Opportunities in ICT Education

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Abstract- While cost saving is at the forefront of the reasons for offshoring to low wage countries, the moves relevant to ICT are also motivated by difficulty in finding the right talents inside the country. One of the root causes for such a difficulty, is related to the drastic fall in the number of students in field like computer engineering and ICT. To combat that, there have been serious changes in national education policies, and the way universities and other training institutions conduct their business to inspire young students to choose ICT for their studies. Although as a consequence of those, in some parts of the world, the number of students enrolling in these fields have stabilized or even increased, given the number of years it takes to educate a graduate, the number of graduates has been dropping at alarming rates. Furthermore, the ICT skills shortages for experienced professionals, in most industrialized countries can be expected to get worse, before they eventually get better. There is also a strong case for retraining many people who already have tertiary education, whether in the workforce or not, to overcome to ominous ICT skills dilemma. This paper reports on the examination of these problems. It also reports on the advantages of taking a more broad-spectrum view, requiring a combination of many existing solutions along with novel approaches and realistic analysis of the acceptance of the current global ICT services and education environments to overcome these problems.

Key-Words: - ICT Education, Higher Education, Offshoring, Skills Shortage.

1. Introduction

The concerns regarding the re-training and education are pervasive, at least for those nations who considered as the forerunners of the world economy. According to many sources, including the World Bank, in most advanced economies the standard of living is now mainly determined by knowledge. The older sense of balance, which tools, land, or resources were the dominant factors in advanced economies has now clearly shifted towards ones that are clearly knowledge-based [16]. As a result, the competition for attracting talent and high quality researchers, educators, and even graduates is now truly taking place in a global sense. These can obviously have great influence on national growth and productivity. Furthermore, the comprehensive status and standing of a country's higher education system will establish its success in attracting international funding, scholars and researchers, as well as students. These are fundamental factors in insuring competitiveness in the knowledge economy.

For many organizations in industrialized countries, offshoring the ICT services and related functions appear to be an inevitable reality. Many may consider this as part of the expected trends in outsourcing. ICT outsourcing has seen an explosive growth over the last couple of decades. For instance, in Australia, the government figures put it at around A$ 7 billion (~U$ 5 billion) for 2009. This is in fact just a small fraction of worldwide spending that saw a staggering growth from A$9 billion (~U$ 7 billion) in 1990 to over A$346 billion (~U$ 260 billion) in 2009 [5]. Various effects and reasons for are cited offshoring. For instance, it has been shown that for some representative EU countries, from 1995

to 2000 offshoring of services to typically low-wage countries has reduced the employment rates by 0.2 percentage points per year [8]. As for the reasons, perhaps the most prevailing one relates to cost cutting and cost saving purposes. But clearly saving money is not the only reason. On many occasions, finding the right skills and talent are the actual underlying reason for the moves offshore.

The moves of ICT services to offshore locations, in conjunction with a related and perhaps the more serious problem of skills shortage and demand for ICT education has been the topic of many scholarly research and more cotemporary articles. For instance, recently in UK, it has been noted that the number of ICT graduates is half of what they were just five years ago, and expected to fall even further [14]. Naturally, the effects of such dramatic falls will not remain restricted to ICT industries of a country. The longer terms effects will be felt by research and development areas, as well as other industries feeding into or being fed by ICT services sectors. On the other hand, the use of sophisticated computing schemes and the prevailing nature of communication technologies in all aspects of modern societies does require a workforce, skilled and professional in these respects. The problems are further complicated by the rapid growth and changes in ICT. This signifies the productivity of the majority of the current workforce, already graduated, is quickly deteriorating in real terms. To remain relevant and productive, workforce needs to be trained and re-educated with newer ICT skills.

There are very hot debates about what needs to be done, leading to many interesting solutions. These include recommending that governments increasing their contributions significantly, through scholarships to study ICT or provisions for tax breaks and the like, for instance see [3]. Others have suggest that, in fact throwing money at the problem cannot produce any positive outcomes, for some example arguments see [15]. There are also strong viewpoints, both for and against, distance education and the use of ICT services themselves providing the main solutions to this problem. Some of these viewpoints can be found in [13] and [9].

