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**BCS, The Chartered Institute for IT**

**Consultation Response to:**

**WILSON REVIEW OF BUSINESS-UNIVERSITY COLLABORATION**

**Dated: Monday, 14 November 2011**

**BCS**

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## **BCS, The Chartered Institute for IT**

The Institute promotes wider social and economic progress through the advancement of information technology science and practice. We bring together industry, academics, practitioners and government to share knowledge, promote new thinking, inform the design of new curricula, shape public policy and inform the public.

As the professional membership and accreditation body for IT, we serve over 70,000 members including practitioners, businesses, academics and students, in the UK and internationally. We deliver a range of professional development tools for practitioners and employees. We accredit the vast majority of university computing departments in the UK.

As a leading IT qualification body, we offer a range of widely recognised professional and end-user qualifications.

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## 1. Executive Summary

Prime Minister David Cameron said during a recent BBC interview *“I think Eric Schmidt is right... we're not doing enough to teach the next generation of programmers. One of the things you hear from the businesses here in Tech City is 'I don't just want people who are literate in technology, I want people who want to create [computer] programs', and I think that's a real wake up call for us in terms of our education system.”*

BCS, The Chartered Institute for IT, believes the key issues that the review should consider when examining business-university collaboration are:

- The range of professional IT capabilities and competencies sought after by employers varies hugely across the different sectors of the UK economy. Consequently such skills need to be developed within an established skills framework such as the Skills Framework for the Information Age (SFIA), which is valued and led by a broad range of employers and also widely accepted by universities. Any Kitemarking scheme will need to be underpinned by such a framework to clearly describe what graduate skills it is certifying and to whom they are valuable.
- An IT or computing degree Kitemark should measure the career progression likely to be experienced by graduates. Where possible Kitemark schemes should involve professional bodies that have a Chartered status underpinned by an employer led skills framework.
- Employer engagement with university degree programmes should focus on improving the professional capabilities and competencies of graduates and support the quality, breadth and depth of learning outcomes.
- New initiatives to improve employer university engagement should promote direct links between the two that are sustainable over the long term and that help to remove barriers and shorten channels of communication between academics and industry professionals. They should support the many examples of good practice that already exist in university departments across the UK.
- Where possible, initiatives to involve employers in the delivery of learning outcomes should be linked to initiatives from professional bodies to certify entrepreneurship and innovation.

The SFIA professional competencies and capabilities employers have defined as being important to them are outlined in the ‘SFIA professional skills sought by employers’ section on P8.

The UK is not alone in considering how best to promote entrepreneurship and innovation to undergraduates. See the section ‘Case study, the US perspective’ for background on the situation in the US. The ACM (the Association of Computing Machinery, the main learned

society for Computer Science in the US) has identified that to compete in a global market computing and IT professionals need:

- a firm grounding in the underpinning principles of Computing, which remain relevant even though particular technologies rapidly evolve and new ones are constantly being developed
- to participate in life-long learning to ensure technology specific skills remain relevant
- soft skills with regards to management, communication and collaboration across different companies
- increasingly to become specialised within an application domain; e.g. pharmaceuticals, finance, telecommunications
- to learn about technologies and management practices that underlie the globalisation of software; e.g. distributed workflow design and orchestration

The employer led SFIA skills framework is designed to support career progression routes for IT and computing professionals that are aligned with these goals (see section 'SFIA professional skills sought by employers' for more details). Initiatives to promote closer ties between employers and universities will have greater impact and value if they are also aligned with the goals identified above and with frameworks such as SFIA.

Whilst considering how to improve the professional skills of graduates, it is worth noting that a degree in Computer Science provides around £250,000 gross additional lifetime earnings compared to two or more GCE A-levels, according to the PriceWaterhouseCoopers report of 2006 for UniversitiesUK. Only medics have a significantly larger lifetime graduate earnings. This demonstrates that employers do value Computer Science degrees in a very material way.

Our conversations with global technology companies, start-ups in London's Tech City, Tier One Banks in the City and leading computer games companies suggest there is a severe shortage of Computer Science graduates with deep expert subject knowledge who also understand how to apply that knowledge to create business value. Technology service companies we have spoken to want graduates with a broad range of business skills who also have a reasonable depth of technical knowhow. Pharmaceutical companies such as GlaxoSmithKline require interdisciplinary teams of professionals working at the boundary of biology, physics, chemistry, pharmaceuticals, numerical analysis and computer science. It is vital that new initiatives to promote employer-university engagement take account of the complexity of the IT employer landscape and the need for diverse professional skill sets that will not be delivered through a single degree programme.

## 2. What Employers Need

*"We now live in a world where technology has made it possible for companies to take their business anywhere. If we want them to start here and stay here and hire here, we have to be able to out-build, out-educate, and out-innovate every other country on Earth."* Barack Obama President of the United States of America, September 2011.

Professionals need to develop and maintain skills that will last them throughout their career, such skills are important for the wellbeing of the UK economy as well as the individual. Therefore, it is important to describe graduate capabilities and competencies using an established, employer led skills framework appropriate to the long term needs of that profession and that is also widely accepted by universities. A high level description of the capabilities and competencies employers have identified as important are outlined in the 'SFIA professional skills sought by employers' section below.

