In this issue:

Offshoring And Immigration – The Impacts On IT Workers In Canada And The United States

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Off shoring and Immigration -- The Impacts on IT Workers in Canada and the United States

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Abstract

The growth of employment in the IT field has been a significant phenomenon in the market place, with IT workers now making up over 3% of the workforce and perhaps another 10% holding IT-related jobs. Following 30 years of almost continuous growth, employment in the field fell in the recent recession. While future projections of employment growth are significant, in Canada and the USA, the economic recovery has not produced a return to the previous levels of growth in the IT field. Enrolment in university computer science and IT programs is down. Some observers hold that key contributors to the lack of growth are the impacts of the offshoring of IT work and the role of immigration, and that these factors make government predictions for growth in IT work unrealistic. This paper examines the impact of immigration and offshoring on the supply/demand situation for IT workers in North America, drawing from both the Canadian and the US experience. Preliminary conclusions suggest that the growth of IT work will continue but in a different pattern than in the past and that immigration policies are having an impact on the evolution of the IT discipline and that offshoring, while having limited overall impact on levels of IT employment, may be causing some problems, especially for entry level workers.

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1. IT EMPLOYMENT IN CANADA AND THE USA

Identifying the numbers of IT workers and rates of growth of employment in North America is a challenging task given difficulties in job classification; however we can arrive at a reasonable estimate of the population of the "core" workers in IT occupations. In Canada, using 12 IT job categories, Industry Canada (2006) estimates a Canadian IT workforce of around 600,000. The US Bureau of Labor Statistics estimates that, in 2005, the USA had some 3.85 million core IT workers, across 14 categories (data extracted from the BLS website, 2006). Exhibit 1 shows a comparison of the two countries job classification schemes.

The 1990s saw annual growths rate of IT employment well in excess of 10%. This came to an abrupt halt in 2001, when IT employment fell in both countries and unemployment in the field, normally around the 2% level, jumped to over 6%. In Canada the total employment fell by about 25,000 workers and is now showing a slow recovery. Industry associations (for example, the Software Human Resource Council in Canada and the Information Technology Association of America) are again projecting shortages in both numbers and skill sets. This contradicts anecdotal evidence reported in the business press that indicates many IT worker are having trouble getting jobs in the industry (e.g. Rapoza, 2005)

In an examination of IT labour statistics covering the last 30-40 years in Canada and the US, Grant and Babin (2006) suggest that while the growth rates in IT employment experienced in the 1980s and 90s are unlikely to return, there is solid evidence from both government and industry projections in each country to support claims that there will be a steady growth in demand for IT workers over the next decade. However they also identify significant challenges on the supply side, fueled by misunderstandings about career prospects. They also developed a mode of IT employment that illustrates the flow of workers in the field and highlights some key issues affecting future supply and demand. Their model is presented in Exhibit 2.This paper focuses two of these issues -- immigration and offshoring.

2. THE IMPACT OF IMMIGRANT WORKERS ON THE IT WORKFORCE

Background

Canada and the USA each have a long and proud history of population growth through immigration. There are, however, some significant differences in current practice. In general, Canada brings in a higher proportion of permanent immigrants, has more of a focus on skilled workers in its immigration policies and immigration issues are the subject of fairly limited public debate. By contrast, US immigration policies are more restrictive, bring in fewer permanent immigrants (about half the rate of Canada), have more of a focus on family immigration, face much larger problems of illegal immigrants and have a somewhat greater emphasis on the use of temporary workers. (C.D. Howe Institute 2002)

This history has had, of course, an impact on the IT workforce in both Canada and the USA. In both countries for at least 30 years, IT workers have been seen as highly desirable immigrants and have been seen, by some, as part of a "brain drain" from other parts of the world to North America (and even between Canada and the USA).

Historically, Canada has had a higher rate of permanent immigration than the US; indeed it has one of the highest immigration rates in the world. The C.D. Howe Institute (2002) reported that the immigration rate to Canada in 2000 was twice as high as in the USA (0.8% of the population vs. 0.4%). The same study reported that the USA has a slightly higher proportion of temporary workers (0.4% vs. 0.3%) and a much higher proportion of illegal immigrants, while Canada has a higher proportion of refugees. Further, the US has a higher birth rate than Canada.