This work, takes a more general viewpoint, requiring a combination of these solutions along with realistic analysis and acceptance of the current global ICT services and education environment. It will also explore appropriate ways to combat this problem through analysis and identification of real prospects for ICT education. As it will be further discussed in the next section, the moves to offshoring are towards the so-called emerging market, with generally a low wage workforce. But the ICT education providers are mixed, with the net effect being more in favor of the industrialized countries. These have perhaps manifested themselves, in high number of international students in some courses in countries like Australia, Canada, US, UK, and the like. These are further discussed in the next two sections. Section 4 looks at more specific question of courses and structure in ICT education and the last section provides the concluding remarks.

2. Outsourcing and Offshoring of ICT Services

Outsourcing is normally taken to mean to manufacture, buy, or use the services of entities beyond the logical boundaries of an enterprise or organization, generally not giving regard to where the activity takes place. Offshoring, on the other hand, is mainly characterized by the geographical and political boundaries where the activity is carried out, irrespective of whether it is within the logical borders of an enterprise or organization or not [1]. There have been clear indications that the older and the larger the firms are, the more they intend to use ICT outsourcing. This is not necessarily true for offshoring. Not surprisingly, the destination for most ICT offshoring appears to be India followed by China. An indication of this can be seen in a sample of research studies summarized in Fig. 1 as reported in [10].

While cost saving is at the forefront of the reasons for offshoring to low wage countries, the moves relevant to ICT are also motivated by

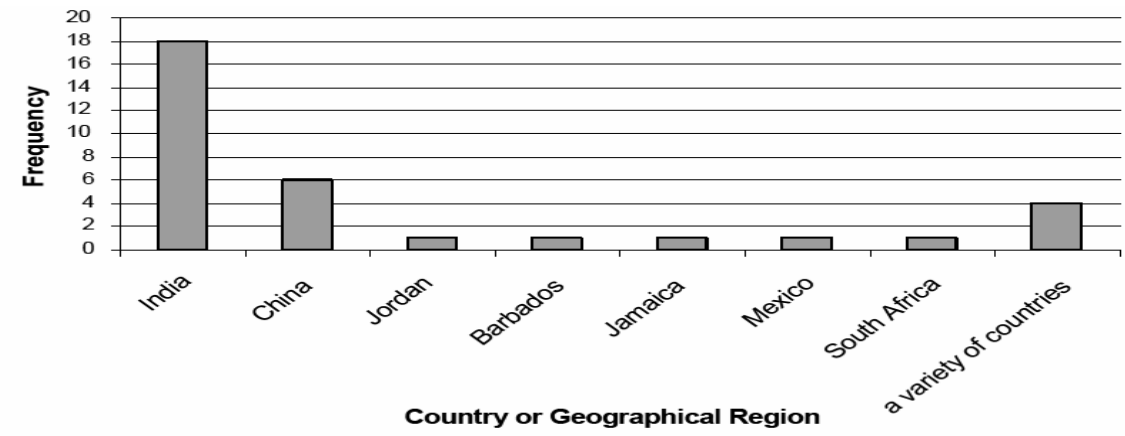

Fig 1. Sample of offshoring destinations, adapted from [10].

difficulty in finding the right talents inside the country. For example, it is now typical to see news and commentary articles, stating that "Lloyds TSB recently announced that the move of two thirds of their ICT staff to India was not to save money. The UK throughput of ICT graduates … is now below that in 1996…. The shortage of those capable of supporting computation intensive industries threatens the continuance of the UK as a major location for leading edge research, let alone product development and support, in pharmaceuticals, aerospace and multi-media content production and publishing…" [14].