For many years now a wide range of employers together with professional bodies (BCS, IET, itSMF, IMIS) and the sector skills council for IT (e-skills UK) have worked together to establish a skills framework of the competencies and capabilities that are needed in the computing and IT profession. This is the Skills Framework for the Information Age (SFIA), which now underpins the Chartered IT Professional (CITP) status of BCS, the UK's professional body for IT. SFIA is an ideal skills framework for underpinning a Kitemark scheme for computing and IT degrees, which would ensure the scheme is consistent with the long term professional needs of graduates.

- Microsoft, IBM, BT, Visa Europe, Capgemini, Deloitte, O2/Telefonica, Unilever and the Cabinet Office are some of the many employers who use SFIA to manage CPD and define the professional IT competencies and capabilities required by their organisations.
- The Open University have just mapped the learning outcomes for their work based IT Foundation Degree onto SFIA because of demand from employers.
- The definition and development of SFIA is also led by employers, for example IBM and Deloitte are two of the partners leading its development.
- Since 2009 BCS, the Chartered Institute for IT, has used SFIA to underpin their CITP Status due to employer demand.

According to P. D. Jagger, PgDMS CITP FBCS, Business Area Manager for IBM Learning Development (Europe), Member of the National Skills Academy for IT Training Quality Panel and Member of the Open University Undergraduate ICT Program Committee: *"Hiring and developing talent with the right skills for the future is a key requirement for IBM to stay competitive. SFIA is the framework that employers and IT professionals use to identify skills gaps and plan how best to close them."*

*Graduates who profile their skills with SFIA will have a distinct advantage when planning their career and looking for employment now and in the future. Employers, including IBM, will have the confidence that graduates have skills aligned with their needs today and a roadmap for future development. Universities that embrace SFIA will ensure that their qualifications are relevant to employer needs and aligned with an industry backed skills framework.*

*Experienced IT professionals who pursue higher education will enhance their career prospects when linking their work experience with SFIA aligned postgraduate qualifications or achieving Chartered IT Professional registration.*

*The latest version of SFIA also brings advantages for academic staff by clearly integrating skill levels for lecturers, researchers and academic support staff in the field of Information & Communication Technology.”*

SFIA then is an employer valued and employer led skills framework that is used by the UK’s IT professional body. It is also understood by UK university Computer Science departments since almost all of the UK’s computing degree programmes are accredited by BCS, who actively promote the professional skills described by SFIA through their accreditation.

It is important to note that the level of skills required by an employer in the various SFIA skills categories will vary tremendously from one employer to another. Employers differ in what they expect a graduate to be capable of for their sector. Even within the same company the range of graduate roles can vary greatly in their skill requirements. Therefore any Kitemarking scheme will need to clearly describe what skills it is certifying and to whom they are valuable.

One of the reasons for the wide diversity of degree curricula across the UK’s university computing and IT departments is precisely because of the great diversity of computing and IT professional careers. A degree in Computer Science has a different purpose than a degree in Software Engineering which again is very different to a degree in IT Management for Business (ITMB). An employer seeking the specific business focus taught in ITMB may not seek to recruit a Computer Science graduate with deep expert knowledge. Conversely, there are many employers who actively want to employ Computer Science graduates, because of their deep expert knowledge, who may not be interested in ITMB graduates.

<b>Subject Category</b>	<b>Full time first year cohort 2011, BSc+MSc+PhD</b>
Computer Science	24,000
Information Systems	8,000
Software Engineering	2,800
ITMB	300

The above table gives an estimate of the full time first year cohort size in UK universities for the three largest categories of computing and IT related degrees in 2011 and ITMB, based on HESA and e-skills UK data. Schemes designed to recognise employability should be customisable so that they clearly state which type of employer the scheme is aimed at. For example, it may be sensible to have one Kitemark aimed at technology creating companies, and another aimed at technology service providers. Ideally each Kitemark would have a profile related to SFIA so that employers and students understand what skill sets are provided.

Computing and IT professional bodies have the necessary understanding of the complex computing degree landscape to aid in the design of an appropriate Kitemark scheme based on SFIA that will have the confidence of employers, universities and graduates.

### **3. SFIA professional skills sought by employers**

To illustrate the relevance of SFIA for employers the following subsections provide a high level view of the main SFIA professional competencies and capabilities an individual must demonstrate to qualify for Chartered IT Professional status. These are the kind of skills that an employer would hope to see evidence for in a graduate recruit. It is these types of skills that a Kitemarking scheme would need to consider certifying for a degree programme. The appropriate level of these skills for a fresh graduate would of course be far less than for a professional with years of industrial experience. SFIA contains much more detail on the specific roles that are relevant for IT employers, and the levels of responsibility appropriate for them. For further details consult [www.sfia.org.uk](http://www.sfia.org.uk).

#### **Business skills, SFIA High Level Summary**

An IT professional is capable of creatively and innovatively applying solutions for the benefit of the customer. They are capable of analysing, diagnosing, designing, planning, executing and evaluating work to time, cost and quality targets.