Somewhat different immigration policies exist. Canada puts a higher emphasis on younger well-qualified "economic" immigrants who make up some 60% of the total vs. 17% in the USA, where family reunification is the largest proportion at 64% (vs. 25% in Canada).

The Role of Temporary Worker Programs

Both countries have developed temporary foreign worker programs to address immediate skills and knowledge gaps, including, but not limited to the IT field. In 2000, Canada admitted 89,000 (0.3% of the population) temporary workers, compared to 1,234,000 in the USA (0.4% of the population). (C.D. Howe Institute, 2002)

In the IT area each country has launched specific programs. In the late 1990s, Canada launched the Software Developers Program (now called the Information Technology Workers Program) to fast track the entry of qualified software developers in 7 specific IT job types. Citizenship & Immigration Canada (2000) reported that some 3,000 workers entered Canada from 1997 to 1999 through this scheme, an average of about 1,000 per year. There has been little public discussion or debate about this scheme. In fact, in Canada, unlike the USA, there has been very little discussion about the impact of immigration policy on IT employment. (There is some criticism on general immigration policy, articulated by such authors as Stoffman (2002,2006), who is concerned about the overall rate of immigration and its potential impact on infrastructure and society.)

Gunderson et al (2005) point out that, in the Canadian private sector, landed immigrants are represented at above average levels in training (24.6%), programming (17%) and software engineering (12.4%) and non-permanent residents are over-represented in training (10.3%) and software engineering (2.6%). To some degree, this indicates the short-term situation, since most landed im-

migrants become Canadian citizens after a qualifying period.

The US has launched a more general scheme, the H-1B non-immigrant visa. The visas run for 3 years and can be renewed. The number of visas issued each year has varied, from a peak of 195,000 in 2002 to the current level of 65,000, soon to be increased to 115,000. This covers a wide range of "professional technical and other highly skilled" immigrants. This can include scientists, engineers, and health care and IT professionals. In some years the total quota has not been fully used (from 2002-2004 only about 55% of the available visas were issued, a total of 320,700). This year the cap was met before the year was over. It should be noted that up to an additional 20,000 visas can be issued to workers who gain a US higher degree and this provides another 10,000 or so workers a year.

The proportion of IT/high tech workers within the pool has also varied from a high of some 65% in 2001 to less than 34% in 2002, with the overall proportion likely to be around 50% (McGee, 2006). Whereas, in Canada there has been no significant debate about the IT Workers Program, the H-1B visa has produced intense political debate in the USA, with employers stating that it is an essential part of the workforce supply and asking for it to be increased (ITAA, 2006); whereas opponents argue these workers are not needed, that they simply provide lower cost labour for employers, and that it has contributed to significant job loss for US workers, with each side often using highly selective data to support their case (for a good summary of these, see Matloff, 2002 or Gaudin, 2006). This paper cannot comment in depth on these issues, but a number of points made by some (more or less) neutral observers are of relevance to this debate. Many of these are summarized in a recent trade journal article (McGee, 2006), which suggests that:

- When IT demand is down, the visa applications fall as well. In 2003, only about 40% of those available were taken, about 78,000 visas -- which suggests about 20-30,000 IT workers were admitted that year.

- If skilled workers are not admitted the work will not go to out-of-work residents but might well be offshored and work

that stays in the country is more economically valuable

- It is not cheaper foreign labour that is keeping some IT workers unemployed but lack of the appropriate skills and experience.

- H1-B visa holders are likely to stay in the country and not leave after the visa period expires, often applying for green cards

- There is significant evidence that the visa is used to lower labour costs with visa employees being paid less than market rates, and that the H1-B mechanism to control this is proving ineffective.

- The emphasis on bringing in qualified outsiders reduces the need to train junior staff and may also contribute to ageism against older workers.

For this paper, we can derive some estimates of significance. The H-1B visa program has been in place since 1990 and has had a major impact on the IT workforce. Estimates of the total population of H-1B workers are hard to come by and vary enormously. However one fairly detailed effort (Lowell, 2000) suggested that the total H-1B population could grow to a level of between 500 and 800,000 by 2004 and then stabilize at that level. Since actual awards fell short of the highest projections in several of the subsequent years it would not be unreasonable to use the middle of this range, say 600,000 workers. Now, if we take the IT proportion overall at about 50% this would suggest that some 300,000 workers currently in the field have H-1B visas. Applying the same 50% adjustment to future numbers, it would also be reasonable to suggest that some 65,000 additional IT workers (60,000 against quota and 5,000 for the exempt higher education category) might come in each year for the foreseeable future to form a major part of the supply.

