

# Techniques for Aligning IT Education with Industry Demand

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## ABSTRACT

Organizations rely increasingly on Information Technology (IT) solutions for day to day operations and as such IT solutions play a significant role in efficiency, effectiveness and innovation of processes in design, development and delivery of products and services. IT is a business enabler and has revolutionized the ways in which various sectors of the industry operate. Various reports and published research suggest that worldwide, IT skills are in short supply and high demand. Universities and other tertiary institutions play a key role in developing skilled IT workforce to meet these skills shortages. The use of most IT solution platforms is global. If language and cultural issues (that can potentially impact nature of design) we put aside, skills related to solution development processes and technology deployment are mostly common worldwide. IT is now a global industry. Therefore it is critical to align skills development strategies adopted within educational programs (offered by educational institutions) with realistic and relevant needs for the global market. Tertiary educational institutions make use of a variety of techniques and frameworks for aligning their programs with IT skills needs. Based on review of cases and previous research, this paper presents an overview of techniques deployed by tertiary educational institutions to ensure relevance and currency of their programs for developing skilled IT workforce.

**Keywords:** IT Skills, IT Education, IT Education Alignment, Skills Frameworks

## 1. INTRODUCTION

Increasing public awareness of the benefits of Information Technology (IT) has raised the expectation that both public and private sectors introduce innovative solutions for better service via use of IT. At the same time, to benefit from IT organizations have had to invest heavily in both IT infrastructure and information systems (IS) applications. The strong link between business growth and IT encourages increased investment in IT. The 2014 New Zealand (NZ) Information and Communications sector report published by NZ government highlights the following themes:

- rising investment in the sector
- the increasing number of computer systems design firms
- strong employment growth, with wages and salaries twice the New Zealand average
- four times as many firms investing in research and development than the average for all sectors
- rapidly increasing exports of computer and information services
- more demand for ICT skills across the economy. (New Zealand Government, 2014)

As IT evolves to become a large part of capital expenditure of organisations, there is an increased expectation to make sure that returns from investment on IT are optimised. What's more, it is critical to minimize risks associated with poorly directed decisions on deployment of IT.

Effectiveness of IT solutions for secured returns is influenced by not only suitability of solutions but also by availability of suitably trained and skilled support personnel. In other words, to minimize the risks associated with the use of IT, both private and public sectors need to ensure that they have access to suitably trained IT personnel at all times. Surveys conducted by Statistics New Zealand (2006 and 2012) suggest

that one of the most common barriers to implementation of new IT initiatives by government organizations is availability of suitably qualified IT personnel – which seems to be the most critical barrier (rated by 45% of participants).

Overall, dependencies on IT solutions for delivery of services have created an increasing need for adequately skilled IT personnel. What's more, the pace of change in technology requires ongoing training to keep IT workers' skills relevant and current. That is to say, the demand is not only for relevant skills but also for up to date and relevant skills – which has created strong growth in IT job vacancies worldwide. Access to suitably skilled ICT personnel is critical in continuous social and economic developments worldwide.

In July 2012 Steven Joyce, Minister of Economic Development, was quoted in the NZ Herald (Fletcher, 2012 and Robertson, 2013) as saying that "There is a worldwide shortage of (people with) ICT skills currently and it's not getting any better and New Zealand is part of that." Early in 2013, according to the Irish FIT ICT Skills Audit, the European Commission President, José Manuel Barroso, (FIT 2013) "called on Europe's digital businesses, governments, training and education sectors to join a Grand Coalition for Digital Jobs to address up to 900,000 ICT job vacancies expected to exist in Europe by 2015". The Singapore Ministry of Manpower has identified the following IT skills that are key to supporting the growth of key economic sectors in Singapore: Analyst Programmer, System Analyst, Software Engineer, IT Project Manager, Software and Solution Architect (Baumgartner and Shankaraman, 2013). The IDA's (Infocomm Development Authority of Singapore) annual survey on Infocomm manpower for 2012, revealed that the number of Infocomm job vacancies increased by 6.7% from 11,900 Infocomm vacancies in 2011 to 12,700 Infocomm vacancies in 2012 (Infocomm Development Authority, 2012). In general, it would appear that the gap between the supply of skilled IT workers and the demand for people with IT skills has been deteriorating globally. Identified Skills Shortages in New Zealand (Immigration NZ) provides the Essential Skills in Demand (ESID) lists to help ensure that New Zealand's skills needs are met by facilitating

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the entry of appropriately skilled migrants to fill identified skill shortages.