An IT professional is able to communicate effectively, formally and informally, with colleagues, subordinates and customers. They are able to facilitate collaboration between stakeholders with diverse objectives. They are able to analyse customer and business requirements and advise on the scope and options for operational improvement.

#### **Autonomy, SFIA High Level Summary**

An IT professional is fully accountable for their own technical work and/or project/supervisory responsibilities. They receive assignments in the form of high level objectives. They establish their own milestones and team objectives, and delegate responsibilities. Their work is often self-initiated.



### **Influence, SFIA High Level Summary**

An IT professional influences their own organisation, customers, suppliers and peers with respect to their own specialism. They have significant responsibility for the work of others and for the allocation of resources. They make decisions which impact on the success of assigned projects i.e. results, deadlines and budget. They develop business relationships with customers.

### **Complexity, SFIA High Level Summary**

An IT professional performs a challenging range and variety of complex technical or professional work activities. They undertake work that requires the application of fundamental principles in a wide and often unpredictable range of contexts. They understand the relationship between their own specialism and wider customer/organisational requirements.

## **4. Employer relevant professional certification for computing graduates**

BCS is working with a consortium of universities to develop a certification scheme for graduate entrepreneurial and innovation skills that will improve learning outcomes through increased employer engagement.

Final year projects are a major component of undergraduate computing degree programmes. Employers often see them as a key differentiator that demonstrates a student is worth recruiting. Some of the best final year projects deliver solutions to real-world employer defined problems where the employer has worked with the student to specify the project and helped to assess its outcome. Such projects often demonstrate significant entrepreneurship and innovation.

A difficulty for employers when recruiting graduates is that they are often faced with a vast number of students CV-s and they would like to easily identify which final year projects demonstrate entrepreneurship and genuine innovation.

BCS is currently working with Imperial, UCL, Queen Mary, Edinburgh University and Greenwich University to pilot a certification for such projects that will give employers a simple quality assurance they can rely on.

By recognising these projects in a highly visible fashion through certification by a professional body

- students will improve their employment prospects,
- employers will have greater assurance that students have the right innovation and business skills, and
- universities will gain greater recognition for working with industry and be seen to enhance student's employability.

We recommend that where possible initiatives that encourage more direct involvement from employers in delivering learning outcomes are linked to this kind of professional body certification of graduate professional skills. These are specific to the individual rather than the degree programme. They provide employers a mechanism for adding genuine value through direct student support that universities and students would welcome.

## **5. The value of student placements**

Student placements and particularly one year “sandwich” placements are a well established and effective form of university-industry collaboration in the field of Computer Science. Computing is underpinned by scientific and mathematical principles, but at the same time it is a practical discipline, which students can appreciate best through a placement in industry. Many employers in the UK are willing providers of a range of well-funded placement positions for Computer Science undergraduates. Examples of employers who have provided paid placements for Computer Science undergraduates includes Microsoft, IBM, Eli Lilly, BMW and BAE Systems, which illustrates the range of employers with an interest in Computer Science.

Graduate employment is higher among placement students than non-placement students, and initial salaries tend to be higher. Data from one representative UK University shows that 6 months from graduating 6.7% of CS non-placement students were unemployed whereas 4% of sandwich CS students were unemployed, based on a sample of 371 students over 5 years. Also, based on the 30% of 2010 CS grads for whom the starting salary was known, the starting salary on graduation for non-placement students was £20,754 whereas for placement students it was £26,461.

While this data shows that placements have employability benefits, it also shows that returning placement students perform better academically. This is evident by looking at the difference in results between the students’ final year and their second year. Placement students typically perform six to ten percentage points higher than non-placement students, which is almost a degree class higher. The university providing the data attributed this improvement to a mixture of increased technical competence, particularly in seeing how theoretical ideas play out in practice, as well as better professional “soft skills”.

## **6. Case study, the US perspective**

*"We don't want the next Intel or Google to be created in China or India. We want those companies and jobs to take root in America"* Barack Obama President of the United States of America, May 2011.

This section considers the situation in the US with respect to computing and IT jobs. Various studies in the US over the last few years have identified the kind of graduate skills needed by high-tech companies to ensure continued US leadership in the ongoing digital revolution.

Other studies have also shown that offshoring of lower skilled jobs has allowed the creation of higher skilled jobs in the US that have resulted in the computing and IT workforce actually growing over the last decade until the current global recession.

The US has been concerned for many years with the increasing competition from countries such as India and China that threaten US leadership in digital technology and engineering. For example, India produced approximately 300,000 technology and engineering graduates in 2010. At the same time 75% of India's technology graduates "*are unemployable by India's high-growth global industries*" according to a 2010 Wall St Journal article<sup>1</sup>.

A 2008 survey of 650 CEO's and CTO's in 500 US tech companies<sup>2</sup> in Silicon Valley found that:

- 85% have a PhD, Masters or Bachelor's degree
- 46.5% have a STEM degree
- 75% spent at least 6 years working for someone else before starting their own company
- 47% had not been interested in starting a company until after they left University

As identified in the review remit, the UK needs to improve its capacity to produce technology entrepreneurs. The survey suggests that although graduates benefit from the professional element of their degree programme, they actually gain their most significant business experience on the job before they go off to start their own company. This contradicts the popular myth that IT entrepreneurs in the US are all drop outs who launch global corporations from their garage. The survey illustrates that although professional and entrepreneurial development may start in university it has to be substantially sustained over the long term by employers before it comes to fruition.