To put these number in context, if the current core US IT workforce is some 4 million, then the 600,000 visa workers make up about 15% of the work force -- by any standard, a high proportion. This can be contrasted with the Canadian situation where Gunderson et al (2005) report that, while 8.5% of the IT work force is made up of permanent immigrants, only 1.4% are on

temporary visas. (Note many workers on H-1B visas apply and get green Cards after the end of their visa period.)

Grant & Babin (2006), drawing on BLS data, estimate that the demand for new IT workers in the USA (including an allowance for those who withdraw from IT jobs) could be around 130,000 per year. Thus it would appear that as much as 50% of that demand would be met by the temporary visas, a sobering prospect for those already in the industry. The Canadian data are less clear, but if we assume a similar growth rate and withdrawal rate to that of the USA, there would be demand for about 20,000 new workers each year, of which perhaps 1,000 (around 5%) would be supplied by special visas.

3. THE IMPACT OF OFFSHORING ON THE IT WORKFORCE

The outsourcing of IT work has been part of the IT landscape for at least 30 years and has led to the evolution of a major service industry in both countries. To some degree, outsourcing always had an element of service being provided across national borders, but with limited visibility. In the early 21st century, this form of outsourcing has received much greater prominence with the emergence of large-scale enterprises willing to provide a range of IT-related services on a global basis. The two countries most frequently mentioned in this regard are India (estimated to have as much as 80% of the market) and Ireland, although others are becoming more significant, such as China and Russia.

This discussion draws on two major studies -- "Trends in the Offshoring of IT Jobs," conducted by Prism Economics and Analysis (2004) for the SHRC; and "Offshoring of Services: An Overview of the Issues" (GAO, 2005).

Prism (2004) suggest that there are four broad types of offshore supply of IT:

- Wholly owned subsidiaries doing application development and support functions for parent companies

- Contract supply of application development and support functions

- Contract Supply of design and integration and support for infrastructure

- Contract supply of IT-enabled services such as accounting, records management and call centres -- often know as business process outsourcing

The main driving force for outsourcing is cost reduction (although some might argue that non-availability of key IT skills may also be a factor) and, as might be expected, the basis of these costs is open to significant debate. The very fast growth of the market is having a variety of financial and demographic impacts on this fast evolving industry, as growth in services increases demand for labour and pushes up costs. In essence this is a current application of arbitrage -- the availability of different buy/sell prices in different markets -- and, as economist would likely tell us, over time these "spot" opportunities tend to settle into equilibrium. CIO magazine suggests (Overbury, 2003) that the offshoring of US IT produces net savings of about 20%, with less in the first year. Also some observers point out that a proportion of the savings gained from offshoring are actually from the process of outsourcing, whether or not it is offshored.

Sources of Offshoring Services

With about 80% of the total market, India is, by far, the largest recipient of offshoring work, with an estimated value of some $10 billion in 2002/3 -- 2/3 of this being from North America (estimate from India's National Association of Software and Services Companies, as cited in Prism, 2004). The focus in India is on custom software (in essence building systems to order) and the basis for competition has at least three elements: The availability of a skilled workforce; low wages costs for the workers; and organizational capabilities -- for example, India has more companies certified to Level 5 (the highest level) in the SEI Capability Maturity Model than any other country.

The first two of these are under considerable pressure as demand steps up and supply looks to fall short of demand. As a result, India itself is looking the offshore some of its IT work and is looking to China as the next source of lower cost workers and services. Indeed the Gartner Group (as cited in Prism, 2004) suggests that "China will be the next India" and that Indian firms may eventually control some 40% of China's IT services market. Gartner projected the Chinese off-

shore market to reach $5 billion by 2007. These and similar estimates are seen as highly optimistic by many, as it is far from clear that China has (or will have in the near future) either the supply of qualified workers (with the needed technical and English language skills) or the necessary infrastructure to sustain such a level of growth.

Canada and the US are also Suppliers of Offshored Services

While offshoring is often seen as a flow of work away from North America to the rest of the world it is often forgotten that a significant proportion of the Canadian and US economies provide services to the rest of the world, although not always in the IT field.