This paper discusses the role of tertiary education sector in developing skilled IT workforce. It discusses strategies for aligning IT and IS education with industry demand for IT skills and elaborates on standardization by using skills frameworks. The methodology applied to date has involved mainly review of previous literature (including reports by IT industry and government agencies) and analysis of a number of case studies of educational and training programs in IS and IT.

## **2. THE ROLE OF THE TERTIARY SECTOR**

Lack of access to adequately skilled ICT workforce has triggered an ongoing need for developing skilled ICT workers within the sector. Even though some training institutes provide focused one-off training with specific purposes, the tertiary education sector are seen as one of the main supplier of skilled ICT personnel. Over the past few years, there has been ongoing debate on the suitability of IT graduates (Asgarkhani and Wan, 2008) for the industry – both in number of graduates and skills gained through educational programs. In other words, there have been discussions on whether or not the training and/or education programs in ICT match what is seen as being essential by the industry.

At the same time, we are witnessing a change in culture and attitudes within the IT job sector. There seems to be growing emphasis on recruiting IT professionals with recognized qualifications. This is evident in a drop in number of IT personnel who do not have a formal qualification. For instance, Cappelli in his study in 2001 outlined that only about half of IT professionals had bachelor's degrees, and only 10% of workers in programming positions had a bachelor's degree of any kind. The data from the Department of Communications, Information Technology and the Arts (DCITA, 2004) Australia in 2004 show that only 9% of IT professionals did not obtain a formal IT qualification. The shift in culture of employment market places added pressure on higher education sector for delivering IT qualifications to bigger number of students and to ensure that programs are current and relevant.

Concern over employability of graduates in IT industry has continued to grow over the past decade. Both industry and education sectors argue about “a divorce between the formal existing educational institutions and the needs of ICT professionals by the industry” (Baltac, 2008, p. 81). Such disconnection has been seen as the origin of the scarcity of IT professionals in many IT skills areas (Selhofer, 2000; Cappelli, 2001; Hagan, 2004; Asgarkhani, 2012; Rabayah & Sartawi, 2008; Van der Vyver, 2009).

An investigation on graduate unemployment conducted by United Nations Educational Scientific and Cultural Organization (UNESCO Bangkok, 2006) also identified mismatch of ICT qualifications with employers' needs as a factor contributing to IT graduate unemployment in Thailand. Findings suggest that technical skills that graduates learned were “outdated and do not match the state-of-art technologies in use at the workplace” (p.3). In addition, a research conducted by Queensland government in 2006 found that industry has expressed concerns over the applicability of course material to workplace situations (particularly in tertiary courses). This could have been caused by slow process of seeking approval and adopting changes in course material - as needed by the changing nature of technology and the requirements of IT job market. In more recent times, as outlined by evidence from reports by New Zealand

government, the issue of disconnect does not seem to have been fully addressed.

Overall, tertiary education institutions play a big part in addressing the issue of high demand for IT skilled workforce. Based on discussions above, a number of key factors impact on what tertiary education institutions can achieve in development of adequately skilled IT workforce. These factors can include:

- Accurate projection of demand for IT skills
- Access to adequately skilled educators
- Availability of resources needed for developing needed IT workforce
- Availability and support from the IT sector (industry) to work in partnership with the education sector for developing more relevant course and programs
- Awareness of potential students of IT roles and uptake of IT education and training of programs and courses with real industry needs to ensure graduates possess relevant and needed skills

Success in addressing the perceived shortage of skills can be achieved via a holistic and strategic approach that brings together influential sectors to collaborate in addressing existing issues.

## **3. STRATEGIES FOR ALIGNING IT EDUCATION**

Traditionally, the tertiary education sector has deployed a number of approaches and strategies to assess skills shortages and develop programs that address the demand for those IT skills. Some of the approaches include:

- Studies and investigations by both academics and the IT sector to project needed skills.
- Use of statistics collected by formal government statistics agencies (e.g. Statistics NZ) and government initiated research in skills needs for future developments.
- Inclusion of advisory boards from the IT sector in curriculum development.
- Formal and informal joint industry forums to collaborate with industry and keep up to date with developments that can change skills needs in both short and long terms.