Although the press is keen to report IT jobs being offshored to India and China, the reality is more complex. For example, 70,000 computer programming jobs were offshored in the US between 1999 and 2003. Over the same period 115,000 more highly paid computer software engineering jobs were created in the US<sup>3</sup>. This illustrates that professionals constantly need to move up the skills value-chain as developing nations race to upskill their own workforce.

An in depth study (see Table 1 below) in 2008 compared the US's technology and engineering graduates with India and China. The report identified that the US needs more engineers capable of leading innovation and transformation, and who work well across international borders (the paper regards computing graduates as engineers). Such professionals were deemed *dynamic* engineers. Clearly this is not specific to engineering,

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<sup>1</sup> [http://online.wsj.com/article/SB10001424052748703515504576142092863219826.html?mod=WSJ\\_hp\\_MIDDLNexttoWhatsNewsTop](http://online.wsj.com/article/SB10001424052748703515504576142092863219826.html?mod=WSJ_hp_MIDDLNexttoWhatsNewsTop)

<sup>2</sup> Education and Tech Entrepreneurship, Vivek Wadhwa, Richard Freeman, Ben Rissing, Ewing Marion Kauffman Foundation, May 2008

<sup>3</sup> [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=779005](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=779005)

nor particular to the US. The basic message of the report was that quality is more important than quantity. India and China produce huge numbers of lower quality engineers but still lag behind in the number of dynamic engineers they produce compared to the US, according to the paper. Dynamic engineers and professionals are likely to be more inclined to start their own companies and are more likely to be able to grow those companies and make them successful.

The definition of skills characterising a dynamic engineer in the paper are entirely consistent with the general categories outlined by SFIA (see section ‘SFIA professional skills sought by employers’).

‘Getting the Numbers Right: International Engineering Education in the United States, China, and India’, Gary Gereffi, Vivek Wadhwa, Ben Rissing, Ryan Ong, Journal of Engineering Education, 2008

This paper looked at what the US needs to do in order to maintain its engineering leadership against competing nations such as India and China. To paraphrase the conclusion; the US has a shortage of what the paper calls *dynamic* engineers, but currently produces too many of what the paper calls *transactional* engineers.

“*Dynamic engineers* are individuals capable of abstract thinking and high-level problem solving using scientific knowledge, and are most likely to lead innovation. These engineers thrive in teams, work well across international borders, have strong interpersonal skills, and are capable of translating technical engineering jargon into common language. In the United States, most dynamic engineers have a minimum of a four-year engineering degree from nationally accredited institutions. These engineers tend to be globally competitive, and are in high demand regardless of their location.”

“In contrast, *transactional engineers* possess solid technical training, but not the experience or expertise to apply this knowledge to larger domains. These individuals are typically responsible for routine tasks in the workplace. In the United States, transactional engineers often receive associate, technician or diploma awards, although they may also have a bachelor’s degree. In other countries, these engineers are produced by lower-tier universities, with thinner curricula and a weaker emphasis on research, group work, applied engineering, and interdisciplinary thinking.”

**Table 1: Dynamic engineers vs transactional engineers**

Summarising the findings from the US, in a global economy IT professionals need<sup>4</sup>

<sup>4</sup> Globalization and Offshoring of Software, ACM Job Migration Task Force, <http://www.acm.org/globalizationreport>, 2005

- a firm grounding in the underpinning principles of Computing, which remain relevant even though particular technologies rapidly evolve and new ones are constantly being developed
- to participate in life-long learning to ensure technology specific skills remain relevant
- soft skills with regards to management, communication and collaboration across different companies
- increasingly to become specialised within an application domain; e.g. pharmaceuticals, finance, telecommunications
- to learn about technologies and management practices that underlie the globalisation of software; e.g. distributed workflow design and orchestration

This demonstrates that promoting employer university engagement needs to focus on long term career progression and not short term training needs. That graduates need to believe a Kitemark reflects the value of a certified degree to their career. That professionalism is recognised as a combination of deep subject knowledge as well as skills. That professional development only starts with a degree and employers need an ongoing commitment to CPD for the entire career of their employees.

## 7. Computer Science is interdisciplinary

This section illustrates through a series of examples the importance of computer science graduates to a diverse range of interdisciplinary R&D projects that are important for both society and the economy. When considering how to engage employers with universities it is worthwhile taking into account the interdisciplinary skills requirements of many global employers, ranging from pharmaceutical companies to aerospace manufacturers.

