool for Enhancing Quality
ICTs are a dynamic tool for enhancing the quality of a firms' products and services based on customer feedback and employee demand for improved functionality. The customer does not necessarily see this aspect of the operation, but benefits from the enhancements afforded by IT.

ICTs as a Vehicle for Increasing Productivity
ICTs are a vehicle for reducing costs, generating operating efficiencies and producing productivity gains. IT, by its very nature, is a tool for streamlining work processes, eliminating the need for multiple data entries and enabling automated processing of data from multiple and integrated sources. Other examples include enabling real-time, just-in-time access to outputs; for example inventory reports, accounts payable and accounts receivable reports, and tracking products and deliveries.

ICTs as a Strategic Investment

ICT is a strategic investment that needs to be constantly customized and leveraged to yield the greatest possible returns. In the early days of modern IT, firms made investments in desk top micro computers, networks, and Internet connectively largely in order to make employees more effective in support positions. IT was also important in manufacturing environments for controlling processes such as continuous casting, automating conveyor systems, and monitoring conditions such as temperature, pressure and levels of hazardous materials such as gases.

Today, IT is still a vehicle for creating operating efficiencies, reducing operating costs and mitigating risks associated with human error or dangerous working conditions. IT is daily becoming more diffuse throughout workplace operations regardless of industry. In other words, there has been a substantial quantitative growth in the extent of IT embeddedness within the workplace.

At the same time, significant qualitative advances have been made in the application of IT in the workplace. For example, IT is now used to drive automated systems utilizing robotic technology for many types of work.

The challenge for firms in the 21st century with respect to IT investments is manifold. Firms that want to make a significant investment in IT to boost their performance need to make investments of the right magnitude, targeted for the right applications, and stay invested for the long haul. This entails:

- Making larger investments in IT;
- Fully utilizing IT within the workplace;
- Ensuring that workers are capable of using IT as intended and to the best advantage (which will involve training of workers);
- Maintaining IT systems (Firms that invest in IT find that maintaining systems is critical to everyday work flow);
- Upgrading IT systems based as needs evolve and demand increases;
- Increasing the functionality of IT;
- Integrating formerly unconnected IT systems to optimize management and control of work, especially work that is carried out in multiple locations; and
- Customizing IT solutions to optimize performance of systems and minimize labour costs .

ICTs as a Driver of Innovation

As a driver of innovation, ICTs have the potential to affect every stage of the value chain from new product or service design to final distribution. ICTs enable firms to engage in dynamic, real-time exchanges of products and services in complex, global value networks and supply chains that cut across industry sectors. For example, an automotive manufacturer can create new design specifications for a car, and share those designs with supply chain partners prior to implementing the final design concept, in order to give them a chance to consider their needs for retooling. New design concepts can initiate a whole new cycle of innovation in materials development, such as ultra-light steels that embed plastics polymers. In this scenario, even the materials' modelling involves IT.

ICTs are a Vehicle for Creating Global Presence

ICTs are a vehicle for ensuring that firms have a global presence with staff and customers alike—from applications such as web sites and e-commerce, to e-learning tools that give staff access to just-in-time product support. For example, advanced research networks such as CANARIE are used in commercial research and development to enable multiple business, education and government laboratory partners to access common data sets and share the results of their work. In these situations ICTs are providing the means of access into an expansive R&D network.

ICTs as a Cross Pollinator of Business Performance

ICTs can act as a cross pollinator in driving business performance. ICTs are more than technologies to get the job done. They are a language unto themselves and as such, provide an opportunity for strategic players from across operating units within firms to engage in a common conversation about improving business performance. When employees in key roles do not understand the language of ICTs or are not engaged in a strategic dialogue about ICTs, they may become out of touch with key enablers in their

operation. A critical challenge and opportunity for the IT function within firms is to takes its place on the centre stage of corporate decision-making.