In fact, Canada is a recipient of offshored services, particularly from the USA, and is seen as a preferred location for advanced software development. According to Prism (2004) "all five of the major Indian-based outsourcers have opened development facilities in Canada, as have the major US outsourcers." Other studies such as the AT Kearney Index of international attractiveness to IT work and KPMG's Competitiveness Alternatives Study (2006) also rank Canada as one of the most cost effective region locations for higher end knowledge work.

In examining offshoring from a US perspective, the GAO study found that, whereas service producing industries make up 78% of the US economy, the value of services imported is about 16% of the total, while US services make up about 30% of all exports). So on a macro level, the US has a pretty solid positive balance of payments in services -- about $70 billion in 2002 (unlike its position in physical goods).

The GAO also found that, in the Business and Professional Services category, US imports of these services grew from $21.2 billion in 1997 to $37.5 billion in 2002 (an increase of 77%, at a time that US export of such services grew by 49%). Notably, 71% of this trade was between foreign affiliates and their parent companies. It is not clear whether this export was of existing or new work.

Potential Job Loss Due to Offshoring

The GAO study found limited data on loss of jobs in regard to outsourcing. It did find that from March 2001 to June 2004, there

were net job losses in the US private sector, including IT jobs, but does not make the direct connection that these losses were caused by offshoring to any significant degree (except perhaps in manufacturing). It also mentions the BLS Business Employment Dynamics series that shows the scale of job creation and loss in the US -- citing that in 2002, gross quarterly job gains and job losses averaged 7.9 million and 8 million, respectively. Finally, it summarizes several other studies projecting job impacts of offshoring. For example the Gartner Group projected that, by 2004 500,000 IT jobs might be displaced and Forrester Research had suggested that 3.3 million jobs (of all types, with only some 470,000 or 15% being in IT) could be moved offshore by 2015, with about 600,000 moved by 2005. Deloitte Research projected 850,000 financial services sector jobs (some 15%) might move offshore.

In another attempt to put the challenges of outsourcing in context, Prism (2004) suggest that the value of IT spending in the US economy would be between $385 and $500 billion in 2003 and that the total value of outsourced (including offshored) work was about $45-50 billion --less than 10% of the total, but projected that this might rise to as much as a third over the next 5 to 10 years.

ITAA (Global Insight, 2005) estimated the degree of offshoring of IT jobs from the USA to be below 112,000 in 2002 and that it might grow to 225,000 by 2010, with the total spend on offshoring to grow from $10 billion to $38 billion in the same period. Despite this, they claim that the result of increased offshoring will be a net gain to employment in the USA, creating more (and higher value?) new jobs than those displaced, while admitting that there will be a net loss of jobs in the Publishing, Software and Communications sector (between 34,000 and 61,000 to 2010), with a counterbalance in the Professional, Consulting and Business sector (of about 40,000 per year). Since this analysis is by industry and not by type of work, this cannot be viewed as the total picture since the loss includes non-IT jobs and other industries net growth numbers will likely conceal IT job changes within that industry.

Limits to the Growth of Offshoring

Much of the North American debate focuses on the demand side -- estimating how much IT work might be offshored, but not enough has been done to examine the supply side -- where will all this work be done?

The Economist (2005) says: "Limits to the growth of offshoring are already appearing. Technology, which made it possible to shift such work abroad in the first place, is now helping to bring it back."

Somewhat ironically, a review of recent literature in India reads just like the North American market a decade earlier. Recent work projects "a severe shortage of knowledge workers in the IT/ITES sectors by 2010" (Herald, 2006) and a "significant shortfall to the tune of 0.5 million (roughly 23 percent of the industry's requirements of 2.1 million) for IT services and IT-enabled services." (NASSCOM, 2006), These studies suggest that new entrants to the IT field in India number around 40-50,000 per year against a projected demand of 80-90,000.

To illustrate the challenges of continued growth in offshoring supply, although China is seen as the next "India", it lacks many of the infrastructural elements that have made India the prime offshoring provider. For example while India's educational system is the world's largest producer of computer science graduates (usually with good skills in the English language) in China there is much more of a focus on traditional engineering degrees, which are less likely to produce graduates with the necessary skills to provide offshored IT services. (Business Week Online, 2003)

The GAO (2005) further suggested that:

> Many economists agree that offshoring is not likely to affect aggregate U.S. employment in the long run, but acknowledge that in the short run, workers will lose their jobs when employers relocate production abroad. At the same time, some economists have commented that offshoring may cause structural changes in the labor market because increased trade alters the mix of goods and services produced in the U.S. These structural changes could generate permanent changes in the types of work conducted by the U.S. labor force and could also

possibly have longer- term effects on the U.S. unemployment rate.