- The Human Genome Project was successful because of advances in computer controlled robotics and data analysis techniques<sup>5</sup>. "*From the beginning, laboratory automation has been recognized as an essential element of the Human Genome Project,*" says Ed Theil a computer systems engineer with the Human Genome Centre's instrumentation group. According to Tony Hansen, a physicist in the instrumentation group: "*Automation also allows the development of new biochemical procedures that would otherwise be inconceivable due to the impracticality of numbers or the volume of work.*"
- The ongoing experiments at the Large Hadron Collider generate 15 Petabytes (15 million Gigabytes) of data annually, which is creating significant data analysis challenges<sup>6</sup>. As a result CERN is now a leading developer of a global computing infrastructure called the Grid spanning 50 countries. According to CERN<sup>7</sup> "*The*

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<sup>5</sup> <http://www.lbl.gov/Science-Articles/Archive/human-genome-mapping-sequencing.html>

<sup>6</sup> <http://public.web.cern.ch/public/en/Research/DataAnalysis-en.html>

<sup>7</sup> <http://lcg.web.cern.ch/LCG/public/default.htm>

*infrastructure built by integrating thousands of computers and storage systems in hundreds of data centres worldwide enables a collaborative computing environment on a scale never seen before.”*

- Predicting global climate change is only possible because of advanced computer models. According to the UK Met Office *“The only way to predict the day-to-day weather and changes to the climate over longer timescales is to use computer models.”*<sup>8</sup>
- Methods of mathematics and computer science have become important tools in analysing the spread and control of infectious diseases. Partnerships among computer scientists, mathematicians, epidemiologists, public health experts, and biologists are increasingly important in the defence against disease<sup>9</sup>.
- The Airbus fly-by-wire system is critically dependent on advanced computer controlled digital technology. According to Airbus<sup>10</sup> *“fly-by-wire (FBW) technology is one of Airbus' principal competitive advantages”* and *“this technology has made significant progress, especially in the field of digital computers”*. This is an example of a system that depends on ‘embedded software’, which is becoming commonplace across a number of manufacturing industries.
- The Chevrolet electric car known as the Chevy Volt has ten million lines of embedded software<sup>11</sup>. According to a recent New York Times article<sup>12</sup> car manufactures *“view leadership in control software as strategically vital”* in developing new electric hybrid vehicles.

## **8. University initiatives to promote entrepreneurship and innovation, case studies**

This section provides a small selection of good practice from universities that promote entrepreneurship through their curriculum or other initiatives that are especially relevant to computing and IT professionals. Due to the extremely short timeframe available for preparing this submission only a small representative selection of case studies was possible. Hence, this is not in any way intended to be an exhaustive list. Any new schemes that are proposed by the review should build on the many such examples of good practice that already exist around the UK.

### **Queen Mary**

Queen Mary, University of London, has a wide range of STEM related initiatives to promote entrepreneurship and innovation.

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<sup>8</sup> <http://www.metoffice.gov.uk/climate-change/guide/science/modelling>

<sup>9</sup> [http://sciencecareers.sciencemag.org/career\\_magazine/previous\\_issues/articles/2004\\_02\\_06/noDOI.13665861607928732511](http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2004_02_06/noDOI.13665861607928732511)

<sup>10</sup> <http://www.airbus.com/innovation/proven-concepts/in-design/fly-by-wire/>

<sup>11</sup> <http://www.eetimes.com/discussion/-include/4215057/Ten-million-lines-in-29-months--model-driven-development-on-the-Chevy-Volt>

<sup>12</sup> <http://www.nytimes.com/2011/01/23/automobiles/23SPIES.html>

- ImpactQM is a three-year EPSRC funded KE project to develop a new cadre of young academic scientists and engineers, who begin their research careers within a structured training framework that immerses them in both high performance research environments, and in organisations that will be of increasing importance to the UK's economy and society. Recent graduates include Kotub Uddin, a PhD student in the School of Mathematical Sciences. In 2010 he was awarded an ImpactQM scholarship to collaborate with Jaguar Land Rover where he used mathematical techniques to ensure optimal operation of co-operative systems involved in motion control in automobiles. Kotub has now joined the company. Jonathan Dunn, a PhD student working in synthetic organic chemistry used his ImpactQM scholarship to undertake a collaborative venture with Cancer Research Technology Ltd, where he worked on drug discovery projects. Rita Jorge, a PhD student in the School of Biological and Chemical Science who is working with the Government Office for Science on science policy projects. ImpactQM have been nominated in the "Outstanding Support for Early Career Researchers" category in the Times Higher Education Awards.
- Like many other universities, Queen Mary has industrial placements degree programme options that allow students to spend a year working in industry. This work placement occurs at the end of Year 2. Students are trained, by a dedicated Industry Placement manager, in interview techniques, CV writing and other employability skills and matched to a range of companies, from SME to blue chip. During this placement students are supported and assessed on their contributions to the work of the firm, with input from employers. A number of students have taken their final year projects with the firm they had placements with, and have gone on to full time employment as a result.
- Student projects provide another well received opportunity for students to interact with industry. A range of student projects have been undertaken with local SME, particularly exploiting the local opportunities of our location in the East London Tech City/ Silicon Roundabout constellation. We also initiated a student project competition to develop student projects exploiting data sets from the estate agents partners RightMoves. Smart phone apps have proven particularly popular in student projects and this student led demand has resulted in the development of a novel venture QApps.
- QApps, a School venture, was created so that smart phone apps created as student projects could be made available to the world. The initiative encourages students to think about a whole range of issues in developing apps, from ethics to marketing. Award winning smart phone apps developers Always on Message have been involved to give students a real taste of the issues that surround making an impact in the growing apps market. The QApps framework provides students with a simple to use portal to app stores, where app store registration and upload, indemnity

insurance, best practice guides and other enabling factors have already been dealt with. Students also share in the revenue streams derived from the sale of their apps.