To help engage strategic workers in the ICT dialogue, some firms are inviting non-IT employees and managers to take a "tour of duty" in IT departments. The rationale is that when critical non-IT workers are exposed to ICTs and their potential to drive business performance, they will be able to cross-pollinate their home departments.

At the same time, non-IT workers have the potential to expose employees in the IT function to other key elements of the business operation, including customer needs, the implementation of strategic directions, and market intelligence. In this way, non-IT workers have a reciprocal cross-pollinating effect on IT employees.

When companies support ICT-based cross-pollination of this sort, they build capacity among IT workers and non-IT workers alike, which they need to maximize business performance. Cross-pollination is therefore a way of building skills and innovative capacity within firms and expanding the awareness and understanding that employees have about the enterprise, the market they are in, and the customers they serve.

IT Workers Wanted—What Employers are Looking For

Coalition members who participated in case study interviews about their needs for IT workers identified three fundamental requirements:

1. Firms looking for IT workers do not just want IT specialists— they want people with solid technical skills who are willing to embrace the culture of their organizations. New IT recruits are expected to bring their IT skills to bear to enhance the unique market position their firms occupy. Coalition members are looking for IT workers who can help them to sharpen their value propositions, to create greater efficiencies within their firms, and to drive innovation. CN, for example, is not just looking for IT specialists; the company is looking for "railroaders" who can drive its IT operations.

2. As a group, coalition members recognize that in a tight labour market and an environment where there are lower cost providers offshore, they may not necessarily be able to pay the highest salaries for new IT recruits. Instead, these firms are hoping to attract the next generation of IT workers with non-salary-based incentives, such as the affinity new workers might have with company values and policies (e.g. being environmentally and socially responsible; or having a reputation for valuing customers and workers alike).

3. Coalition members, in general, do not hope to meet all of their IT requirements utilizing their core in-house IT staff. They are committed to retaining business critical expertise in-house. The types of IT workers they are interested in retaining in-house include high value-added jobs such as:
   - Engineers or MBAs or strong managers who posses IT skills;
   - IT managers who can negotiate critical relationships with offshore IT suppliers; and
   - IT workers who have proprietary knowledge that is critical to business innovation.

CHAPTER 8

Recommendations

The ICT sector should take leadership role in addressing IT labour shortages in order to maintain the future human capital capacity of the ICT sector and meet IT labour needs throughout all sectors of the Canadian economy.

While it may seem paradoxical to increase demand for IT workers when starting from the premise of an IT labour shortage, the long-term health of the ICT sector depends on increasing the appetite of business for intensifying their investments in information and communications technology, which, in turn, requires human capital to make the investments pay.

The ICT sector seeks to expand the role of ICTs in the Canadian economy to improve national productivity and competitiveness and to stimulate growth in the ICT sector. This strategy, in turn, requires additional IT workers—both in the ICT sector and throughout the economy as a whole. The interrelationship between economic activity and IT labour force is positive in the economy. The economic stimulation caused by more ICT usage creates increased demand for IT workers; their subsequent performance will further stimulate growth which will build yet further demand for IT workers.

Accordingly, the Conference Board recommends taking a proactive and comprehensive approach which includes a wide variety of measures to increase both the *supply* of IT talent and to increase the *demand* for IT workers.

Research relating to US firms reveals that substantial productivity gains have been achieved when adequate investments have been made in ICTs, supported by employees with appropriate IT skills. It is reasonable to expect that when Canadian firms make more substantial investments in ICTs in the workplace, their demand for qualified IT workers will increase.

It is worth considering that the potential demand for IT workers could increase beyond current projections of 89,000 positions over the next three to five years[99] as organizations intensify their investments in ICTs to achieve productivity gains and move up the value chain.

The comprehensive approach should not only include measures to increase the supply of IT workers in the talent pipeline, and concomitant demand for IT workers, but also tactics for improving transitions into IT careers.