These concerns have lead to huge expenditures by governments and private sector. For instance, the UK Government has recently announced £14 billion of IT spending that would be used to improve workforce skills and workers' job prospects. This has been in realization of UK's IT industry facing dramatic challenges in finding suitably qualified people who have the right skills to enable it to compete internationally. The Sector Skills Council for IT has forecast that for the next 10 years, the IT industry requires around 131,000 people each year and most of these will be graduates. Otherwise, a lot is at stake. The value added by UK digital industries is estimated to be in the order of £86 billion per annum, which is 10.9% of the UK total. , and have the potential to contribute a further £35 billion over the next five to seven years [7]. There is also great need for re-education and bringing up the skills base of the current workforce, in terms of ICT and management capabilities. This is of particular interest and consequence in the current downturn of the global economy. This has been one of the motivations behind large governmental expenditures. Continuing with the UK example in announcing the expenditure, the relevant minister said: "In tough economic times like these, there is a danger that employers will reduce their investment in the skills of their employees as they look to cut costs. But research shows that companies who don't train are 2.5 times more likely to fail than those who do. A failure to train now will mean that when the economy begins to grow again we will not have the skilled workers we need to seize those opportunities that growth presents" [7].

3. Global ICT Education

Many indicators have pointed that the number of students studying ICT related disciplines has fallen dramatically. In general this is considered to be a global issue, not restricted to any corner of the globe. It has affected the education at all levels of study, from vocational to postgraduate research studies. For instance, Figures 2 to 4, represent part of the results of an indicative study carried out in UK [2]. According to that report, in a three year period, from 2003 to 2006, computing student

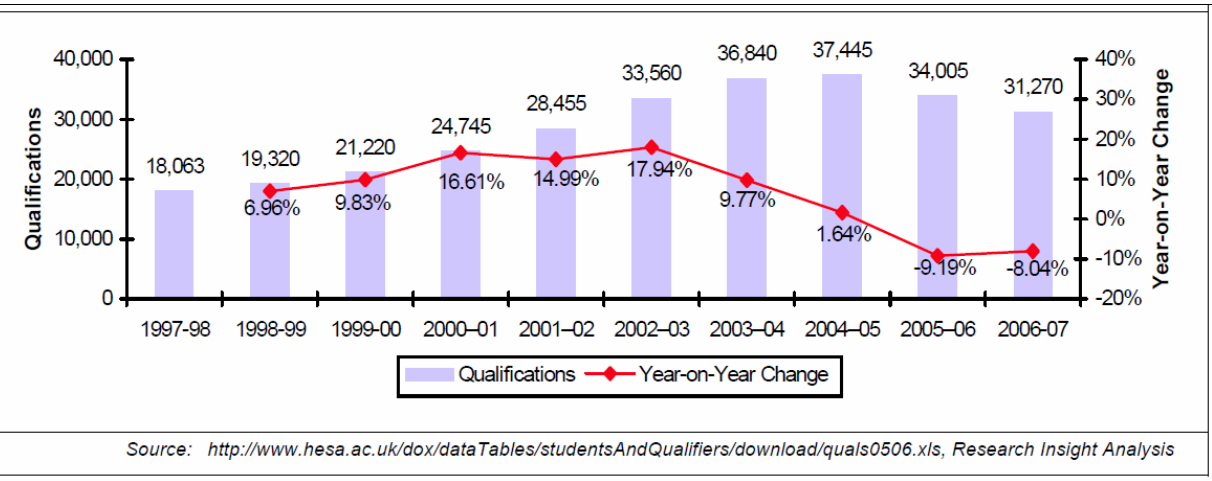

Fig 2.Tertiary level ICT student numbers, adapted from[4] [2].