- A module for final year Undergraduate and MSc students, first introduced around 2008, in Entrepreneurship in Information Technology is available as an option. The aim of this module is to increase students' awareness of the commercial opportunities available in the area of Information Technology. The module covers how to cultivate an entrepreneurial mindset and discuss the routes available for turning ideas into business ventures. The module also provides an introduction to a number of crucial business skills such as financial planning, business planning and how to sell yourself and your ideas.
- A new optional module for final year Industrial and Professional Perspectives is being delivered. This module is intended to equip students with a better understanding of the industrial and professional context of their subject area, to enable them to see more clearly the relevance of their studies, and to inspire them to become more proactive partners in both their studies and their subsequent career. It will include significant input from external industrialists and structured, themed opportunities for students to meet with them, as well as an integrating thread of academic content. Speakers will include some with whom we have existing links, e.g. through the School's Industrial Advisory Panel, student placements, etc, as well as relevant contacts made through the Careers Service and the college Technology transfer arm QMIL. This new module complements the existing EECS Entrepreneurship in Information Technology provision, which focuses more strongly on the practical aspects of business.
- The School is also active in helping developing and enhancing the College Student Entrepreneurship Society's through for example building links with the BRICS industry investment partnership, support and student speakers for the Colleges Global Entrepreneurship Week and the successful Student Union bid to host "Silicon Valley Comes To QMUL". The School has also been involved in supporting students in the formula students' project where EECS student form part of the team developing a Formula One racing car.

### **University of Edinburgh**

The University of Edinburgh ran ProspeKT, a partnership between Scottish Enterprise and the University to promote greater impact from the research within the School of Informatics. Funding was also obtained from the European Regional Development Fund to extend the Enterprise Creation element of the program to cover all of the Scottish Computer Science group. A follow on program, focussing on the Scottish Research Pool in Computer Science – SICSA, has just been launched funded by both SE and SFC. This program is called AspeKT

The program provided some 3 floors of space for commercial activity next to the School and a team of Business Development Execs to translate between business and the academic



world. It has succeeded in driving a culture change within the School so industrial cooperation is now very widely accepted by the academic body, one major element here was having qualified Business Development staff to be able to screen and choreograph the relationships so the academics were not distracted by a large number of fruitless conversations. The concentration of high quality research within the School makes it an anchor site for inward investment, with presentation to companies brought in by UKTI and SDI. Visits have run at a rate of about 1 per week for extended periods of time and a number of local successes have been reported recently – the basing of Amazon’s new support Centre and Avaloq’s recent move to Edinburgh, both are worth some 500 jobs. The School also houses an Innovation Lab for EADS and recently a major US entertainment company has also taken space for an innovation studio. The School now has relationships with most of the global ICT players and a number of local technology based SME’s.

The major success of the program has been the number of start-ups and spin-outs it has spawned – 37 in 5 years making it one of the most productive academic centres in the UK. Many of these companies are now trading internationally and a significant amount of seed funding (>£8.5M) has been raised despite the economic downturn. The survival rate of these companies is also quite strong according to a recent BIS report. This also reflects a strong interest in the student base to build or work with a start-up when they graduate

The School has a number of programs to promote entrepreneurship This has involved some 700 companies and nearly 1,000 individuals (drawn from local start up as well as the academic base) in the last 3 years:

- A module in the Masters program, based in the Stanford Technology Ventures Entrepreneurship curriculum with a good proportion being taught by guest entrepreneurs brought in to teach a particular area of expertise.
- A strong Entrepreneur in Residence Group which meets monthly to mentor potential start-ups and help network them in to the local entrepreneurial and funding fabric.
- A series of Entrepreneurship seminars open to both the academic side and local young start up companies taught by seasoned entrepreneurs. There has been a partnership with MIT here for 3 years using their staff and approach and a new program is being launch utilising local senior entrepreneurial figure to provide both the education and role models.
- A series of CEO master classes which bring together small groups of local start-ups leaders with more experienced entrepreneurs drawn locally and from the USA.
- A series of Tech Meet Ups to bring the technical community together for regular meetings and networking, this has developed into an idea exchange and hiring fair, facilitating the growth of young enterprises. These run monthly in Edinburgh, Glasgow and Aberdeen and are well attended by a wide spread of the software community.

- In partnership with the Business School, Informatics has helped develop the e-Club - a student entrepreneurship club - and ran the Silicon Valley Speaker Series featuring guest speakers from California to help inspire local ideas.
- An annual Investment Conference – Engage, Invest, Exploit to showcase prospects to the funding community. On average some 40 new companies exhibit each year. Prior to each event a series of workshops is held on how to develop and give an investment pitch to help the new entrepreneurs articulate their business propositions more clearly.