4. IMPLICATIONS ON IT EMPLOYMENT AND EDUCATION

From the analysis presented above it seems clear that, in the USA, combined impact of the immigration polices and offshoring on the nature of IT employment and career development is significant. The impact on Canada is less obvious.

General Impact on Employment

For many years, both Canada and the USA have depended on immigration to fill skilled job gaps. In the IT field the main difference seems to be the immigration methods adopted. The vast majority of immigrant IT workers to Canada come in through permanent immigration schemes with only a very small proportion on special visas. In the USA, the use of special visas seems to predominate. It seems clear from both historic and current data that, in both countries, without the addition of workers through immigration the growth experienced over the last 15-20 years would not have been achieved. The Canadian experience has been that, even with a fairly open and skillsoriented approach to immigration it was still necessary to "top up" with some special temporary visas for certain specific skills. In the USA, with much less of a focus on skillsbased immigration, the approach has been to complement the permanent resident awards (the "Green Card") with a much more aggressive approach to attract temporary workers -- including the H-1B Visas.

However, now that the IT job market appears to be more mature, its future growth, although still well above national averages, is much less than before. As a result, in the US the special visa may make up as much as 50% of the increased demand, mainly at the level of the mid-career experienced professionals. It is difficult not to conclude that this can only have damaging effects on the career prospects of existing professionals who, either can, or could with limited training, hold these jobs.

The impact of offshoring is less obvious, though also troublesome. Generally, projections are that there will be some limits to growth and that most offshored jobs will be those supported by IT rather than those of

IT workers. However, certain types of IT work, particularly application development and support, are vulnerable and make up much of the current offshoring of IT work. Exhibit 3 drawn from Prism (2004) shows the potential impact of outsourcing on different types of IT work. Since working in programming and user or technical support is a typical entry-level job for recent university and college graduates, the removal of a substantial proportion of these jobs is likely to reduce availability of entry-level positions in the industry -- something already identified as a systemic problem.

One critical issue is that it is not clear whether the BLS growth estimates that are most widely used to project future demand have taken the potential offshoring of IT services into account. If not, this could reduce demand for IT workers in the USA by some 40,000 workers per year (if we use the Forrester estimate referenced earlier). This makes up 25-30% of the estimated new demand.

Implications for Educators

There are some contradictory messages for educators (and their students) in these findings. First, IT work in both countries is expected to see above average demand. So for those who successfully enter the industry after education, there appear to be good career prospects. However depending on the skills the student has gained, the mid-career prospects of US IT professionals may be somewhat dampened by the continued influx of temporary workers. Long-term career success may depend on having a skill set than likely includes but goes beyond the technical skills that are seen as the main criteria for H-1B qualification. So, soft skills, project management and business application skills and experience will likely become increasingly important and their development should be carefully considered in curriculum review.

For students who choose to follow technical streams that lead to entry-level jobs in programming or technical support, there are some significant concerns. Since these jobs are seen as more under threat from offshoring than others, this may reduce the potential for both entry-level jobs and career development. It is noteworthy that several studies indicate that not only will programming jobs not grow at the same rate as other areas; there are also much higher rates of exit from the job (indicating, perhaps, its role as an entry level position). Educators would do well to consider whether their curriculum gives appropriate weight to the needed technical and professional skills as well as addressing these new trends. (For example, the establishment and management of offshored work.)

The need to gain practical experience as well as a relevant education, when combined with the pressures to offshore entry-level work, should be of significant concern to educators. This is most often provided through formal co-op or internship programs or more specific practical project work. Ironically, there is some evidence that industry is not stepping up to this challenge and that the number of such opportunities is dropping. So, a concerted effort by educators to emphasize this need and to create and launch innovative work experience programs could prove most beneficial to both the schools and their students.

As researchers, faculty should consider the opportunity to do further research in this area to examine both the match of degree programs to future jobs and to better understand the overall demographic pressures within the IT employment field. Objective work in this field could be useful to assist policy makers in assessing the relevance and appropriateness of special programs such as the H-1B visa. Such work would also assist the IT industry in making more informed decisions in hiring and staff development.

