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Contents

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Summary Findings and Recommendations

The Summary Findings and Recommendations document provides an overview of this report together with additional analysis, comments and recommendations and can be downloaded from:

www.microsoft.com/uk/developingthefuture

Section 1 Skills: The Foundation of the UK Software Economy

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Computing Science degree programs in Higher Education, in comparison to most other disciplines, are relatively new considering that they did not exist until the second half of the twentieth century. The academic perspective of the subject evolved from other disciplines such as electronic engineering, mathematics, aspects of business and other scientific based subjects. The early computing curriculum focused on machine and assembly language programming and other languages such as Algol, basic operating systems, study of compilers and assemblers and a mathematical approach to theory. These skills were deemed those necessary to apply the emerging technology to the then limited applications of largely mathematical calculation and data processing.

Today we live in an entirely different technology world of internet, multimedia, web technologies, scripting languages, social networking, mobile and distributed computing and games devices. Computing is all pervasive and applied to practically every aspect of life, although often opaque. The curriculum has thus evolved beyond recognition to concentrate on Internet friendly and object oriented languages, network protocols, graphical user interface design, large and distributed database models and topics encroaching on current research work such as artificial intelligence. It is unlikely that any discipline has had to deal with such a dynamic change in curriculum in order to keep producing graduates with the appropriate skills for the modern age. However practically every university in the UK has a computing science department, approximately 120 in all, and the subject has had major significance in many. Additionally many enter the profession from sub degree routes and other subject area qualifications. Professionals in the discipline also very often require a mixture of technical and business skills, the degree of which depending on the business nature.

Attracting more students to study the subject has been a matter of concern to the industry for some time[1]. From a high level of participation during the 'dot com boom' of 2000/2001 there has been a steady decline in applications to higher education and indeed in the study of the subject at school level. This is in the light of increasing demand for skilled computing professionals. Many reports have speculated on the reasons and offshoring, image and aversion to the

[1] Technology Counts IT & Telecoms Insights 2008 e-skills UK

analytical nature of STEM (Science, Technology, Engineering and Mathematics) based subject disciplines have been postulated. In common with most STEM subjects the failure to attract more females into the discipline results in the sector missing out on a large proportion of the available talent pool.
In addition to the skills emerging from more conventional routes from schools directly through the higher education system, up skilling of the workforce, as identified by the Leitch[2] report, needs to play an ever more important role. More input from industry into the higher education system and accreditation for Work Based Learning by universities has an important role to play. This requires considerable effort from both parties. It is complicated by the nature of the IT business, embracing both small and major companies, with a diverse range of business objectives. Many find it difficult to articulate what their skills requirements are and the time sequence through conventional university programs does not correlate well with software application deadlines and release dates. To counteract this timely intervention through CPD (Continuing Professional Development) modules must play a more significant part in facilitating greater employer engagement with the educational establishments. Change is needed and Industry, educational establishments and government must work together to sustain the high value of the UK knowledge based economy[3]. It is crucial that universities produce the graduates the economy needs, with the skills that employers value.

Part 1.01 Graduates Entering the Software Industry

Part 1.01.1 Introduction to the cpSTEM subjects and Methodology

The term STEM incorporates subjects that belong to the Sciences, Technology, Engineering and Mathematics and have commonly been referred to as the key disciplines underpinning a knowledge and innovation-based society[4] [5]. It is also well perceived that these STEM subjects create skilled individuals that gain employment within the software industry.

The sciences portion of the STEM definition cover a broad number of subjects and can include computer science, chemistry, as well as the physical and biological sciences. For the purposes of this analysis, both chemistry and

[2]http://www.hm-treasury.gov.uk/independent_reviews/leitch_review/review_leitch_index.cfm

[3] Higher Level learning. Universities and employers working together. Universities UK

[4] http://www.doleta.gov/Youth_services/pdf/STEM_Report_4%2007.pdf

[5] http://www.umich.edu/~advproj/ncid/assessing_programs.pdf

biological sciences were not analysed, as these subjects are not directly relevant in creating skill sets relevant to the software industry.

From this point onwards in the report, the computer and physical Sciences, Technology, Engineering and Mathematics group of subjects will be denoted as cpSTEM subjects.

Graduates from universities are perceived to be an important source of skilled individuals for the software industry. It has also been recognised that not only do computer science graduates enter the software industry, but so do graduates from the cpSTEM disciplines as described above. This analysis looks at the contribution of the cpSTEM disciplines to the software industry over time.

In this analysis, the number and importance of cpSTEM graduates feeding the software industry was examined over time, building on research carried out in previous Developing the Future Reports[6] [7]. The demand for cpSTEM courses was also analysed for changes. When analysing the fate of new cpSTEM graduates, their employment rate was analysed as well as the direct effect of graduates on the software industry, by calculating how many cpSTEM graduates are actually employed in the information technology professionals sector, and whether this has changed over time.

Part 1.01.2 Number of Graduates of cpSTEM subjects

The first determinant was the number of graduates that studied cpSTEM subjects from 1997-98 to 2006-07 garnered by using data from the Higher Education Statistics Agency (HESA), which is shown in **Figure 1**. This showed the extent of how many graduates with relevant skill sets entered the software industry at the end each of these years. To ensure concordance with the STEM nomenclature, mathematical sciences will be referred to as mathematics, as characterised in the HESA data.

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[6] http://download.microsoft.com/documents/UK/developingthefuture/Developing%20_The_Future_07.pdf

[7] http://download.microsoft.com/documents/UK/citizenship/Developing_the%20_Future2006.pdf

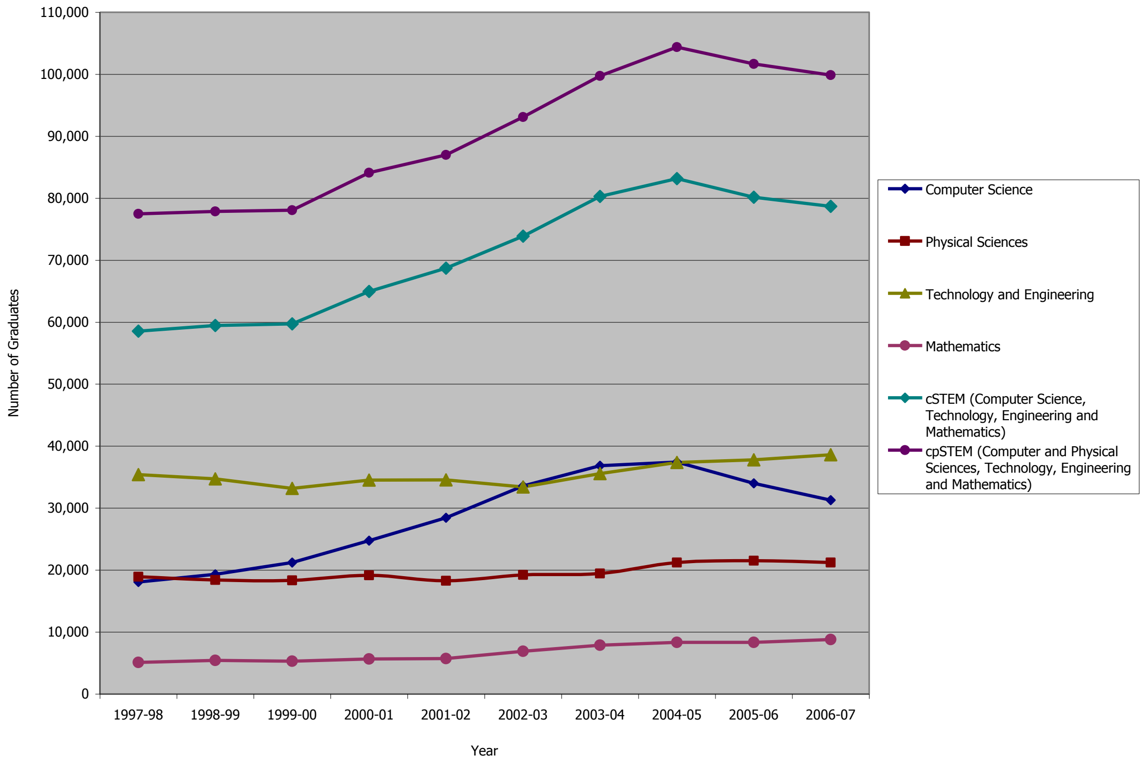

Figure 1: Number of Graduates of cpSTEM subjects between 1997-98 and 2006-07 (Source: HESA)

This revealed that the number of graduates that studied the cpSTEM subjects of computer and physical Science, Technology, Engineering and Mathematics rose steadily from 77,475 students in 1997-98 to peak at 104,370 students 2004-05 (a rise of 34.7%), then drop to 99,875 students by 2006-07 (a drop of 4.3%).

The majority of the increase in cpSTEM graduates from 1997-98 to 2004-05 can be attributed to a rise in computer science graduates who were responsible for 72% of the rise (19,382 of the 26,895 new cpSTEM graduates). Mathematics was responsible for 12% of the rise (3,240 graduates), the physical sciences for 8.5% (2,282 graduates), and technology and engineering (which are classified together by HESA) for 7.4% (1,991 graduates).

Computer Science was also responsible for the majority of the subsequent decline in cpSTEM graduates from 2004-05 to 2006-07. Whilst the number of cpSTEM graduates dropped by 4,495 from 2004-05 to 2006-07, the number of computer science graduates dropped by 6,175 students. In contrast, the number of graduates in mathematics (445 graduates) and technology and engineering (1,240 graduates) both rose, whilst the number of graduates in the physical sciences remained constant.

Interestingly, the rise in the number of computer science graduates from 1997-98 to 2004-05 and subsequent fall, mirrors that of the dot-com boom and subsequent bust around 2002-2003. The drop in computer science graduate number is most apparent in 2005-06, around 3 years after the dot-com bubble burst, suggesting that many students turned away from studying computer science subjects in 2002-03.

The next stage involved the examination of the total number of graduates from HEIs from 1997-98 to 2006-07 in order to determine if the rise and fall in the number of computer science graduates was mirrored in the overall graduate number, perhaps reflecting a greater trend. A time-series analysis of total graduate numbers is shown in **Figure 2**, and revealed that HEI graduate numbers have steadily increased by 49% between 1997-98 and 2006-07 (437,128 to 651,060 graduates), suggesting that this was not the case. Although HEI graduate growth slowed after 2004-05, this was still in contrast to the decline in cpSTEM graduate numbers over the same period.