### **University of Greenwich**

The University of Greenwich has a number of initiatives to promote entrepreneurship and innovation. In addition to entrepreneurship modules, which are offered to most students as part of their course, sandwich placements, and many final year Bachelors and Masters degree projects which are undertaken in conjunction with industry, the University has the following specific initiatives:

- The School of Computing and Mathematical Sciences (CMS) has developed a vehicle for academic-employer engagement called GWizards. Its primary aim is to enhance university engagement with the local community, provide employability skills for students (in the area of their degree specialisation) and support innovation. This involves working directly with all types of organisation to identify project activities of mutual benefit. This mutual benefit is determined by opportunities for students to gain experience in the workplace, organisations to gain practical technical help for little or no cost, and academic staff to gain project experience and to develop enterprise and publishing opportunities. The students may be either directly employed by the company (for at least the minimum wage) or undertake voluntary work in the case of charities etc. In addition, the CMS School has developed credit bearing modules on its programmes that link to these employability opportunities, so students have the chance to follow directly relevant project work within their academic studies to earn academic credits for practical work, and also to be engaged in the management and control of these activities both internally and externally to the university within a student-run company structure. This company operates within GWizards in a standard enterprise structure, run by a student executive board responsible for hiring and firing student employees and all enterprise operational activities, and takes on internal and external contracts on a professional basis. The information related to these activities is reported and recorded in an active portfolio, maintained electronically by the students, who also take the responsibility for collecting evidence of their activities, in terms of customer report and feedback, prototype or service development reports, and academic supervisor feedback. This active portfolio provides the fundamental information for a technically detailed CV, describing the students' knowledge and experience in terms of employability skills, while

also providing the academic evidence necessary for the application of credits towards degree study.

- As part of the GWizards initiative, the School of Computing and Mathematical Sciences is working with Greenwich Council to support local startup companies. The Council has rented offices on the Greenwich Peninsula (local to the university) and the University has a presence in these offices (8 desks) which are used by GWizards students to work on projects for companies, and to engage with, and support, the organisations at the Peninsula.
- The University has also developed an Employers Advisory Boards for each School. These Boards consists of representatives from Industry from both global organisations (e.g. BT) and local SMEs, who provide advice to students, student mentoring, case studies for use by academics in their teaching, placements, contacts and job opportunities for GWizards work, short training sessions for students, for example on “Freelance and Working For Yourself”.
- The University of Greenwich runs an annual Business Plan Competition with a prize of £5,000 of investment capital as well as runner up prizes including tickets to high profile seminar events. The scheme provides an excellent opportunity to support the development of a student’s own enterprise. As well as the financing, winners have access to business development facilities, support, and networks which can provide introductions to potential investors. The scheme has been founded to encourage and support entrepreneurship and innovation from students and in 2011 was won by a computing student for the idea to set up a games development company (Desert Monkey) and the business is now being successfully developed as a result. This competition award was the conclusion of a year-long contest in which 9 finalists (out of 220 entrants) pitched their business plans to a panel of judges.”

### **Sheffield University**

epiGenesys<sup>13</sup> is a business that was set up by the University of Sheffield’s Department of Computer Science in late 2007. The enterprise is wholly-owned by the University, employing Sheffield graduates and offering experience to current students. The key industry collaborators for epiGenesys are IBM, ThoughtWorks and Microsoft.

The company works on IT projects for businesses and charities, as well as for other University departments and research groups. The distinctive ties that epiGenesys has with the University of Sheffield mean that they are able to offer various opportunities to current students to help them gain experience of operating within a real business environment.

Working with epiGenesys enables students to gain real life skills and experience that is valued by employers. Students can choose to work in one or more of five areas of the

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<sup>13</sup> <http://www.epigenesys.co.uk>

business: sales and marketing; project management; software development; software testing and systems administration.

The following two health-informatics epiGenesys projects illustrate the societal as well as economic value that a University-led venture such as epiGenesys can deliver alongside a distinctive teaching programme:

- **CTRU Prospect:** In association with the Clinical Trials Research Unit at The University of Sheffield, epiGenesys has developed 'Prospect', a bespoke system for clinical and research information management. The core features of the system enable the capture of a wide variety of data, using methods including staff input from paper forms, and direct patient input. The system has various features that are focused around access control, data quality and security. The CTRU Prospect system is currently used by ten clinical trials and studies, with approximately twelve new trials and studies planned for 2011, for customers including Sheffield Teaching Hospitals NHS Foundation Trust and the Medical Research Council.
- **DAFNE Clinical & Research Database:** epiGenesys have recently worked with the national DAFNE Programme, based at Northumbria Healthcare NHS Foundation Trust, to develop the DAFNE Clinical & Research Database. Based on the framework developed in collaboration with the Sheffield Clinical Trials Research Unit, the web based database supports data capture, retrieval and reporting, across national and international sites, for use in clinical audit and assorted research studies. The services included design, development and implementation, import of over 15,000 existing patient records, and ongoing user support, maintenance and technical support.

### **The Open University**

The Open University is unique in the breadth and depth of its engagement with employers. Of the Open University's current student population an estimated 23%, or 51,000 students, are fully or partly sponsored by their employer. 9% of all Open University students (29,000) are directly and fully funded by employers. More than 7,000 employers directly sponsored employees on OU courses at undergraduate and postgraduate levels.