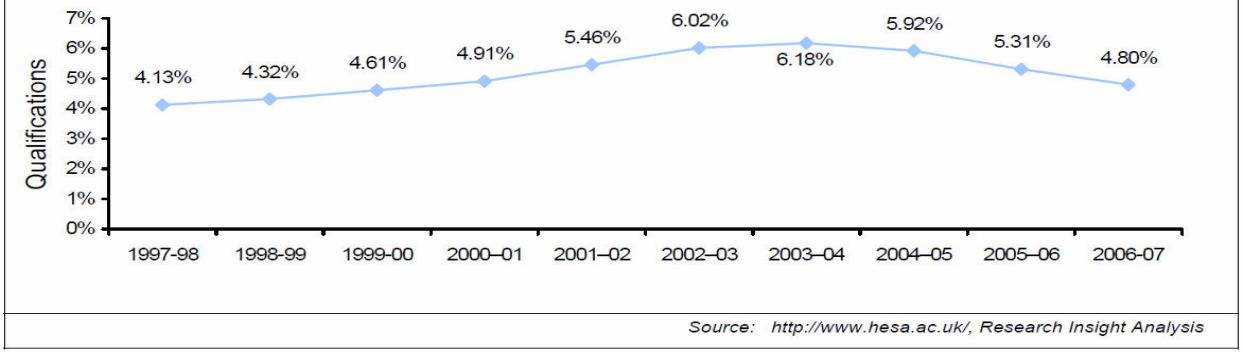

Fig 3. Percentage of tertiary level students studying ICT, adapted from[2].

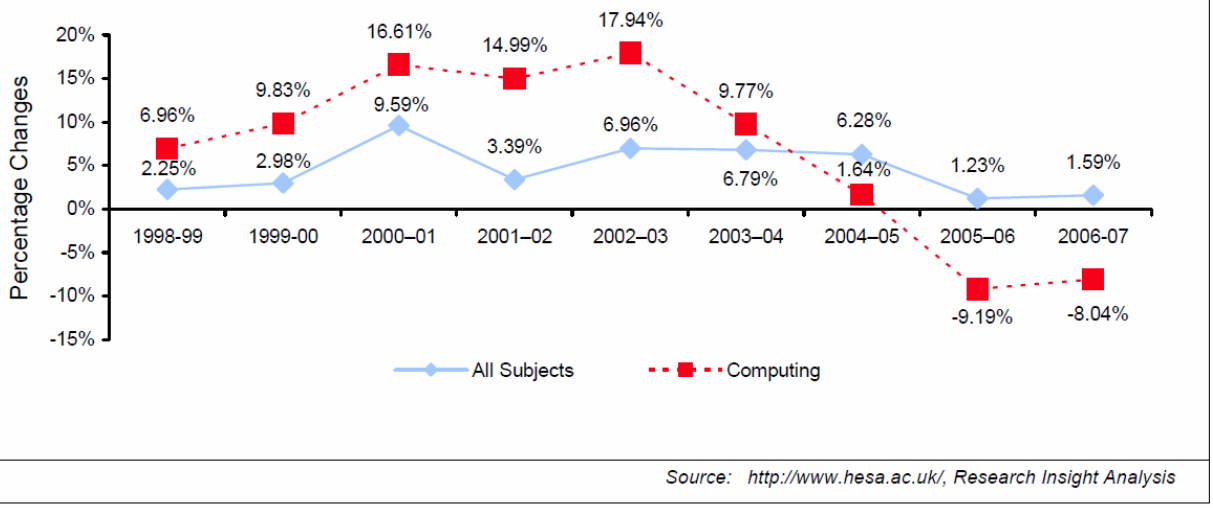

Fig 4.Year-on-year tertiary level ICT student number changes, adapted from[2].

numbers at tertiary level fell by 22.3%. The changes may have now flattened, with the

Characteristic	1996*	2007	1996 % of total profile	2007 % of total profile
Postgraduate students	132,444	278,257	20.7%	27.0%
Undergraduate students	496,227	720,003	77.7%	69.9%
Domestic students	584,476	756,747	91.5%	73.5%
-Full-time students	340,333	481,140	53.3%	46.7%
-Part-time students	244,143	275,607	38.2%	26.8%
International students	54,020	273,099	8.5%	26.5%
-Full-time students	37,986	218,867	5.9%	21.3%
-Part-time students	16,034	54,232	2.5%	5.3%
Mature-age students (21 or over)	402,884	682,225	63.1%	66.2%
External (off-campus) students	85,938	130,277	13.5%	12.7%
Multi-modal students	17,508	71,386	2.7%	6.9%
All students	**638,496**	**1,029,846**		

Fig 5. Australian higher education profile, adapted from[3].

student number reductions stabilizing over the last few years as shown in Fig. 4.

For countries, like US, UK, Australia and Canada who are normally providing education services for international students, this turn in numbers has a double negative effect. In most cases, the higher education institutions in these countries are partially dependent on full-fee-paying international students for their funding. For example Australian universities began their full-fee program for overseas students in 1985. By considering the profile of students in Australian higher education system, shown in Fig. 5, adapted from [4], the tremendous effect on the funding available to universities should be obvious.