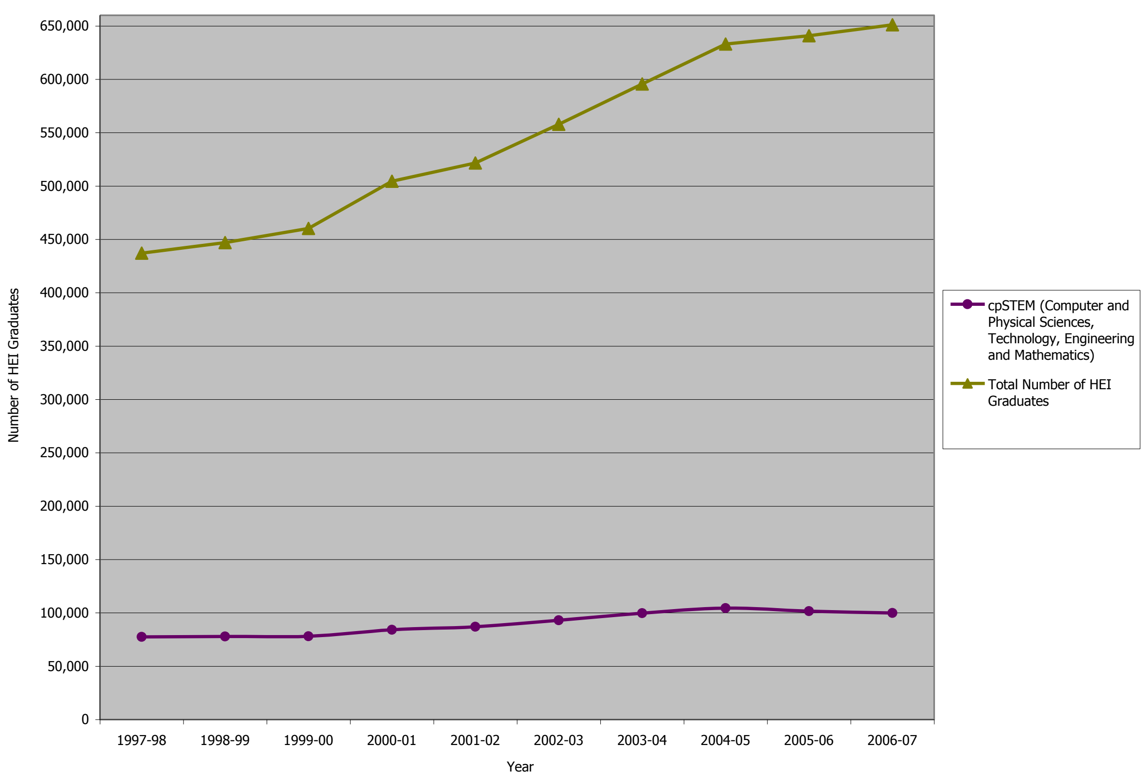

Figure 2: Time-Series Analysis of the Total Number of HEI Graduates from 1997-98 to 2006-07 (Source: HESA)

Taken together this suggests that against a backdrop of rising HEI graduate numbers from 1997-98 to 2006-07, cpSTEM graduate numbers have also risen, but only until 2004-05 from which point they have dropped slightly. The rise and fall of cpSTEM graduate numbers is largely attributable to a corresponding rise and fall in the number of computer science graduates in HEIs. This suggests that there may be a shortage of graduates feeding into the software industry compared to previous years.

Part 1.01.3 Percentage of Graduates that studied cpSTEM subjects

The next question posed was if there has been a corresponding decline in the proportion of graduates that studied cpSTEM subjects. A time-series analysis is shown in **Figure 3** using data from HESA, and revealed that there has been a general decline in the percentage of HEI graduates that studied cpSTEM subjects, dropping from 17.7% of all graduates in 1997-1998 to 15.3% in 2006-07.

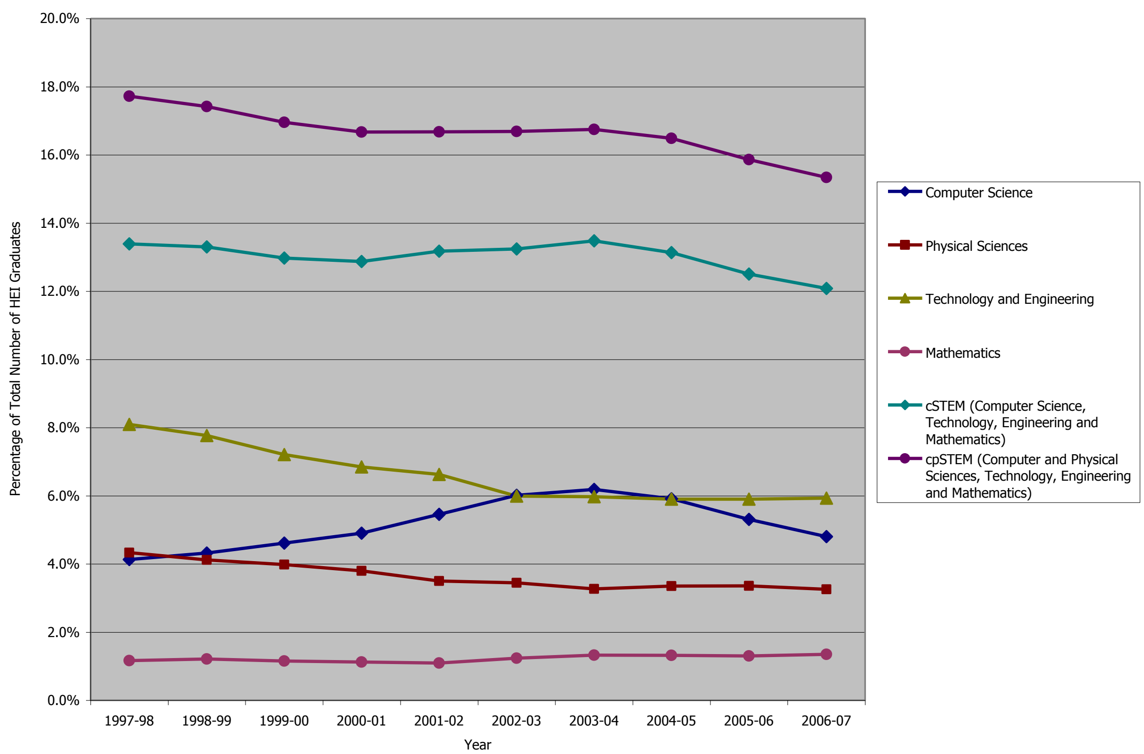

Figure 3: Percentage of HEI Graduates that studied cpSTEM subjects (Sources: HESA and Library House)

This drop was characterised firstly by a corresponding drop in the percentage of physical sciences graduates (4.3% in 1997-98 to 3.3% in 2002-03) and technology and engineering graduates (8.1% to 6%) between 1997-98 and 2002-03, followed by a drop in the percentage of computer science graduates between 2003-04 and 2006-07 (from 6.2% in 2003-04 to 4.8% in 2006-07). The percentage of mathematics graduates generally remained constant between 1997-98 and 2006-07 (between 1.2% and 1.3%).

Taken together, this analysis suggests that cpSTEM subjects are less attractive for today's university students than they were in 1997-98. If this trend continues along with the decrease in cpSTEM graduate numbers that has also been observed, it is possible that there could be difficulties in finding suitably skilled individuals such as graduates to feed into the software industry in the years to come. However, it is important to note that new graduates are not the only source of skilled individuals for the software industry, with graduates with work experience, and individuals with other industry-relevant qualifications also highly sought after. The importance of these other sources of skilled individuals to the software industry will be further examined in a subsequent section.

Because of the decline in STEM importance and graduate numbers, Governmental Funding Bodies such as the Higher Education Funding Council for England (HEFCE) have classified the STEM subjects as "strategically important and vulnerable", and as such have undertaken initiatives to counter this decline, particularly in chemistry, physics, engineering and maths[8]. These include initiatives in collaboration with Aimhigher to increase and widen participation in STEM subjects, particularly with regards to currently under-represented groups.

Part 1.01.4 Number of Applicants for cpSTEM subjects

The decrease in both the number and percentage of graduates studying the cpSTEM subjects could be due to either a decrease in the number of applicants for the cpSTEM subjects, or a reduction in the acceptance rate of applicants for cpSTEM subjects.

To explore these two possibilities, a time-series analysis of the number of applicants for cpSTEM subjects from 2002 to 2007, and the corresponding acceptance rate was performed. This time period was chosen as it coincided with the decline in the percentage of students studying computer science, and the rise (until 2004-05) and subsequent fall in the corresponding number of cpSTEM students.

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[8] http://www.hefce.ac.uk/AboutUS/sis/stem.htm

The data from the Universities & Colleges Admissions Service (UCAS) was analysed as the UCAS classifies data differently from HESA, publishing data for each calendar rather than academic year (i.e. 2004 instead of 2004-05). However, UCAS data will be represented in the HESA data-set in the following academic year (i.e. 2004 UCAS applicants (if accepted) will be included in the 2004-05 HESA data-set).

In addition, whilst HESA groups technology and engineering together, UCAS differentiates between the two, but instead groups the mathematical and computer sciences together.

In order to see whether there have been any changes in the demand for cpSTEM subjects over time, the number of applicants for the cpSTEM subjects from 2002 to 2007 was firstly determined and shown in **Figure 4**. As with the HESA data, to ensure consistency with the STEM nomenclature, we have also referred to the mathematical sciences as mathematics.

Figure 4 shows that the number of applicants for cpSTEM subjects has generally decreased over the 5 years that were analysed, from a high of 70,505 students in 2002 to 65,105 students in 2007, representing a decline of 7.7%. This decline was attributable to a drop in the number of computer science and mathematics applicants. The number of computer science and mathematics applicants dropped by 26.5% (34,136 applicants in 2002 compared to 25,102 in 2007) between 2002 and 2007.

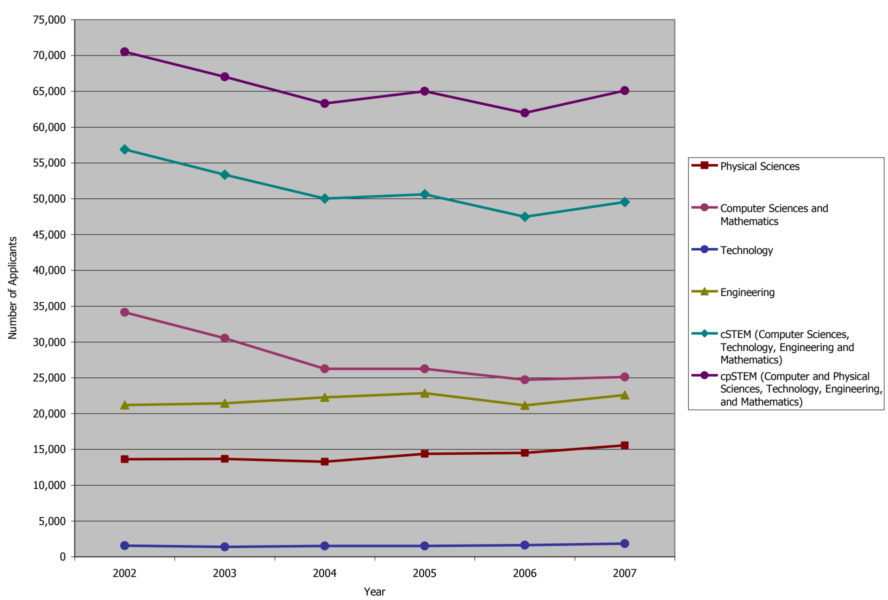

Figure 4: Applicant Number for the cpSTEM Subjects (Source: UCAS)

In contrast, between 2002 and 2007 the number of physical sciences, technology, and engineering applicants all rose by 14%, 18.4%, and 6.7% respectively. It was also observed that a similar rise in the total number of HEI applicants between 2002 and 2007, with a 15.8% increase (461,365 applicants in 2002 compared to 534,495 applicants in 2007).

The decrease in the number of computer science and mathematics applicants is likely due to a drop in computer science applicants given that the number of mathematics graduates increased by 27.3% between 2002-03 and 2006-07 (6,895 to 8,780 graduates, see **Figure 1**), whilst the number of computer science graduates decreased by 6.8% (33,560 to 31,270 graduates).