5. CONCLUSIONS.

In summary, both immigration policy and offshoring are having a significant affect on IT employment in North America. While not sufficient to challenge the overall projected growth in demand, they are fundamentally changing some aspects of the IT employment model and educators should consider their impact in program development and delivery as well as in industry liaison activities. Industry and government should consider carefully whether their actions will provide the right environment to allow young people and experienced professionals to benefit from the growth that will take place and to minimize the longer-term impact of these new realities.

If this is not done, the combination of employment fact and mythology will continue to impact entry to the field through traditional sources, such as computer science, and may, as a result, make the rumoured IT staffing shortfall a "self-fulfilling prophecy"!

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US Bureau of Labor Classification

- IS Manager
- Comp. Systems Analyst
- Comp. Programmer
- Comp. Software Engineer (Applications)
- Comp. Software Engineer (Systems S/W)
- Comp. Scientist, Database Anal.
- Comp. Scientist, Networks & Datacom
- Network & Systems Admin
- Comp. Operator
- Comp. Support
- Comp. Scientist, Research
- Other Specialists
- Comp. Hardware Engineer
- Electrical & Electronics Engineer

Canadian HRDC Labor Classification

- Computer & IS Manager
- Information Systems Analyst & Consultant
- Computer Programmer & Interactive Media Developer
- Web Designer & Developer
- Software Engineer
- DB Analyst & Data Admin.
- Comp./Network Operator & Web Tech
- User Support Technician
- Graphic Designer & Illustrator
- System Testing Technician
- Computer Engineer
- Elec. & Electronic Engineer

Exhibit 1: US & Canadian IT Job Classification

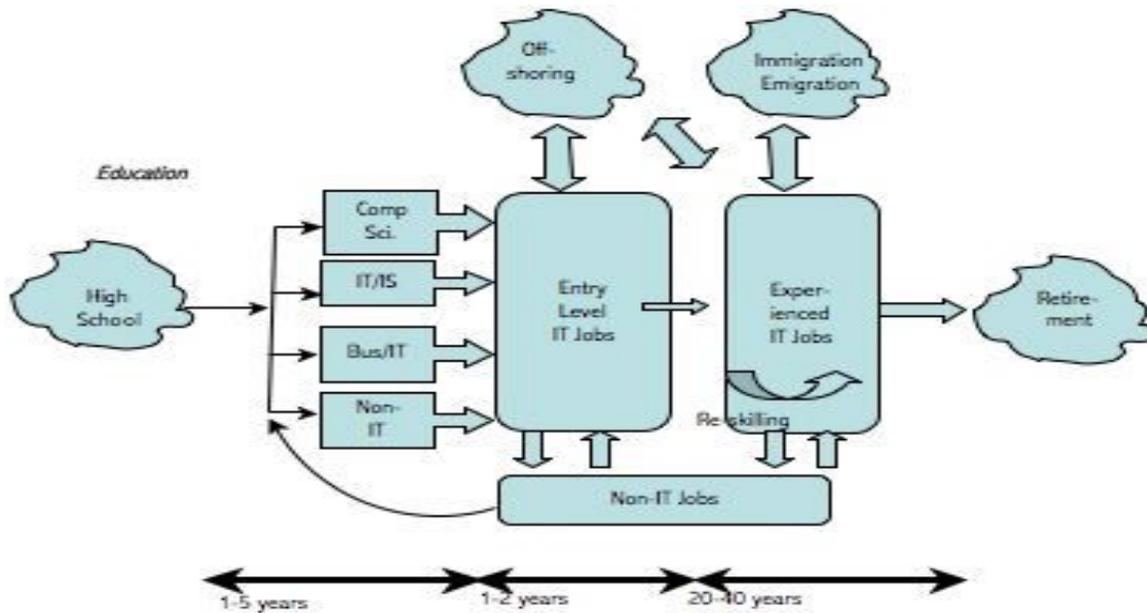**Exhibit 2: An IT Employment Model**

High	Medium	Low
• Application Development – discrete components	• IT Infrastructure	• R&D
• Coding	• Data Centres	• Systems Architecture
• Application Maintenance (legacy systems)	• Human Resources and Finance	• Network and Data Security
• Help Desk	• Network Management	• Integration of IT and business processes
• Call Centres	• Web Hosting	
	• Server Management	

Exhibit 3: Likelihood of IT Work Being Offshored (Prism, 2004)