There have been various studies conducted by academics, consulting firms and government agencies to assess resources needs for economic development including human resources and IT skilled personnel. Unfortunately, in most cases, these studies use different models, methodologies and assumption and lack consistency. It is therefore difficult to use projections made in these reports as the basis for putting together ICT education and skills development programs.

Some government based agencies conduct investigative activities such as census and collect data that can help projection of required skills and human resources. For instance, as outlined earlier, Statistics NZ provides census data that can be used by industries to assess future development strategies. At the same time, the census is not necessarily tuned to identify needs of a specific industry.

In many educational institutions and university, advisory boards made up of representatives from the IT industry in various shapes and forms are put in place to facilitate collaborative development of IT and IS education programs and ensuring the graduates of the programmes are “work ready”. Even though this seems like a credible approach, in reality and in implementation of the concept, the success depends highly on people from the industry (and education) and their commitment of time. The success of this strategy can also depend on how seriously an institution approaches

implementation and to what extent the advisory boards are involved.

Another factor that impacts IT and IS skills development is the uptake of computing education by secondary school students. There is a need worldwide to educate secondary school educators and students to become aware of roles IT industry offers so they make a better informed decision about tertiary studies. The Institution of IT Professionals in New Zealand (IITP NZ) launched a national project in 2012 (ICT Connect) to engage high profile IT industry personnel to attend high schools and raise awareness of the broad range of IT roles available.

In general, most issues that create barriers to more accurate assessment of skills needs and more effective programs originate from lack of standards. For instance, studies in skills needs can be more consistent if there are standards to follow in firstly understanding skills and secondly assessing skills in a consistent manner. Similarly, if the view of the IT sector of roles in the sector and the views of the education sectors of the skills needed are better aligned (based on standards), there is a better chance of making advisory boards more effective. Overall, skills frameworks standards can facilitate better understanding of skills needed and more effective alignment of IT sector and academics.

#### 4. IT SKILLS FRAMEWORKS

It was discussed earlier that some of the previous work on assessment of IT skills needs used different categories of skills and resulted in inconsistency of outcomes. Furthermore, it was argued that using skills frameworks to standardise understanding of IT skills can play a significant role in more effective alignment of IT/IS education programs with industry needs. In this section, some of the IT skills frameworks are introduced.

Over the last decade, numerous classifications of IT skills and roles have been developed and introduced. Some were developed by academics for research purposes and others put together by the IT industry practitioners. For instance, the Association of Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE) have developed curriculum guidelines for qualifications in undergraduate Computer Science (ACM, 2013). The ACM has also developed curriculum guidelines for Information Systems undergraduate degree programs. (ACM, 2011). Ashenhurst (1972) identified 37 IS skills and abilities into 6 categories: people, models, systems, computers, organizations, and society. In their study of IS job advertisements from 1970 to 1990, Todd, McKeen and Gallupe (1995) classified the IS job skills into 7 categories: hardware, software, business, management, social, problem solving, and development methodology. Nelson (1991) categorized 30 IS knowledge/skills into 6 groups: organizational knowledge, organizational skills, organizational unit, general IS knowledge, technical skills and IS product.

Today, both technical and non-technical skills are required of IT workforce. In attempting to standardize roles and responsibilities within the sector (so as to making it easier to train, develop and drive recruitment selection processes) a number of industry supported standards for frameworks were developed.

The Skills Framework for the Information Age (SFIA) is a framework grouping 86 skills into 5 categories: Strategy and Architecture, Business Change, Solution Development and Implementation, Service Management, Procurement and Management Support and Client Interface. (SFIA, 2014) With 7 levels of responsibility associated to each skill/knowledge, it

matches the skills of the workforce to the needs of the business.