However, there was a slight rebound in cpSTEM applicants between 2006 and 2007 primarily mediated by a 6.9% increase in engineering and physical sciences applicants, a 1.5% increase in the physical sciences and a 12.7% increase in technology applicants. Importantly however, there was also a 7.4% increase in the number of computer science and mathematics applicants, although this was negligible given the overall reduced demand in previous years (a drop of 7,407 applicants between 2002 and 2006, compared to an increase of 458 applicants between 2006 and 2007).

Taken together, this suggests that between 2002 and 2007 there has been an increased demand for subjects that indirectly feed into the software industry such as engineering and the physical sciences. This is consistent with the increase observed for all applicants to HEIs in the past 5 years. However, there has been a significant decrease in the demand for subjects that directly feed into the software industry such as computer science (and mathematics) over this period (34,136 applicants in 2002 to 25,102 applicants in 2007).

This paints a worrying picture for the computer sciences in particular, as the analysis suggests that applicant numbers may not bounce back to those at the height of the dot-com boom and could stabilise around their current number. Additionally, this raises the scenario that there may be a shortage of new graduates to directly feed into the software industry in the years to come.

Part 1.01.5 Acceptance Rate for cpSTEM subjects

One possible explanation for the decline in the number of graduates since 2004-05 is that the acceptance rate for cpSTEM subjects has become lower over time and so the percentage of acceptances for the cpSTEM subjects from 2002 to 2007 was calculated and findings shown in **Figure 5**. The acceptance rate for some of these subjects can be higher than 100% because this includes applicants who did not put the particular cpSTEM subject as their first choice.

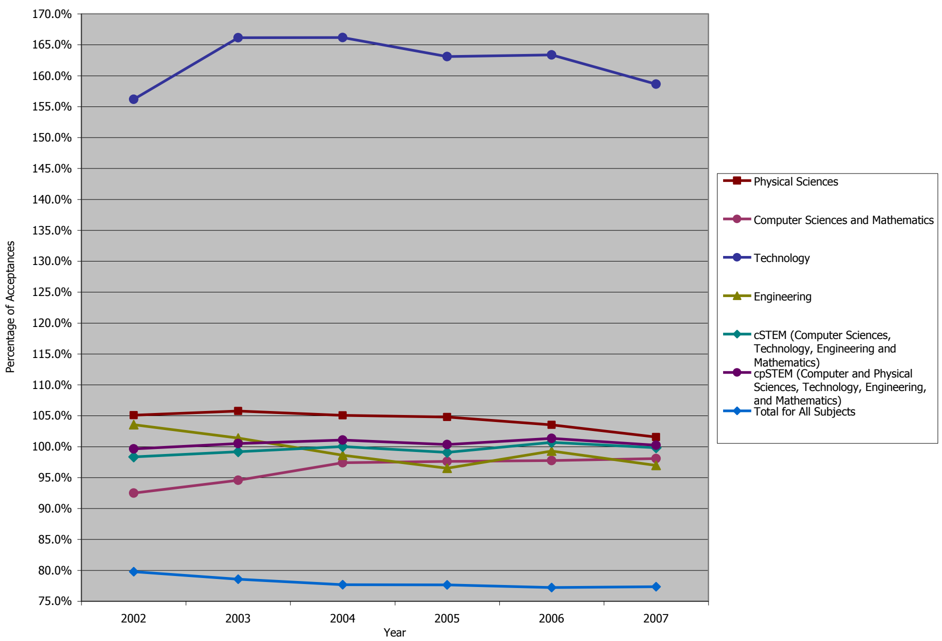

Figure 5: Analysis of Acceptance Rate for cpSTEM Subjects (Source: UCAS)

Figure 5 shows that in general there has been a decline in the acceptance rate for many of the cpSTEM subjects, and indeed in terms of all degrees. The acceptance rate for the physical sciences has dropped by 3.5%, (from 105.1% in 2002 to 101.6% in 2007), whilst that for engineering has dropped by 6.6% (from 103.6% in 2002 to 97% in 2007). There was a slight rise in the acceptance rate for technology (2.4%, from 156.2% in 2002 to 158.6%), however it is important to note that this has on an overall decline since peaking in 2004.

The most likely explanation for the reduction in the acceptance rates for these subjects is to counter the increased demand seen in these subjects in terms of the number of applicants (see **Figure 1**). Though the acceptance rate for all HEI subjects decreased by 2.5% between 2002 and 2007, the number of HEI graduates has also by 16.7% since 2002-03, suggesting that the decrease in acceptance rate is likely to be due to increased demand.

Conversely, in contrast to the general and specific cpSTEM decline, the acceptance rate for computer science and mathematics jumped by 5.6%, from 92.5% in 2002 to 98.1% in 2007. This is most likely a measure to counter the general decline in the number of applicants since the dot-com bubble burst in 2002-03.

However, given that the number of acceptances for computer science and mathematics in 2007 (24,622) was less than the number of graduates of computer science only in 2006-07 (31,270, with mathematics a further 8,780), this suggests that there will be a shortage of new graduates entering the software industry in the next three years. It will be interesting to see whether the increase in the acceptance rate for computer science and mathematics will have any affect in stemming the decline in computer science graduates in the future.

Part 1.02 cpSTEM Graduates employment trends

It was next asked whether cpSTEM graduates are easily employed following the completion of their degree, and if so, where they are employed. This would allow the understanding of the proportion of cpSTEM graduates that enter software-related industries.

This step of the analysis used data from Prospects and HESA, who compile an annual Destination of Leavers from Higher Education (DLHE) survey. The HESA DLHE survey asks new graduates 6 months after completion of their degrees whether they are employed or not, and if so, where they are employed. Although the DLHE survey does not ascertain whether cpSTEM graduates stay in the profession they are employed in 6 months after completion of their degree, the survey nonetheless should prove useful in our assessment of graduates entering the software industry.

Part 1.02.1 Employment of cpSTEM Graduates

The percentage of cpSTEM graduates that are in employment from 2003 to 2006 was firstly analysed. This is shown in **Figure 6** and shows that in general, the percentage of graduates that are employed 6 months after completion of a cpSTEM degree has increased over time, from 67.3% in 2003 to 69.1% in 2006.
In all disciplines, there has been an increase in the percentage of graduates that are employed following completion of their degree. For example, there was a 0.4% increase in the employment rate of mathematics graduates, a 0.8% increase for physical sciences graduates, and a 2.1% increase for IT/computer science graduates. This was compared to a 0.4% increase in the rate of employment of graduates for all first degrees.

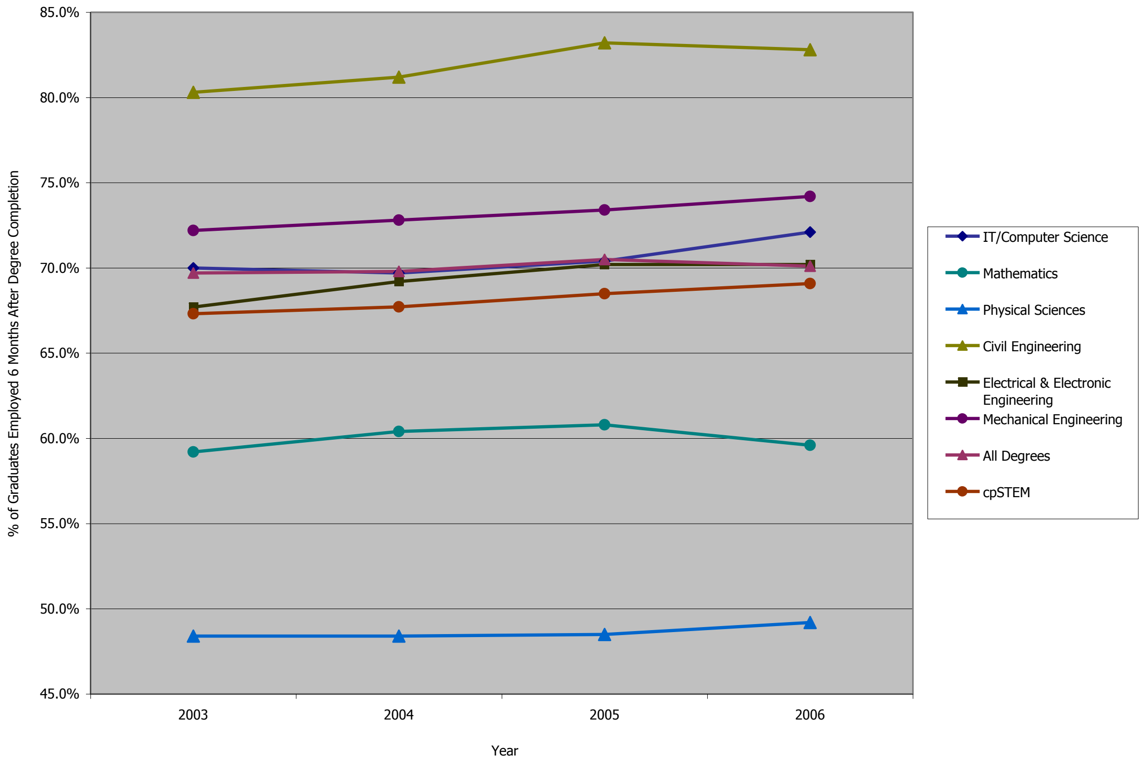

Figure 6: Analysis of the Percentage of Graduates that are Employed 6 Months after Completion of their Degree (Sources: Prospects.ac.uk and HESA)

Taken together, this suggests that cpSTEM graduates are finding employment more easily than in 2003, and that the rate of employment is increasing more quickly than that for all degrees.

Part 1.02.2 Unemployment Rates for cpSTEM Graduates

In using the data from Prospects.ac.uk and HESA, **Figure 7**, the percentage of cpSTEM graduates that are unemployed 6 months after completion of their degree and it reveals that the percentage of cpSTEM graduates that are unemployed has significantly decreased between 2002 and 2006, from 14.1% in 2002 to only 9.6% in 2006.

Contrary to recent articles in the press that suggest IT graduates are struggling to find work[9,10], the analysis reveals that the unemployment rate for

[9] http://www.ft.com/cms/s/0/25c2c8e0-491e-11dd-9a5f-000077b07658.html

[10] http://www.telegraph.co.uk/news/newstopics/politics/education/2242062/Art-and-computing-students-face-higher-unemployment-risk.html

IT/Computer Science graduates has actually dropped by 4.2% between 2002 and 2006 (from 14.6% to 10.4%[11]). In addition, the unemployment rate for graduates of Mathematics dropped by 3.2% (8.6% in 2002 to 5.4% in 2006), and the Physical Sciences by 0.5% (8.7% to 8.2%).