Part of the solution, is to improve the effectiveness of transition vehicles for graduates and workers from a variety of target groups. Our emphasis on measures to support effective transitions into IT careers is based on the observation that Canadian employers are not as involved as they need to be with target populations and the institutions that support their career preparation and workplace transitions. Employers need to partner more effectively with educational institutions, immigrant serving agencies, professional associations, sector councils and others to ensure effective transitions of talented individuals into jobs that match their skills, education and experience.

The Conference Board of Canada recommends four multi-stakeholder approaches:

1. Increasing the supply of IT workers;
2. Improving transitions to work;
3. Creating additional demand; and

[99] John O'Grady, *Outlook for Canadian IT Occupational Employment* (Toronto: Prism Economics and Analysis, Autumn, 2006) p. 1.

4. Effectively managing talent.

Approach 1: Increasing the Supply of IT Workers

- Increase the supply of potential IT workers in the talent pipeline by incorporating ICT literacy into the K-12 curricula in order to attract more people into IT related PSE programs.
- Promote interest in IT and skills relating to IT by working with educational partners to promote, develop and implement ICT literacy programs at elementary, secondary and post-secondary levels.
- Characterize IT jobs as high value-added; as drivers of innovation and business performance; and as opportunities to make a difference.
- Ensure that students are aware that IT is a "rising star". IT is fast moving out of the back room and into the board room.
- Use strategic marketing and communications to build awareness and interest in IT careers.
- Engage under-represented IT workers in Canada including:
  - Unemployed immigrants, recently arrived, with IT backgrounds;
  - Immigrants who have been in Canada long term, with IT backgrounds in their originating country, but underemployed in another sector here.
  - Former IT workers displaced during the dot-com crash and currently working in non-IT jobs.
  - IT graduates since the dot-com crash who are not employed in IT jobs.
- When recruiting immigrants, send out a signal that Canadian employers are seeking people with IT skills.
- Develop a unique approach to promote IT work for each of the target population groups (youth, women, immigrants, mature workers).
- Raise awareness with target populations about the attractiveness of IT careers, including the high earning potential and policies that are supportive of workers individual needs (i.e. work-life balance).

Approach 2: Improving Transitions to Work

- Engage employers in bridging programs (co-ops; mentorships; internships).
- Undertake a substantial orientation for new workers and establish onboarding strategies to develop critical/relevant skills.
- Promote informal learning opportunities in addition to formal training and education. Develop a culture of life long learning.
- Establish mechanisms for ongoing business-education communication systems to ensure that educational programming is relevant for emerging business needs.
- Provide role models in education and work for target population groups.
- Recognize the benefits of career-pathing within the firm and across the ICT sector, and establish multi-firm linkages (e.g. communities of practice).

Approach 3: Creating Additional Demand

- Build understanding among SMEs of the productivity increases that come from intensifying and leveraging their investment in IT capital and the absorption of IT workers into firms (i.e 'Make the case').
- Deepen and intensify investment in ICT to improve productivity and create demand for higher level IT skills.

Approach 4: Effectively Managing Talent

- Create a supportive environment that accommodates workers changing needs through their career life cycle (e.g. flexible work schedules, working from home, flex days).
- Implement diversity management programs that take into account the needs of all target populations.
- Establish processes for improved credential recognition for immigrants and for experiential learning.
- Promote public and private policies that address the needs of the current and emerging workforce

(e.g. relax mandatory retirement; flexible pensions; sabbaticals; flexible work schedules).

Valuing IT Internally

Coalition members should appreciate that their efforts to elevate the status of IT within their firms represent a smart, strategic direction. Valuing IT internally, in other words, recognizing the contribution of IT beyond the "support role" with which it is typically credited, is critical for driving business performance in the 21st century. IT rightfully has a place on the centre stage of the knowledge economy and efforts to move it out of the back room will yield returns to forward-thinking firms in the form of increased social capital, enhanced labour performance, improved business functionality and enriched customer experience.

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