Obviously the level of funding has a lot of effect on the availability and quality of ICT education. Therefore, one of the fist points to consider, relates to funding arrangement for ICT education, and perhaps under the general umbrella of funding the higher education systems. In many cases, it is clear that the real funding levels have drastically gone down. For instance, in UK, the level of public funding for ICT higher education has decreased by over £100 million (U$200 million) per annum. This equals a reduction of £1 million (U$2 million) from the annual budget of each and every ICT school in UK [15]. The Australian higher education system provides another viewpoint. In Australia, most of the

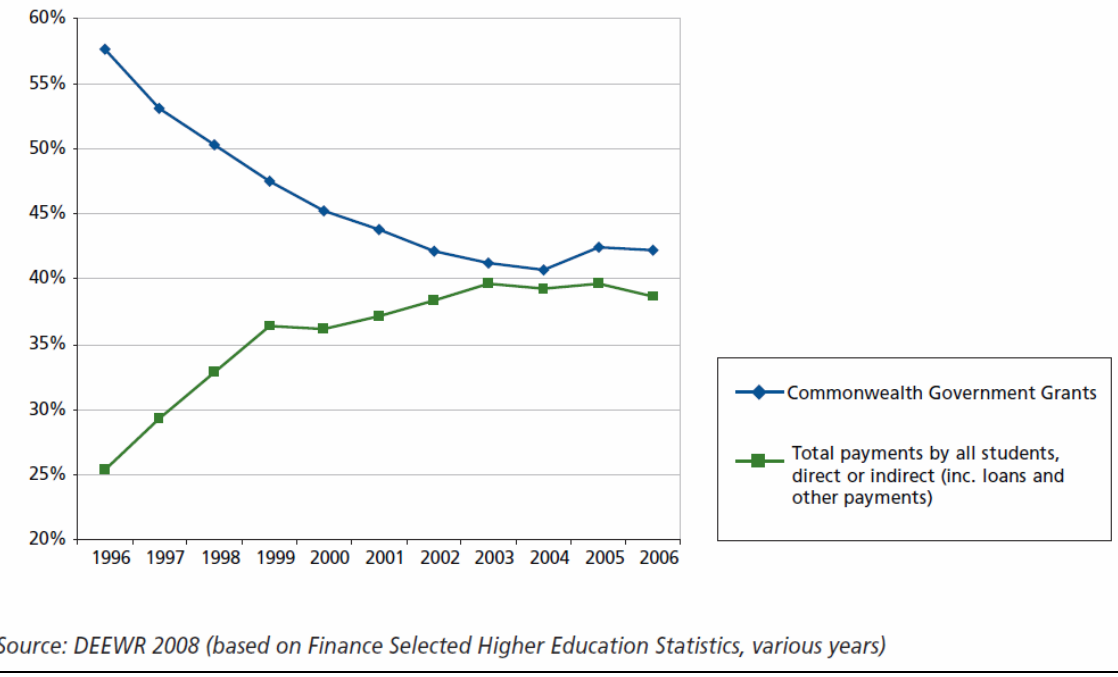

Fig 6. Government and student revenue for Australian higher education system, adapted from[4].

revenue is actually coming from sources other than direct government financial support. Direct funding from the Australian government, actually fell in real terms, from 1997 to 2001, when they started to grow again but just marginally. The share of government funding has cut down from 53% of total higher education revenue in1997 to 42% in 2006. This has caused most universities to seek revenues from various student sources, rising from 29% 1997 to 39% 2006, summarized in Fig. 6 [4]. Given these, for ICT education, with the general trend of the reduction in student numbers in the past few years, it is obvious that it is a huge challenge to keep research and academic staff to student ratios at existing levels. In Australia, for instance, student to staff ratios have noticeably grown, from 12.9 in 1990 to 20.5 in 2006 [2]. This clearly contradicts the requirements for advances in knowledge-based economies.