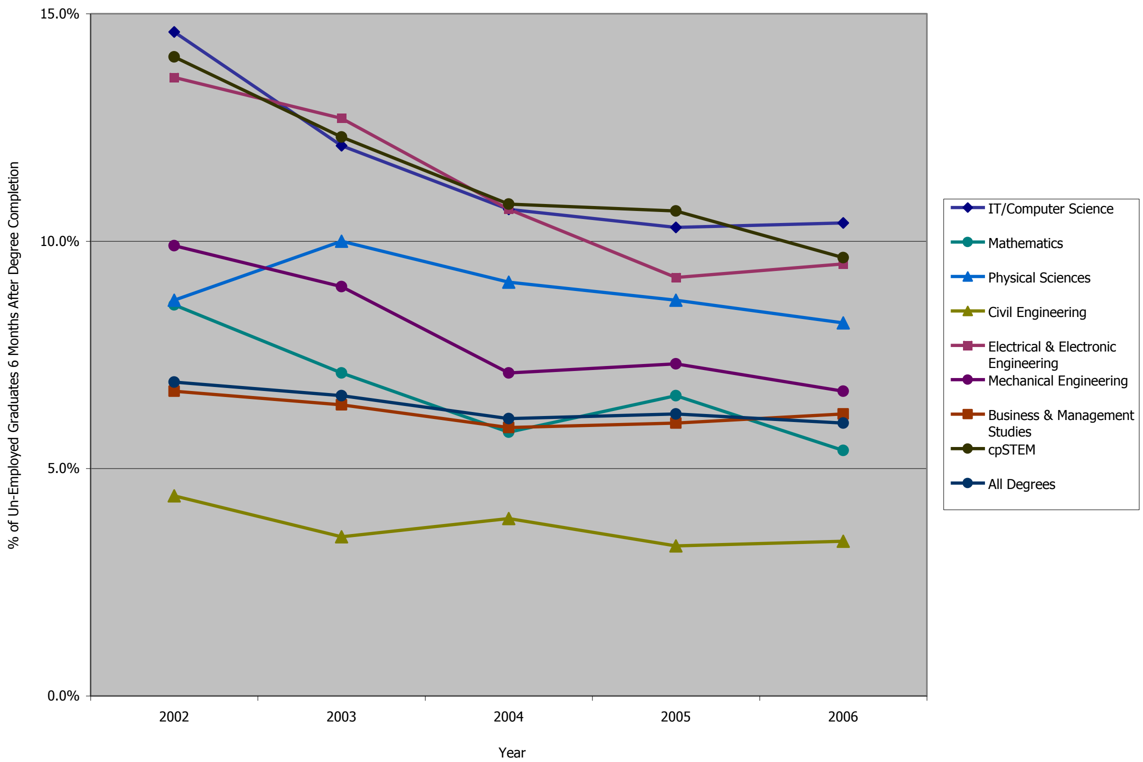

Figure 7: Percentage of Unemployed cpSTEM Graduates 6 Months after Completion of their Degree (Sources: Prospects.ac.uk and HESA)

In comparison, the percentage of graduates from all degrees that are unemployed dropped by only 0.9% (from 6.9% to 6%). However, it is important to note that this is still 4.4% lower than that for cpSTEM graduates in general (10.4% for cpSTEM graduates vs. 6% for all graduates). Furthermore, the unemployment rate for other degrees such as business and management studies was also lower than that for the cpSTEM subjects (6.2% in 2006 compared to 10.4% for cpSTEM graduates).

Given the difference in the unemployment rate between cpSTEM graduates and alternative subjects for potential cpSTEM students such as business and management studies, it is perhaps unsurprising that cpSTEM graduate and

[11] N.B. The 2006 data represents the latest HESA data for the 2006-07 academic year

applicants numbers have been dropping. However, considering the importance of STEM subjects for innovation and the economy as highlighted by a recent report from the US Department of Labor, Employment and Training Administration[12], it is imperative that new initiatives be undertaken to increase the attractiveness of STEM subjects for tomorrow's HEI students. This should be undertaken by both governments, and companies alike, otherwise there will likely be an increased shortage of cpSTEM graduates feeding into all industries in the years to come, which could have significant impacts on the economy and innovation in general.

Despite these potential difficulties, the analysis suggests some encouraging recent trends for the software industry. An example of which is the rate of employment of cpSTEM graduates that is increasing whilst the rate of unemployment is decreasing. In both cases, this outperformed the trends observed for all degrees and given the decrease in graduate numbers since 2004-05. However, more initiatives (governmental and business) need to be developed and implemented to make STEM subjects more attractive for tomorrow's HEI students, and reduce the disparity in unemployment rates between cpSTEM subjects and all HEI degrees, as well as alternative degrees such as business and management studies.

Part 1.02.3 cpSTEM graduates in the software industry

The number of cpSTEM graduates that actually go into the software industry was investigated to determine the importance of each discipline in terms of feeding new graduates into the software industry.

The datasets utilised again were from Prospects.ac.uk and HESA dating 2002 to 2006. This data estimates the percentage of graduates from each discipline that enter different sectors. The most relevant sector for the software industry is what is classified as information technology professionals. First examined was the percentage of Computer Science/IT graduates that entered the IT professionals sector from 2002 to 2006, which is shown in **Figure 8**.

[12] http://www.doleta.gov/Youth_services/pdf/STEM_Report_4%2007.pdf

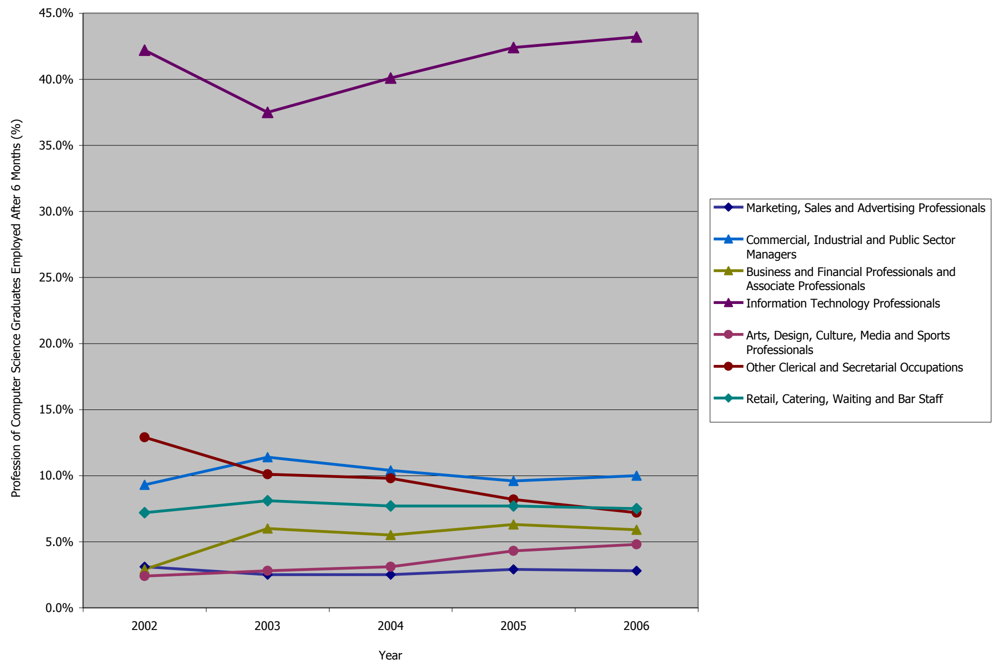

Figure 8: Employment Sectors entered by new IT/Computer Science Graduates 6 months after completion of their degree (Sources: Prospects.ac.uk and HESA)

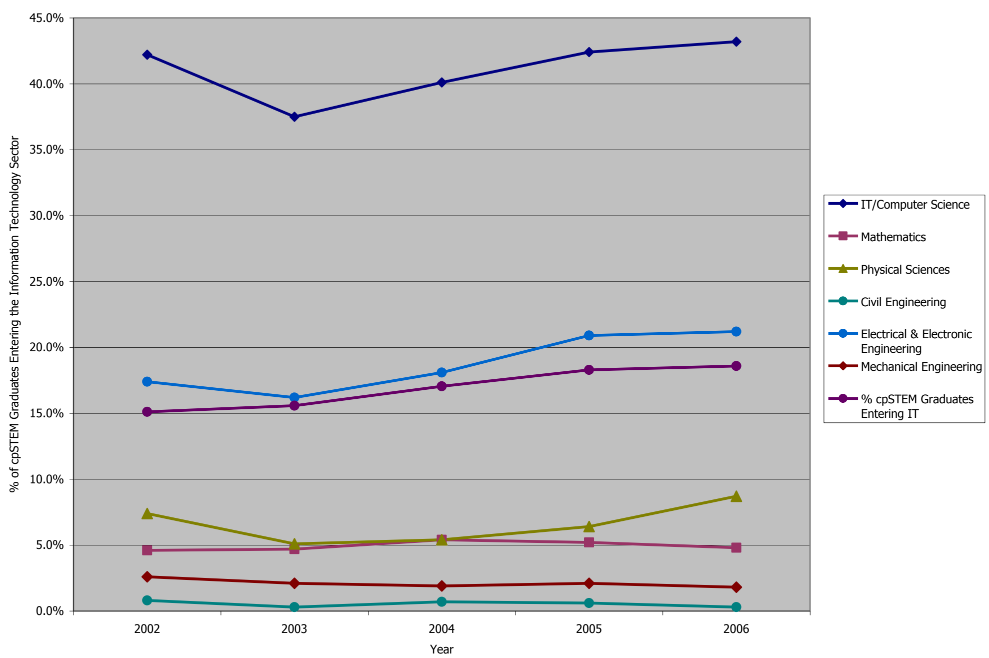

Figure 9: Proportion of new cpSTEM Graduates entering the Information Technology Professionals Sector (Sources: Prospects.ac.uk and HESA)

This shows that although the percentage of IT/Computer Science graduates entering the IT Professionals sector decreased by 4.7% between 2002 and 2003 (from 42.2% to 37.5%), since then it has steadily increased to be 1% above the levels of 2002 (43.2% compared to 42.2%).

Although this is an encouraging sign, it is important to note that in 2006 (**Figure 10**), only 43.2% of employed IT/Computer Science graduates entered the IT professionals sector. In the remaining 56.8% of employed graduates, the next largest employing sector was the Commercial, Industrial and Public Sector Manager Sector, which employed 10% of the IT/Computer Science graduates up from 9.3% in 2002. It was also found that 7.5% of IT/Computer Science were employed as retail, catering, waiting and bar staff, whilst 7.2% were employed in other clerical and secretarial occupations which was surprisingly down from 12.9% in 2002.

Interestingly, 5.9% of IT/Computer Science graduates were employed as Business and Financial Professionals and Associate Professionals in 2006, up from only 2.9% in 2002. This suggests that the skills of these graduates are in increasing demand from the business and financial sector.

Though this suggests that a significant proportion of IT/Computer Graduates are not entering the IT Professionals sector, it is important to note that a proportion of these individuals will probably be undertaking IT-related activities in other sectors. This would particularly be true for those in the Commercial, Industrial and Public Sector Manager, Other Clerical and Secretarial, and Business and Financial Professionals and Associate Professionals sectors. Thus the actual percentage of IT/Computer Science graduates undertaking IT-related activities is likely to be higher than the 43.2% of graduates directly employed in the IT professionals sector.

The proportion of individuals from other cpSTEM disciplines that entered the IT professionals sector was analysed in order to ascertain their contribution to the software industry, though only the IT professionals sector was analysed given that it is impossible to ascertain the proportion that are involved in IT-related activities in other sectors.

This is shown in **Figure 9**, and reveals some very encouraging trends for the sector. Firstly, in terms of cpSTEM graduates as a whole, the percentage entering the IT Professionals sector has increased by 3.5% between 2002 and 2006 from 15.1% of all cpSTEM graduates in 2002 to 18.6% in 2006.