In the last three years, the Open University has partnered with a number of large public employers such as the Prisoners Education Trust, the Youth Justice Board, the NHS and the Ministry of Defence, and with large private organisations such as BAE Systems, Ford Motor Company and Pfizer International. In addition, the Open University is working in partnership with unionlearn, the TUC's learning organisation.

The Open University has extensive partnerships with employer led organisations that inform their educational programmes:

- The Open University is the only higher education corporate member of Intellect, the Technology Trade Association. Intellect represents around 800 large and small organisations including BAE Systems, BT, HP, IBM, Intel, Logica, Microsoft, Motorola, Nokia, Philips, SAP, Sony.
- The Open University has a multi-faceted relationship with e-Skills UK as both a partner delivery organisation for the e-Skills Professional Programme, a partner in the Vital IT CPD programme for specialist IT teachers in schools and as a recipient of support and advice on the development of a nationally relevant IT & Telecoms curriculum. In June 2011 The Open University launched a fully revised Computing & IT Practice undergraduate programme which e-Skills has contributed to significantly as part of their qualification reform programme.
- The Open University is the first higher education provider to have been approved by the National Skills Academy for IT as an approved provider. This represents recognition by the Training Quality Panel of major employers in the sector that The Open University offers a high quality and appropriate curriculum for the sector. The National Skills Academy for IT has a specific remit to provide appropriate solutions to the SME's in the IT & Telecoms industry and their Employer Apprenticeship programme represents an ideal route to market for Open University led Higher Apprenticeship offerings.
- The Open University has extensive relationships with three key professional bodies for IT & Telecoms professionals – BCS, The Chartered Institute for IT, the Institute of Engineering and Technology and the Institute of Telecoms Professionals. The Open University has extensive connections with all three bodies both academically through the Faculty of Maths, Computing and Technology, and also commercially through the Business Development Unit. The Open University is currently working with BCS and IET on developing a pathway to professional recognition through the use of SFIA (Skills Framework for the Information Age) accredited modules.

The Open University's Centre for Professional Learning Development (CPLD) unit is also working closely with employers and has created more than 70 flexible and customised CPD modules across the University's different faculties.

- The Open University and e-skills UK worked together to develop an industry-recognised training framework that both improves skills and career progression for IT professionals and enhances the performance of their organisations. The Postgraduate Certificate in IT Professional Practice is the first part of the e-skills Professional Programme and can be studied over 12 or 18 months. Organisations participating in the programme have included British Airways, the Cabinet Office, Metropolitan Police, NHS IT, the Prison Service and a number of SME's.
- The Open University has an employer led negotiated foundation degree developed as part of Foundation Degree Forward's National ICT Foundation Degree project as

the basis to deliver Higher Apprenticeship programmes to Visa, O2/Telefonica and Capgemini.

- The Open University was approached by Global Knowledge Network, one of the top three IT training providers in the UK, to develop a professional certificate in IT Service Management based on the UK Government's IT Infrastructure Library for Service Management (ITIL). ITIL has over the last twenty years become the de-facto standard in the IT industry for the management and maintenance of IT systems in deployment. This aligns with the research conducted by e-Skills UK in 2008, 2010 and 2011 that professional (postgraduate) skills in IT service management will be the most are of learning need in the IT industry over the next nine years. Global Knowledge provide access to a wide range of corporate IT sector learning buyers with key accounts managed by GKN including BAT, HSBC and O2/Telefonica. This project is developing a unique Postgraduate Certificate Qualification in IT Service Management that will enable highly skilled IT Professionals to achieve recognition across their organisation in a similar manner to business leaders who possess advanced qualifications for example a Postgraduate Certificate in Management or Master of Business Administration. The Postgraduate Certificate is tightly coupled to Global Knowledge's ITIL training curriculum and will be offered to their customer base and The Open University's corporate customers.

### **Silicon Valley Appathon Competition 2011**

This example is included to illustrate how a consortium of employers and universities can collaborate to promote entrepreneurship and innovation.

Silicon Valley Comes to the UK<sup>14</sup> (SVC2UK) is an annual event aimed at supporting pioneers of the most disruptive consumer internet and green technologies. The event involves a series of Appathons at six universities including London, Cambridge and the University of Oxford. The idea is to build consumer-facing web and mobile applications, powered by government data.

The Appathon in Oxford will be held on the 15th and 16th of October at Said Business School. There, students will take part in a 'coding competition' on recently released government data sets in order to build applications using platforms supported by a diverse range of partners (Google, Microsoft, Facebook, Apple and Nokia). The aim is to produce high impact applications to unlock the power of public data to help "rewrite the rules of the Economy 2.0".

Nine UK participants will win a trip to Silicon Valley, followed by a visit to SXSW in Austin. Ten regional winning teams will be invited to a TechCity gala dinner at Ravensbourne College as well as other events in London for Global Entrepreneurship Week.

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<sup>14</sup> <http://www.oxfordentrepreneurs.co.uk/events/silicon-valley-comes-to-the-uk/>