IT ROLES	% OF PROFESSIONALS WITH COMPUTING DEGREE
Software Professionals	46%
IT Strategy/Planning Staff	44%
Operation Technicians	38%
ICT Managers	28%
Total Workforce	**39%**

Source: UK ICT Enquiry, Q3 2006 – e-Skills UK

Fig 7. Percentage of tertiary level degree qualified ICT professionals with ICT qualifications, adapted from[2].

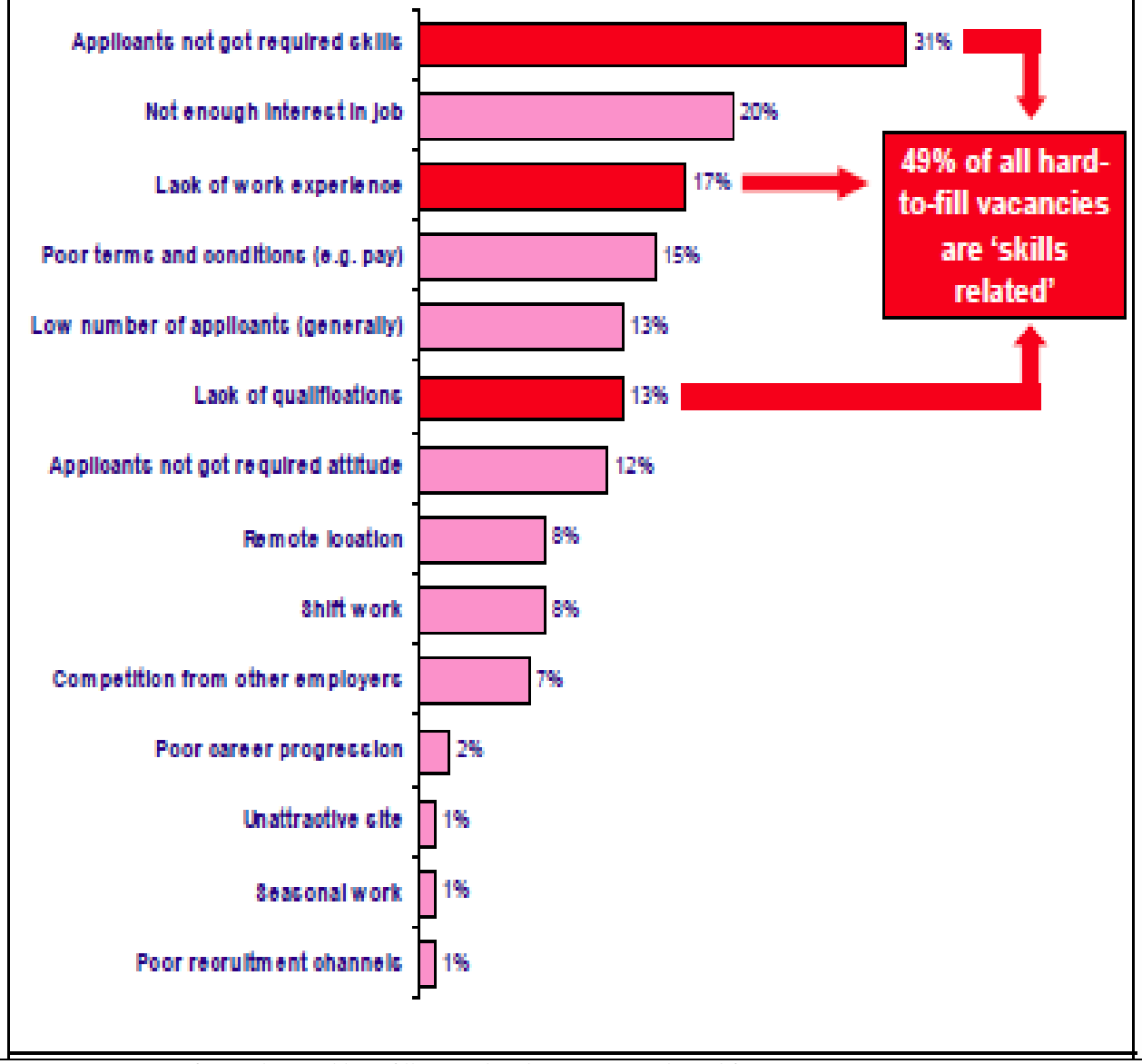

Fig 8. Main reasons for not being able to fill ICT related vacancies , adapted from [11].