Furthermore, the number of Electrical and Electronic Engineering graduates joining the sector, from 17.4% in 2002 to 21.2% in 2006. Electrical and Electronic Engineering graduates make up the 2nd highest proportion of individuals entering the IT professional sector behind Computer Science/IT, with Physics and Mathematics the 3rd and 4th most important contributors. This suggests that contrary to the perception that the sector is diminishing, cpSTEM graduates are actually entering the IT Professionals sector in increasing proportions.

In **Figure 10** it is revealed that the number of cpSTEM graduates entering the IT professionals sector has increased by 47% between 2002 and 2006 (2,887 to 4,244 graduates). Although the 2002 figure does not include those working and studying due to a difference in the Prospects classification system from 2003, there was still a 14% increase in numbers between 2003 and 2006.

The majority of this increase was from IT/Computer Science graduates, which increased by 50.6% between 2002 and 2006 (2,440 to 3,675 graduates), and 14.7% between 2003 and 2006 (3,204 to 3,675 graduates). The number of Electrical and Electronic Engineers entering the IT Professionals sector increased by 29% between 2002 and 2006 (283 to 348 graduates), and by 5% between 2003 and 2006 (348 to 365 graduates).

Taken together, this paints a promising picture for the IT/Computer Science sector in general, as well as the software industry.

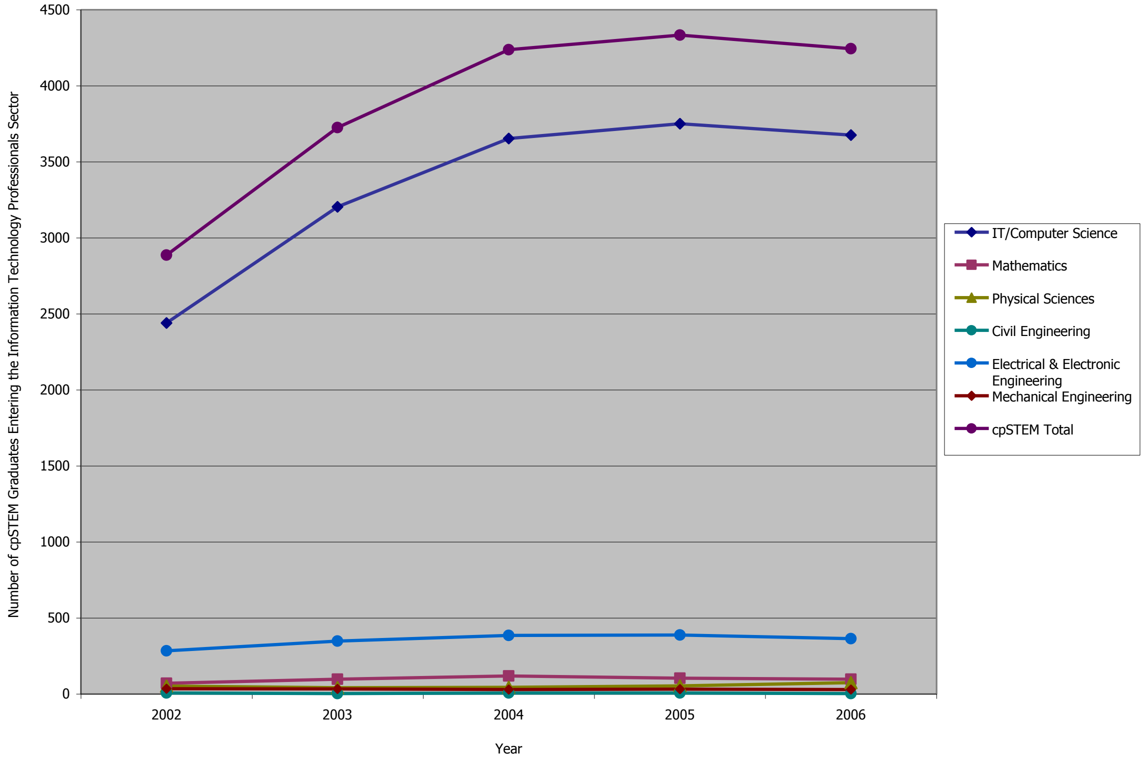

Figure 10: Number of new cpSTEM Graduates that are employed in the IT Professionals Sector (Sources: Prospects.ac.uk and HESA)

Part 1.03 Who does the Software/IT sector want?

Although the increased number of cpSTEM graduates entering the IT Professionals sector is an extremely encouraging sign, an important question that remains is whether the software/IT sector actually wants HEI graduates or individuals with industry-specific qualifications or previous employment experience.

To explore the importance of HEI degrees in obtaining employment in the IT sector, it was first determined whether the demand for a degree in IT jobs across the UK has dropped over time. Using data from IT Jobs Watch[13] revealed that the demand for a degree in IT jobs has dropped since 2004. There was been a 13% drop in degree demand between the middle of 2004 and the middle of 2008, from around 62% in 2004 to only 49% in 2008.

[13] http://www.itjobswatch.co.uk/jobs/uk/degree.do

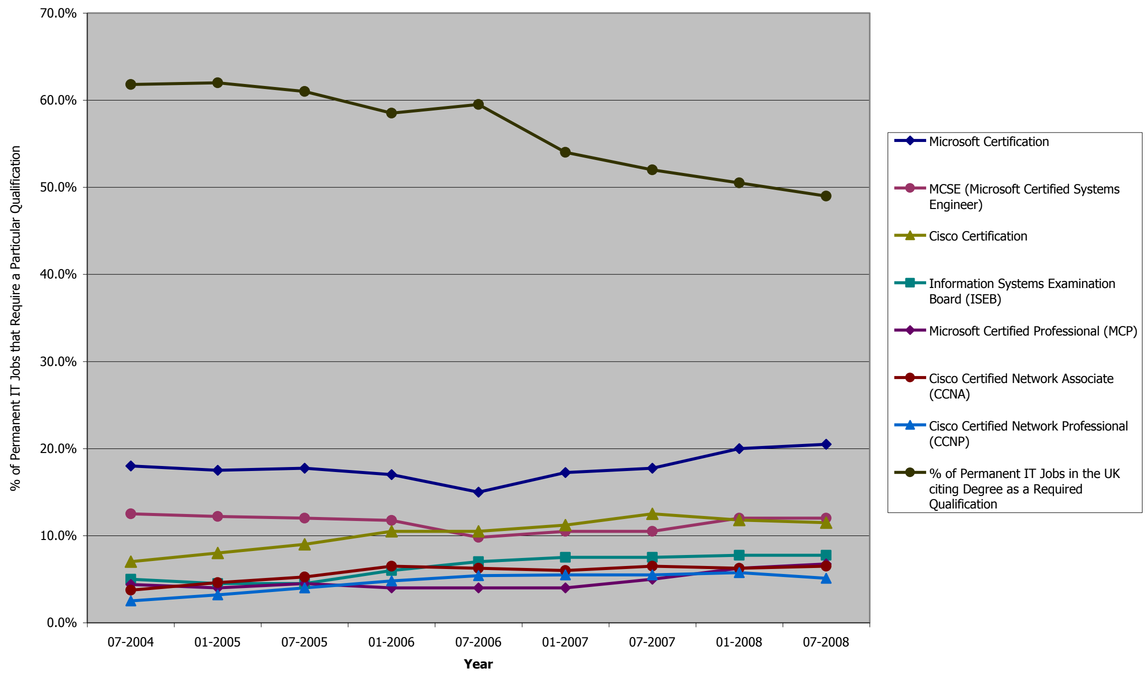

Figure 11: Percentage of Advertised Permanent IT Jobs which require a Degree or other Non-Degree Accreditations as a Qualification (Source: IT Jobs Watch)

Interestingly, along these lines, there seems to be a greater importance from the software industry on hiring individuals with relevant skills rather than graduates fresh out of university. Mark Emanuelson of Cisco Systems stated that Cisco, in order to address the so-called skills gap between what the market demands and suitably qualified graduates, has implemented the Cisco Networking Academy, in order to train individuals to a high standard. Since its inception 10 years ago, it was stated that 22,000 people have come out of the academy, and are in high demand after finishing their qualification. Mr. Emanuelson stated that the majority of the qualifications were done in conjunction to a degree, though part of it can be completed outside of a university. Mr. Emanuelson also stated that the program had been running in prisons for example, giving these individuals an opportunity to develop new skills to aid them in seeking employment following their release.

To further evaluate the importance of other industry-specific qualifications, analysis on the percentage of advertised IT jobs which required qualifications other than a degree, using data from IT Jobs Watch. This is shown in **Figure 11**, and revealed that demand for other industry-relevant qualifications has increased in general since 2004. For example, demand for Microsoft Certification has increased by 2.5% since 2004, from 18% in mid-2004 to 20.5% in mid-

2008. Demand for Cisco Certification increased by 4.5% (7% to 11.5%), whilst that for Information Systems Examination Board (ISEB) qualifications rose by nearly 3% (5% to around 8%). Furthermore, demand for Microsoft Certified Professionals rose by 2.4% (4.4% to 6.8%), Cisco Certified Network Associates by 2.7% (3.8% to 6.5%), and demand for Cisco Certified Network Professionals more than doubled (an increase of 2.6%, from 2.5% to 5.1%). However, although less likely, the increasing importance of qualifications other than degrees may simply be a response towards declining graduate numbers.

Interestingly, software companies also appear to be placing a greater importance on hiring individuals with industry-relevant experience rather than graduates fresh out of university. For example, David Bailey of Short Fuze (formerly of Tiga) stated that he would not hire anyone with less than three years' prior experience in the gaming industry.

This suggests that there may be a so-called risk/quality gap, with companies preferring to hire experienced individuals, either with more industry-relevant qualifications, or previous job experience, rather than graduates fresh out of university.

Part 1.04 Conclusions and Recommendations

In summary, the analysis suggests that whilst there has been a rise in the number of graduates that studied cpSTEM subjects since 1997-98, there has been a steady decline in the number of cpSTEM graduates since 2004-05. The rise and fall of cpSTEM graduates appears to coincide with a similar rise and fall in computer science graduates, possibly as a result of the bursting of the dot-com bubble around 2002-03.

The percentage of graduates studying cpSTEM subjects has declined steadily since 1997-98, primarily due to declines in technology and engineering, physical sciences since 1997-98 and the computer sciences since 2003-04. This suggests that graduates are now placing less importance on the cpSTEM disciplines than 1997-98, and computer science in particular since 2003-04.
The lower emphasis on the cpSTEM disciplines, and in particular computer science, is also borne out by the decline in the number of applicants for cpSTEM subjects since 2002, suggesting a reduced demand. Although there have been slight increases in the number of applicants for engineering and the physical sciences, this has been offset by a significant decline in the number of applicants for the computer sciences and mathematics.

However, in a possible move to counter the decline in applicant numbers for the computer sciences and mathematics, there has been a 5.6% increase in the acceptance rate between 2002 and 2007 compared to a 2.5% decline for all degrees. However, this has not been enough to offset the lower number of acceptances of computer science and mathematics, with a 22% drop in the number of acceptances between 2002 and 2007.

But despite a drop in graduate and applicant numbers since the end of the dot-com boom, there are some extremely encouraging signs for the industry. Since 2003, the percentage of cpSTEM graduates that are employed 6 months after graduation has risen by 1.8%, whilst that for computer science has increased by 2.1%. This was compared to a smaller 0.4% increase for all degrees.