Another job roles/occupation framework that has been widely used within Australia and New Zealand is ANZSCO (Australia and New Zealand Standard Classification of Occupations). SFIA seems to be increasingly accepted as the global framework that could lead towards standardization of IT skills. The reasons for SFIA becoming widely accepted can include:

- SFIA seems to have considered a comprehensive range of skills and roles;
- SFIA has the advantage of recognizing the level of responsibility and authority associated with skills and roles;
- SFIA seems relevant to professional IC bodies' accreditation programs. This framework was recently adopted by the Institution of It professionals NZ (IITP NZ) to be the basis for issuing first group of ICT Professional certificates. That is to say, SFIA will be playing a significant role in the future of the ICT sector within New Zealand. At the same time, this framework is used with UK by British Computer Society for standardizing IT skills.
- SFIA is likely to be the basis of future accreditation of ICT qualifications within a number of countries – including the signatories of the Seoul Accord ([http://www.seoulaccord.com/accord/contents.jsp?menu\\_1=85&menu\\_m=218](http://www.seoulaccord.com/accord/contents.jsp?menu_1=85&menu_m=218))

Skills-based programs are part of the education system. However, most of such programs have been implemented in the professional or vocational training sector.

Thus, only in recent years skills-based teaching and learning frameworks have found their application in higher education – primarily due to the growing gap between the academic curricula of the higher education institutions and the actual demands from businesses and society.

More and more higher education institutions are attempting to reshape their programs with a professional orientation. In order to do this, these programs have defined competency frameworks, which are essentially skills that are to be acquired by the students doing a particular course (Baumgartner, 2013).

#### 5. MROQ

In 2008 the New Zealand Qualifications Authority announced the Mandatory Review of Qualifications (MROQ), a complete review of all the qualifications at levels 1-6 on the New Zealand Qualifications Framework (NQF). The review aimed to “ensure that New Zealand qualifications are useful and relevant to current and future learners, employers and other stakeholders”. The parties involved in the initial consultation were “The Ministry of Education, NZQA, the Tertiary Education Commission and Department of Labour worked with the Industry Training Federation, Business New Zealand and the Institutes of Technology and Polytechnics New Zealand, the New Zealand Council of Trade Unions, the Private Training Establishment sector and Te Taihū o Nga Wananga on the Targeted Review of the Qualifications System.”. (NZQA, 2008) The intent of this consultation was to involve industry in the development and redevelopment of all qualifications in each discipline to ensure future qualifications meet the demands of industry.

In the steering committee for the ICT include four industry representative, three tertiary providers representatives, one high school representative, one NZQA representative and is chaired by the Chief Executive of the IITP NZ. This example

of industry involvement outnumbers the educational input. It could be argued that the industry voice could outweigh the education input and result in educationally unsound qualifications. The consultation on the final draft of the proposed qualifications has now been closed so it is now a matter of waiting to see if the final qualifications meet all the stakeholders needs.

## 6. REFLECTIONS AND CONCLUSION

Advancements in IT have made it possible for communities and firms in both private and public sectors to develop more innovative technology intense solutions to deliver products and services. It is widely acknowledged that the use of IT plays a crucial part in both economic and social development. Companies increasingly rely on IT solutions to deliver product and services which has in turn encouraged high level of investment in IT. With high level of investment there is an expectation of high returns and desirable outcomes. High returns cannot be achieved by deploying technology only, there is a need for adequately skilled IT workforce to operate technology solutions which enable business.

The high demand for skilled IT personnel is a worldwide phenomenon. Governments, the IT sector and the education sector project needs on an ongoing basis so as to develop effective skills development strategies. Tertiary education institutions play a key part in skills development. It is essential that educational programs offered to educate and train IT/IS personnel are effective. Effectives of programs can be best achieved by close alignment of education and industry.

Educational institutions use various strategies for effective alignment of education programs. However, some of the strategies deployed are highly dependent on common understanding of issues and problems. There is a need for standardising IT roles so there is a common view of roles and skills required.

Developing a common view of IT roles can be achieved via IT skills frameworks. A number of IT/IS skills models were discussed. It was suggested that SFIA (Skills Framework for Information Age) is likely to in advantageous position to be accepted as an international framework to be the basis of standardising IT and IS roles as well as IT and IS Education.

This paper presented findings (to date) of studies and investigations that are still in progress. Future studies concentrate on effectiveness and validity of alignment strategies and relevance of programs of studies.

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