4. Profile of ICT Students and Professionals

There are suggestions that in the current employment market, many of the ICT graduates do not necessarily work in their own field. On the other hand, many of those who are working in the ICT areas are not degree qualified. For instance, the analysis of skills in UK has shown that only around 40% of those with post-secondary degrees working as ICT professionals, have a computing or IT degree [2]. The same report, whose summary is shown in Fig. 7, shows that actually almost half of those considered as ICT professionals, do not have any tertiary level degrees.

SKILL REQUIREMENT	SHORT-TERM DEMAND	LONG-TERM DEMAND
Highly-skilled IT Personnel	Immigration / offshoring to non-EU countries with a highly qualified labour force	Increased output of tertiary education
Medium-skilled IT Personnel	Immigration, off-shoring, training and retention activities	Increased output of secondary education
Low-skilled IT Personnel	Training and re-qualification activities	Increased computer and Internet literacy in primary and secondary education

Source: http://ec.europa.eu/enterprise/enterprise_policy/competitiveness/doc/competitiveness_report_2001/chapter_3_annex_1.pdf

Fig 9. Reducing the ICT skills shortage , adapted from[2].

For many employers, there are various vacancies that are hard to fill. These are mostly related to the skills gap, where lack of tertiary level ICT qualifications can be a major contributing factor. For example, the results of a study, with one of its summaries shown in Fig. 8, indicate that almost half of the individual vacancies that are flagged as hard to fill, are so due to skills related reasons [11].

Several other studies have also pointed to the skill shortage and perhaps, more importantly to skill gap. For instance, for the interval 2008 to 2012, the estimates point to around 180,000 appointments per annum in the UK ICT workforce, with approximately 39,000 going to people already in ICT workforce. The big portion of these appointments, around 141,000 of them though, are to be filled by new entrants to ICT job market. The expected breakdown of the people to make up this relatively big gap, is as follows. Around 27,000 are tertiary level graduates from both ICT and non-computing disciplines. Another 71,000 are expected to change jobs from a non-ICT background. The remaining 43,000 are to be filled by those re-entering the workforce after some break in their carriers [7].

Even if the skills shortages are somehow addressed in this fashion, an issue of serious consequence that remains, relates to ICT skills gap. It has been argued that in particular, technical skills remain the largest skill gap in the ICT workforce. According to some studies 38% of ICT managers, 12% of Networking staff, 10% of Programmers, and 10% of PC Support Staff have technical skill gaps. While there are no magic wand to overcome these problems, most experts agree that the long term solutions require intensifying ICT education at various levels of study from primary to tertiary levels. An example of such suggestions, summarized in Fig. 9, date back to reports as earl as 1999.

5. Concluding Remarks

For modern economies, knowledge, rather than resources, represents the main pathway to growth. In these economies, in addition to the more obvious cost cutting reasons, the needs for qualified people with appropriate expertise and experience have forced many enterprises to offshore part of their operations. In the recent past, the skills shortage and gap for ICT expertise plays a major role in this process. With lower

enrollment in tertiary level courses, the break between available and required degree-qualified workforce is rapidly growing. The problem is aggravated in most countries with the general tendency of lowering the public funding for higher education sector. The problem is predominantly alarming, for ICT education being also hit by lower student numbers. Additionally, with the rapid intensification of the use and need for ICT services, the retraining and education of current workforce in this area is inevitable. To tackle these issues realistically, there are clear needs for increased public funding, as well as recognizing ways to expand the collaboration between industry and ICT education providers. Furthermore, ICT education and industry need to find ways to spread the inspiration of the discipline and make it more attractive and appealing to high school students. High school curriculum must also be looked at and redeveloped to make them inspirational, up-to-date, and imaginative. Re-skilling and education of current labor force, perhaps through short ICT courses, or postgraduate diplomas and coursework masters is a huge opportunity and need for ICT education.

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