Furthermore, there has been a 4.5% decrease in the unemployment rate for cpSTEM graduates and a 4.2% decrease for computer science graduates, compared to a 0.9% decrease for all degrees. Taken together, this suggests that today's graduates are finding it easier to obtain employment than in 2003, and is an encouraging sign. However, the cpSTEM unemployment rate is still 4.4% higher for cpSTEM graduates than for all graduates (10.4% vs. 6%). Thus, in order to reduce this disparity as well as increase the attractiveness of cpSTEM subjects for tomorrow's HEI students, more initiatives at the governmental and business level need to be developed and implemented.

There have also been some encouraging signs for the percentage of IT/Computer science graduates that are entering the information technology professionals sector. Although declining between 2002 and 2003, the percentage of IT/Computer graduates entering the IT professionals sector are now back up to 2002 levels. And there has also been a 3.8% increase in the percentage of Electrical and Electronic Engineering graduates joining the information technology professionals sector, which is the second biggest source of employees for the sector behind IT/Computer science.

There has also been a 13.9% increase in the number of cpSTEM graduates entering the information technology professionals sector between 2003 and 2006, which has been primarily driven by a 14.7% increase in the number of computer science graduates entering the sector.

Taken together, this paints a very encouraging picture for the software industry and does not suggest that this sector is in decline.

However, against this backdrop it is important to note that the software industry is less focused on university qualifications such as undergraduate or postgraduate degrees compared to other professions such as medicine, law, engineering, and scientific or other academic research. Other more industry-specific qualifications or previous work experience in the sector for example, may be more desirable.

In fact, recent trends suggest that the importance of having a degree as a requirement for employment in the IT/Software sector may be dwindling. For example, the percentage of permanent IT jobs that require a degree as a qualification has decreased by 13% since the middle of 2004 until 2008.

In contrast, the corresponding percentages for other qualifications have increased. For example, there has been a 2.5% increase in the percentage of IT jobs requiring Microsoft Certification, a 4.5% increase for Cisco Certification and a 2.75% increase for the Information Systems Examination Board (ISEB) qualification. The possibility that this is a response by SMEs and corporates to counter the declining number of skilled individuals graduating from universities however cannot be ruled out.

Nonetheless, this suggests that a trend is emerging with regards to hiring experience graduates or individuals rather than recent graduates from an HEI without any prior experience. This raises the issue of the relevancy of university degrees in the software industry? Although the percentage of permanent IT jobs requiring a degree have dropped, it is important to note that it is still required in 49% of advertised jobs, which is significantly more than the next highest qualification, that of Microsoft Certification (20.5%).

Furthermore, at least in the gaming industry, it seems as though employers are placing greater importance on prior industry-specific experience, preferring to hire individuals with a least 3 years experience rather than new graduates, as stated by David Bailey of Short Fuze.

Against this backdrop of the increasing importance of other qualifications and prior industry experience, how can universities meet this challenge? One possible strategy is to include industry-relevant qualifications as part of a degree. This would allow new graduates to have more industry-specific skill sets that could aid in employment after completion of their degrees. In order to address the lack of experience of new graduates, ideas such as placing students on long-term placements for a significant period of time, such as at least 3-6 months, as a requirement of their degree, could be implemented. This would allow for new graduates to at least have some prior industry experience, which could aid them in finding employment.

In order to fully assess the importance of having industry-specific qualifications and prior employment experience in obtaining employment, it would be useful to have a sector-wide survey of software companies to determine the proportion of individuals employed that are:

1) New graduates
2) Individuals with industry-specific qualifications
3) Individuals with prior experience in the sector.

Furthermore, a classification by type of company, for example, by SME and Corporate, would also be useful in determining whether the trends that we have observed are specific to company type. One hypothesis, for example, is that graduates are hired by corporates as they have the time and resources to train them, whereas it is more risky for SMEs to hire new graduates as too many resources would be spent training them. Thus an SME might prefer to hire one experienced individual rather than two inexperienced individuals, as it will be more productive in the longer term.

It is also important to note that the data used in the analysis only surveys graduates 6 months after completion of their degree. Such a time-frame may be too short with regards to giving graduates enough time to find employment. If a survey was taken sometime afterwards, for example a year following completion of their degree, the data may be more representative of the actual situation with regards to graduate employment. It is recommended that the DLHE Survey by HESA that underpins the survey be undertaken at a later time than is currently undertaken.

In summary, although the number of cpSTEM graduates and applicants has been declining since 2004-05, there are still many positive signs for the software industry. cpSTEM graduates are finding is easier to gain employment, and unemployment levels are also dropping. In addition, more cpSTEM graduates are entering the IT Professionals Sector. However, given a decreasing importance in having a degree, and an increase in the importance of having sector specific qualifications and experience, universities must adjust the structure of their degrees to maintain relevance in today's marketplace. Two methods of achieving this could be to implement industry-specific accreditation programs and long-term industry placements as core components of a degree, thus giving new graduates industry-specific skill sets and work-experience before they enter the workforce.

Ian Robertson

Chief Executive, NCGE

This section of Developing the Future 2008 reports the number of computer science graduates and – in a wider context – graduates from all cpSTEM subjects entering the software industry. It suggests declines in the supply of IT and computer science graduates might lead to a skills shortage, but says degrees are demanded less by the software industry now than in 2004. Instead, specialist skills and experience are more highly prized than a relevant degree qualification due to a perceived "risk/quality gap", where graduates fresh out of university are suspected not to have all the skills and qualities they need to meet the demands of a software development role. All this applies not only to 'employability' but also to the future sustainability of the software development sector fuelled by innovation, new business start-ups and a vibrant supply chain of services and skills.

Investments in time, effort and resources made by individual universities through working closely with businesses in this sector to develop curricula that deliver specific, up-to-date technical skills; offering training accredited by industry; and developing the interpersonal, collaborative and entrepreneurial abilities needed in this marketplace can engender more trust in the graduate intake. A higher education institution that actively encourages all this in a coherent way in its staff and students has the hallmarks of an 'entrepreneurial university'.

An entrepreneurial university is characterised by: strong leadership that develops entrepreneurial capacities for all students and staff across its campus; strong ties with external stakeholders that deliver added value; the delivery of entrepreneurial outcomes that make an impact to people and organisations; innovative learning techniques that inspire entrepreneurial action; open boundaries that encourage effective flows of knowledge between organisations; multi-disciplinary approaches to education that mimic real-world experience and focus on solving complex world challenges; and the drive to promote the application of entrepreneurial thinking and leadership. An entrepreneurial university is a place where entrepreneurship is part of the fabric of the institution.

Potential for enterprise and entrepreneurship in the software industry remains undiminished. Graduates are well placed to pursue opportunities building businesses using a mix of technical and entrepreneurial skills. Analysis this year of the FastTrack Tech Track index 100 fastest growing private technology companies on behalf of the NCGE found that 83% were founded and are run by graduates. Developing and maintaining applications and web-services can, in many instances, be much cheaper than other product development or business start-up costs, and there is great scope for creativity and innovation. Worldwide, information technology is tightly integrated into our everyday lives, more people connect with others via the internet, and simple distributed applications across a multitude of platforms provide useful services that bridge cultures and generations.

One implication in this report's figures is that higher education is perceived not to be delivering the mix of relevant skills and experience needed in the software development sector. Embedding entrepreneurship throughout higher education will bring universities closer to industry and build trust in the advantages UK graduates can deliver to software development.

Section 2 Innovation, Entrepreneurship and Investment: Feeding the UK Software Economy

Richard Anton

Council member of the British Venture Capital Association (BVCA) and Chair of the BVCA Venture Capital Committee

As this report states, the UK venture capital market has reached a level of maturity that puts it on a par with other global markets. Venture capital is vital for business growth and development in Europe and the UK specifically. It helps develop scientific ideas and new technologies and turn them into viable businesses. It supports the growth areas of the future, encouraging investment, innovation and enterprise. And, it propels small businesses forward and helps them grow faster; many of which have the potential to become global market leaders. Venture capital also covers a very broad spectrum of activity; ranging from early stage investments from investment levels of around £200,000 up to as much as £10m+.

The UK venture capital community leads Europe with about one third of all venture capital in Europe being invested into UK-based companies. But its lead is narrowing, and many more companies than those being funded today deserve follow-on investment to propel them to leadership on the global stage. And this is the key point. Opportunities to create global leaders from the UK are being missed due to a shortage of capital available to the VC industry itself to invest in these rising UK stars.

Looking at today's fastest-growing technology and software companies in the UK and Europe more widely, most will be backed by venture capital. The UK has always benefited from an exceptional corporate and university research base with a favourable tax regime for entrepreneurs, angel investors, staff and venture capital investors. Consequently, many venture firms active across Europe specifically concentrate their resources in London, which has now attained critical mass as the venture capital finance centre of Europe.

So, to address the "follow-on" investment equity gap, we need to persuade investors to invest more in venture capital funds, and a large part of that is down to long-term, high potential performance delivered over time. Government also has a responsibility, to maintain the right overall taxation and regulatory environment, to remove distortions that hold venture capital back, and to take targeted action to encourage the UK industry to close the gap on the United States.

That said, the US and the UK venture capital markets are closer than many think. The UK is as good at inventing breakthroughs as the US. Its most local market, Europe, has greater online spend, greater mobile usage and greater broadband penetration than the US. In addition, Europe's population is growing faster as it expands eastward and around the Mediterranean rim, giving the UK ready access to lower cost development resource as well as strong consumer and business demand for innovative goods and services. And, through culture, location and time zone the UK is at least as well positioned as the US to leverage export markets in the fast growing new economies in Asia. But we have to remain competitive; a challenge we are up for.

Part 2.01 Innovation in the UK

Part 2.01.1 The UK's innovation environment

Through its strong entrepreneurial backbone coupled with the strong venture capital activity and strengthening public policy, the United Kingdom has remained to be one of the most innovative environments in Europe. With new innovation led public policy and tax reforms on the horizon or currently being implemented, it is the belief that these help strengthen the UK's stance. This section reviews the current innovative climate in the UK and delves into the software industry's opinion of both the climate and government intervention.

Part 2.01.2 Internet penetration in business

Internet penetration in businesses continues to increase in OECD countries. Businesses can develop their own websites or rely on sites managed by third parties. A website can reflect the firm's level of sophistication (or propensity to innovate) in the use of the technology.[14]

"The difference between the UK and the US in their use of technology may be embedded in managerial practices and organisational practices. These practices don't travel as easily as scientific research does. Practices do not travel as well across firms and geographical boundaries as research has been able to."

[14] "Measuring the Information Economy" – OECD 2002 - http://www.oecd.org/dataoecd/16/14/1835738.pdf

"US firms are able to adapt and transfer successfully which may account for their ability to transfer to the UK easily. The process of learning how to use technology effectively may take a bit longer, but is by no means a dead end."[15]

Part 2.01.3 Entrepreneurship in the UK

Through the barometer, it was identified that the UK has the highest level of "Total Early Stage Entrepreneurial Activity" among European countries with a score of 5.6%.[16] It is seen that this activity has been driven primarily by opportunities rather than necessity as is primarily the case in BRIC nations. In all the participating countries in the Global Entrepreneurship Monitor, the UK has the best overall ratio.[17]

The UK is one of the most active countries in entrepreneurial teaching and training and is the leader in best practices of knowledge and technology transfer activities globally.[18] Several organisations for example the Council for Science and Technology, UNICO, National Council for Graduate Entrepreneurship and the Technology Strategy Board are actively promoting the excellent UK science and innovation base which provides the raw material for any entrepreneurial activity. The UK start-ups and spin-outs provide a strong knowledge and technology basis across all industries and are preferred investments targets for international investors and corporates.[19]

Despite these strong arguments the UK does come under criticism for a lack of capacity and ambition and that this is one of the reasons the UK struggles to create international champions.

Part 2.01.4 R&D Companies

In 2000, ICT manufacturing industries accounted for more than a quarter of total manufacturing business R&D expenditure in most OECD countries, and more than half in Finland, Korea and Ireland. During the 1990's, in countries with data for both manufacturing and services industries, ICT-related expenditure on R&D

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[15] Quote taken from interview with Amar Bhidé by Library House on 27/05/2008

[16] London Business School (2007): Global Entrepreneurship Monitor (GEM UK), p.7.

[17] London Business School (2007): Global Entrepreneurship Monitor (GEM UK), p. 10.

[18] Library House (2008): Metrics for the Evaluation of Knowledge Transfer Activities at Universities.

[19] Council for Science and Technology (2008): Corporate venturing in the UK (forthcoming).

generally expanded much more rapidly than in the services industries.[20] European software companies invested £2.4bn in R&D in 2006, 63% more than in the previous 12 months. The UK's Autonomy Corporation was named Europe's best-performing software company, moving up the rankings from 44th to 15th place.[21]

The first official measurement of the value of in-house software development has added £8.3bn to the UK economy. The latest accounts released by the ONS in July 2007 showed a 0.6% increase in 2006 GDP attributable to the long-term economic potential of software developed by corporate IT departments. ONS economic analyst Graeme Chamberlin said that "in-house software development was becoming an increasingly under-reported investment as more firms are developing their own software, especially in financial and business services which accounts for about half of the spending."

The ONS plans to measure R&D as an investment rather than cost over the next two to three years. Private sector R&D expenditure is £12.4bn compared with software spending of £20bn.[22]

The Truffle 100 vendors are relentless innovators and typically invest 15% of their revenues in R&D, which amounted to €3bn in 2006.
Total revenues for the Truffle 100 in 2007 were €26.2bn of which €22bn was in software.[23]

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[20] "Measuring the Information Economy" – OECD 2002 - http://www.oecd.org/dataoecd/16/14/1835738.pdf

[21] "£16bn software industry is key to EU economy" by Janie Davies – from www.computing.co.uk/computing/news/2203906 on 21/11/2007

[22] "IT adds value to UK economy" by Lara Williams – from www.computing.co.uk/computing/news/2193468 on 05/07/2007

[23] The Truffle 100 http://www.truffle100.com/europe/downloads/2007/Truffle100_2007.pdf November 2007

Rank	Company	HQ	Revenues 2006 from Software activity	Total revenues 2006	R&D headcount 2006*
1	SAP	DE	9 400.0	9 400.0	11 801
2	SAGE	UK	1 366.0	1 366.0	2 300
3	DASSAULT SYSTEMES	FR	1 177.5	1 177.5	2 678
4	BUSINESS OBJECTS	FR	994.0	994.0	1 450
5	SOFTWARE AG	DE	471.4	483.0	401
6	MISYS PLC	UK	428.6	855.8	1 678
7	NORTHGATE	UK	334.9	516.0	210
8	DICOM GROUP PLC	UK	321.6	321.6	24
9	VISMA ASA	NO	295.1	295.1	338
10	ISOFT GROUP PLC	UK	266.3	295.9	1 454

Table 1: Truffle Top 10 (Source: The Truffle 100 November 2007)

When companies were questioned as to their projected forecasts for the future, 63% of companies expected the R&D investments to increase, while 55% of companies believed that they would not be increasing their offshore outsourcing. The data also indicates that the UK has the second highest number of companies making the Truffles 100 list with 25, just behind France with 26. Software revenues for the UK are €4.2bn, more than €1bn higher than France's.[24]

UK investment has also benefited from world-class academic talent and an excellent R&D environment. The UK's software sector is one of the most vibrant and fastest growing areas in the economy, characterised by extremely rapid technological change. Numerous UK-based software companies draw on the world-class research and development skills in UK universities, particularly in areas such as parallel computing, artificial intelligence (AI) and multimedia.

Several IT companies have located R&D operations in the UK, taking advantage of established academic and industry linkages in research and innovation. Microsoft located its only European research centre in Cambridge. IBM's software development facility at Hursley is the largest of its kind in Europe.[25]

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[24] The Truffle 100 http://www.truffle100.com/europe/downloads/2007/Truffle100_2007.pdf November 2007

[25] UK Trade & Investment Information Sheet at www.uktradeinvestment.gov.uk

Part 2.01.5 Access to capital

Access to capital is essential to the growth and sustainability of any entrepreneurial society, and one that is as strong as the UK must have both access to private equity and public funds. In regards to private equity, the UK is considered to be Europe's largest and most developed industry - accounting for over 30% of the deals and disclosed deal amounts in European venture capital investments in 2007. This is further discussed within the venture capital section of this report.

Part 2.01.6 Foreign Direct Investments

Since the mid-1980s foreign direct investment has been central to industrial restructuring. Most firms have found the establishment of an affiliate to be a particularly effective way of penetrating markets. In the ICT service sector of computer services (SIC 72), foreign affiliates play a more substantial role. The share of foreign affiliates is relatively high in Belgium and the UK but very low in the US. In large OECD countries, such as the UK, a considerable share of R&D in ICT manufacturing is due to foreign affiliates, a sign that many firms are establishing R&D laboratories outside their home countries.[26]

In 2007/2008, the UK increased the number of FDI projects to 1,573, increasing the total number of projects by 10% since 2006/07. The software industry accounts for 15% of all FDI projects making it the largest sector, apart from that denoted as other. The UK accounted for 28 percent of European inward investment market for software and IT services in 2005/06.

[26] "Measuring the Information Economy" – OECD 2002 - http://www.oecd.org/dataoecd/16/14/1835738.pdf

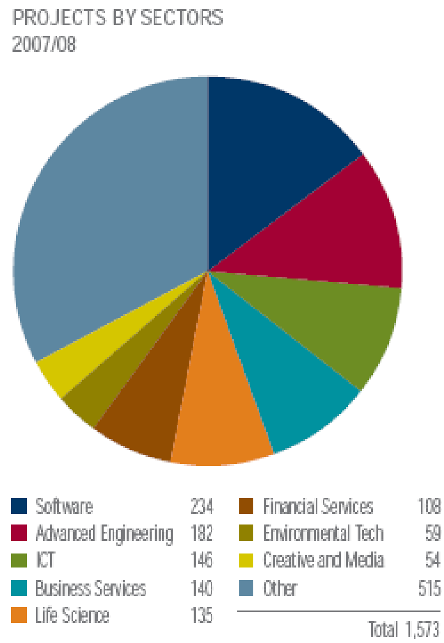

Figure 12 Foreign Direct Investment Projects by Sectors (Source: UKTI 2008)

Part 2.01.7 M&A

As suggested earlier, the decrease in micro enterprise numbers and stable large enterprise numbers and importantly an increase in employment numbers in large companies suggest that the UK is rife in regards to M&A activity. To realise if this trend is commonplace and not just singled to one particular dataset, data from the London Stock Exchange (LSE) was analysed to see if it was an emerging trend. Software companies on the LSE from 1999 to 2007 were analysed to see if they still existed in this current day and it was found that 1/6 of the companies over that time still underwent M&A activity. It was also found through the LSE that a high concentration of firms from 2001 to 2006 underwent massive M&A activity. In line with this trend, it was found when analysing the top 15 software companies from the Truffle Top 100 list, that 60% of the largest firms underwent M&A activity from either other European software companies or those based within the US.

Part 2.01.8 Tax and Legal Environment

The Tax and Legal systems within the UK has both its many advocates and detractors. On the one hand, in the inaugural World Bank "Paying Taxes Report" (2008), the UK was placed 12th within the league table of 178 countries. The majority of western countries were placed lower than the UK, some included

Switzerland (15), Germany (67), US (76) and France (82). It is interesting to note that the majority of the countries that placed within the top ten were countries located within the Middle East.

Another point of praise for the UK Tax and Legal systems is in the recent EVCA report "Benchmarking European Tax and Legal Environments", which ranks countries around the world based upon the tax and legal environment for the development of private equity and venture capital. After being in the number 1 position for 2003 and 2004 the UK had the lowest scoring, meaning that it had a highly favourable tax and legal environment for business, however in 2006 it dropped to third place after Ireland and France.

Table 1: Overview of results 2006, 2004 and 2003

Results for 2006[1]		Results for 2004[2]		Results for 2003[3]	
Country	Total Score	Country	Total Score	Country	Total Score
Ireland	1.27	United Kingdom	1.26	United Kingdom	1.20
France	1.36	Luxembourg	1.49	Ireland	1.58
United Kingdom	1.46	Ireland	1.53	Luxembourg	1.67
Belgium	1.51	Greece	1.75	Netherlands	1.79
Spain	1.52	Netherlands	1.76	Italy	1.96
Greece	1.55	Portugal	1.81	Greece	1.96
Netherlands	1.60	Belgium	1.82	Total Average	2.03

Table 2: EVCA Ranking of Tax and Legal Environment (Source: EVCA)

In opposition to this, the general sentiment held by those interviewed was that the UK Tax and Legal systems had a definite negative effect on the software industry especially in the areas of Capital Gains Tax and current governmental policy and inaction.

Charles Armstrong from start-up Trampoline, interviewed for this report, stated "the recent Capital Gains Tax have had the most significant effect on software companies" and stated that the skill set shortage was also a by-product of less than adequate capital gains tax by "Software requires lashings of talent… and that the greatest and best way to attract the right talent is through options. Capital Gains Taxes means that options are very difficult to organise, and therefore recruitment and retention of good talent is harder too".

It was also said that Capital Gains Tax was not only seen as a hurdle for gaining and keeping skilled individuals within the UK but it is also seen as being responsible for pushing large software corporations out of the UK, "we [UK] just loose businesses as they just move to Switzerland or Canada".

Other criticisms of the government included the opinion that the regulatory and tax environment has become markedly worse over the past 2 years due to a lack of consistency and increased bureaucracy especially within the regulatory and tax environment. Another source of chagrin with the UK government was the insufficient amount of direct investment and the ineffective distribution of the IT procurement funds.

Part 2.01.9 UK initiatives promoting innovation

As of recent times, the government has taken a more proactive approach to funding and supporting start-ups. In particular, the initiative of the R&D tax credit allows SMEs to deduct up to 150% of qualifying expenditure if they are considered to be R&D activities. This initiative is very similar to that of other nations which are very proactive in their support of an entrepreneurial society. There are also many cases of direct investment by government bodies into start-ups, an example of this is a company called Trampoline, where the UK Government recognised Trampoline's pioneering technology with a Research Award in 2004, it was also the first European "Enterprise 2.0" vendor to receive institutional investment.

In addition to these public based funding initiatives, there has been a growth in the public sector interest in the importance of innovation to the economy. It is commonly believed that the driving forces for this renewed interest lies in part to a growing concern over increased competition from the emerging economic powers of China and India, and also the OECD's Lisbon strategy, outlining the desire of OECD economies to become *knowledge economies*. In 2006, around 42% of the UK's jobs were attributable to knowledge-intensive activities, and this is expected to grow to 45% by 2014[27], in line with the European Union's Lisbon Strategy.. The UK is already one of the most knowledge-intensive economies in the world, but this sector must continue to grow in order to prevent over reliance on the manufacturing sector, which cannot compete as effectively with emerging economies.

Part 2.01.10 Corporate Venturing in the UK

Corporate Venturing is the building of new businesses in an established organisation, through one or a combination of the following activities: corporate venture capital, acquisition, minor direct investments and corporate spin-outs.
These corporate activities are mainly focussing on smaller innovation-based companies in high-tech sectors. Corporate venturing will allow larger companies

[27] http://www.workfoundation.com/pressmedia/news/newsarticle.aspx?oItemId=107

to benefit from the entrepreneurial and technological capacities in smaller companies while the spin-outs and start-ups themselves get access to financial and non-financial resources provided by the corporates.

While corporate venturing mainly happens outside any public or governmental initiatives, the UK has developed a beneficial innovation climate for both small companies and corporates.[28]

Part 2.01.11 The Lord Sainsbury Review on Innovation and Science

Though there might have been a renaissance in interest in innovation, there did not seem to be a push in what was considered the right direction. Till now, as stated by many interviewees, there was not a defined step forward for the government. However, the general opinion is that the Sainsbury review, "Race to the top", published in October 2007, cemented the importance of the country's innovative enterprises into the mind of the public sector.

The review made 72 recommendations for changes to policy which would allow the UK to more effectively foster innovation, including the following:

- A more central role for the Technology Strategy Board (TSB), working with the RDA's Research Councils and Government departments in order to co-ordinate innovation, resource management, and access to funds.
- Provide more support for knowledge transfer through the Higher Education Innovation Fund, by setting helpful targets, and by doubling the number of Knowledge Transfer Partnerships (KTP).
- Work to train more STEM teachers with a view to inspiring more young people to take careers in science and engineering.
- Improve procurement activities of Government departments in order to incorporate innovation into the duties of economic regulators.
- Increase the effectiveness of RDAs on science and innovation by encouraging them to focus on TSB programs, KTPs and innovation clusters around research universities.

In March 2008, the Department for Innovation, Universities and Skills (DIUS) published its 96 page "Innovation Nation" white paper, and the 50 page "Implementing the 'Race to the Top'" paper, outlining the Labour government's

[28] Council for Science and Technology (2008): Corporate Venturing in the UK (forthcoming)

acceptance of, and plans for the implementation of all the proposals made in the Sainsbury review. In fact, 20 of these had already been implemented by the time the paper went to press. The Innovation Nation paper states that "Innovation is essential to the UK's future economic prosperity and quality of life. To raise productivity, foster competitive businesses, meet the challenges of globalisation and to live within our environmental and demographic limits, the UK must excel at all types of innovation."

Part 2.01.12 Technology Strategy Board

Another key factor in the push towards a more innovation focussed society has been the revamp of the Technology Strategy Board (TSB). The TSB is an organisation whose aim is to promote technology-enabled innovation in the UK, and support the successful exploitation of the UK's innovation talent commercially.

The TSB is involved in several different activities, including assessing the areas of technology and innovation where the UK should focus, and promoting, supporting, and investing in technology research, development, and commercialisation. The TSB also actively engages with a range of public sector organisations and businesses, along with governmental departments in an advisory role.

The TSB is focused on 5 main mechanisms to drive innovation, Collaborative Research and Development, Knowledge Transfer Networks (KTNs), Knowledge Transfer Partnerships (KTPs), Micro and Nanotechnology Centres, and various International Programmes.

With regards to Collaborative Research and Development, the TSB actively invests in projects involving both business and researchers that involve the development of new technology-based products and services. Since 2004, the TSB has funded over 700 projects, amounting to an investment of over £500 million.

The TSB is also involved in the transfer of knowledge between universities and businesses through the creation of knowledge transfer networks and partnerships. Knowledge transfer networks are a less formal mechanism that allow for interactions between individuals, businesses, universities, and research, finance and technology organizations in a specific field of technology or business application. Knowledge transfer partnerships are a more formal mechanism for facilitating a direct interaction between businesses and universities. In the case of KTPs, a recently qualified individual is placed into a business to work on innovation-based projects, in effect increasing the business interaction with the university knowledge base.

The TSB has also been involved in the creation of Micro and Nanotechnology Centres, which allow open access of the UK Micro and Nanotechnology community to a range of key services and capabilities.

Finally, the TSB is also involved in various international programmes such as EUREKA, a pan-European initiative for promoting Collaborative, Business-led Research and Development. In addition, the TSB is also involved in helping UK businesses participate in the Seventh Framework Programme for Research and Technological Development, which is the main instrument for funding research in Europe by the EU, through the creation of the P7 UK National Contact Point service.

Part 2.01.13 Interviewees view on the UK's science policy

As an aspect of the 2008 DTF, it was essential to gauge the popular perspective of the UK government's current policy. Though it was noted that the UK government has been proactive through new policy steps and initiatives, it was felt by those interviewed that the government has been - and still is - disconnected from the true needs of the software industry.

All those interviewed stated that there is still the disparity between the views on the skills that the government and universities perceive to be essential for the software industry in comparison to the actual skill sets required.

Technological innovation can enable the creation of new products and services which can replace existing technologies or open new markets, while an early market entrance can secure high returns on the capital invested.

Part 2.02 Venture Capital Activity in the UK

Part 2.02.1 Venture backed companies and the venture capital model

Venture Capital (VC) is an important source of financing for fast-growing companies who have the potential to make a global impact. In 2007, over €4.5bn (disclosed deal amount) was invested in over 1,500 companies Europe wide. The greatest share of this, €1.5bn, was received by UK-based companies, over 500 of them in all (see **Figure 13**). Most European governments actively promote these investments either through tax incentives (e.g. Tax Credits for Research and

Development[29], and for Video Games Producers[30] in France) or through their own investment vehicles (e.g. High-Tech Gruenderfonds in Germany[31], which is a collaboration between the German government, KfW Banking Group, BASF, Deutsche Telekom and Siemens).

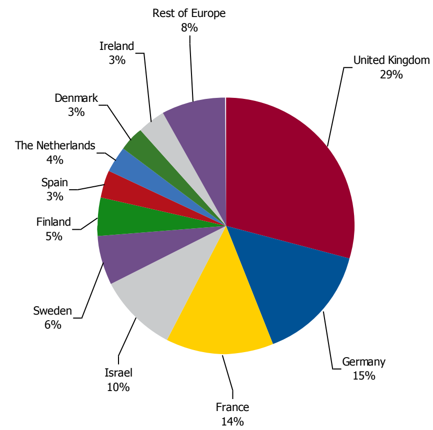

Figure 13 Distribution of number of venture capital deals across Europe (Source: Library House)

Venture capitalists invest in companies that have the potential to succeed in a relatively short time frame, typically five to seven years. A high return from these investments is required by the VC model in order to offset the risk of the investments. This risk arises due to the illiquidity of the investment, as venture capitalists are usually unable to convert their equity into cash without making an exit such as an initial public offering or a trade sale.

Venture capitalists tend to have a preference to invest in technology companies for two important reasons: Firstly, technology companies need venture capital investment because they need a substantial amount of cash upfront in order to develop their technology into a product prior to ultimately generating revenues. Due to the fact that technology companies tend to have little collateral, and often no revenue, it is difficult or impossible for them to finance with debt (i.e. loans).

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[29] http://www.invest-in-france.org/international/en/the-best-research-tax-credit-in-europe.html

[30] http://www.invest-in-france.org/uploads/files-en/08-03-26_163121_Argumentaire_fev_eng.pdf

[31] http://www.high-tech-gruenderfonds.de/htgf/index.php?id=102

Secondly, from the venture capitalist's point of view, such investments make sense because revolutionary or disruptive technologies typically translate into a high return. For example, if such a technology replaces an existing technology and otherwise disrupts the incumbents in the market, then it is likely that the newcomer will take a large market share, resulting in high revenue growth, and eventually a high return for the venture capitalist.

Another factor that attracts investors to the software industry is that technology innovation can create whole new product and service categories where early entrants have the opportunity to achieve spectacular returns.

Part 2.02.2 Venture capital as a proxy to innovation

Whilst around two thirds of R&D spending is done by larger corporations in the UK[32], the importance of smaller innovative businesses in bringing new technologies and ideas to fruition has been widely reported[33]. Also widely agreed upon is the importance of access to finance for these enterprises, the most applicable source often being venture capital[34].

Innovative capacity has been taken as a vital component of an economy's competitiveness since Michael Porter's work on the subject[35,36]. Porter introduced a way of measuring the innovative capacity of an economy by means of a series of input and output measures. Porter considers venture capital to be an "innovation output", and therefore a measurable factor which provides an insight as to the innovative capacity of a particular economy.

It is acknowledged however, that although there are generally other sources of finance, especially in OECD nations, access to venture capital remains important, and can be used as a proxy both to innovative capacity, and to the relative success of an economy[37].

[32] R&D Scoreboard (Page 7) – http://www.innovation.gov.uk/rd_scoreboard/downloads/2007_rd_scoreboard_analysis.pdf

[33] Sainsbury Review – "Race to the Top"

[34] http://www.berr.gov.uk/files/file38273.pdf

[35] The Competitive Advantage of Nations, Porter, M. E. (1990)

[36] http://www.isc.hbs.edu/Innov_9211.pdf

[37] Sainsbury Review – "Race to the Top"

Venture capital can be defined by its investment philosophy, an important pillar of which is its focus on finding innovative companies. As a result, venture capital investments tend to be biased towards these sorts of companies.

Another key pillar of this investment philosophy is a belief in people and in innovation, and the willingness to make high-risk, high-value investments based on those two factors.

For these reasons, venture capital investment can be thought of as a proxy for innovative activity, with a correlation existing between the two. This correlation should hold true so long as the equilibrium between available capital and innovative businesses looking for funding remains approximately even[38].

Part 2.02.3 Venture capital in the UK

Europe has just over 7,630 active venture capital backed companies, the largest group of which are based in the UK (1,768 companies). Out of this UK set, one third (approximately 33.6%, a total of 595 companies) are engaged in software development activities, under the definition described earlier in this report[39].

This section will focus on venture capital as a proxy for both the innovative capacity of the nation's software enterprises, and as an indication of how favourable the UK climate for enterprise is in terms of access to funding.

It is important to note that the Library House data used here in our analysis is entirely based on disclosed deal amounts. Due to the private nature of venture capital, investors are not obligated to disclose details of their investments, and many of them choose not to do so. The disclosure rate across all UK venture capital deals between 2004 and Q3/2008 was about 75%, remaining roughly steady over this period.

Between Q1/2004 and Q3/2008, venture capital-backed companies in the UK have raised just under £5bn in investment through over 1,933 deals, with a further 657 investments of undisclosed amount made. This includes deals with companies that have since exited or gone into liquidation after receiving funding.

As **Figure 14** shows, venture capital investment in the UK has not increased noticeably over the past two years but has rather fluctuated around its current level (except for a an increase in Q1/2008 and subsequent drop in Q2/2008),

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[38] See Professor Amar Bhide – The Venturesome Economy, October 2008

[39] See "Defining Software", Section 2.2

both in terms of the number of deals done, and the amount that has been invested.

Part 2.02.4 The most active investors and important deals in the software industry

In contrast to the trends noted above, the software industry appears to be prone to more significant fluctuations (see **Figure 15**). For example, the level of investment tripled between Q1 and

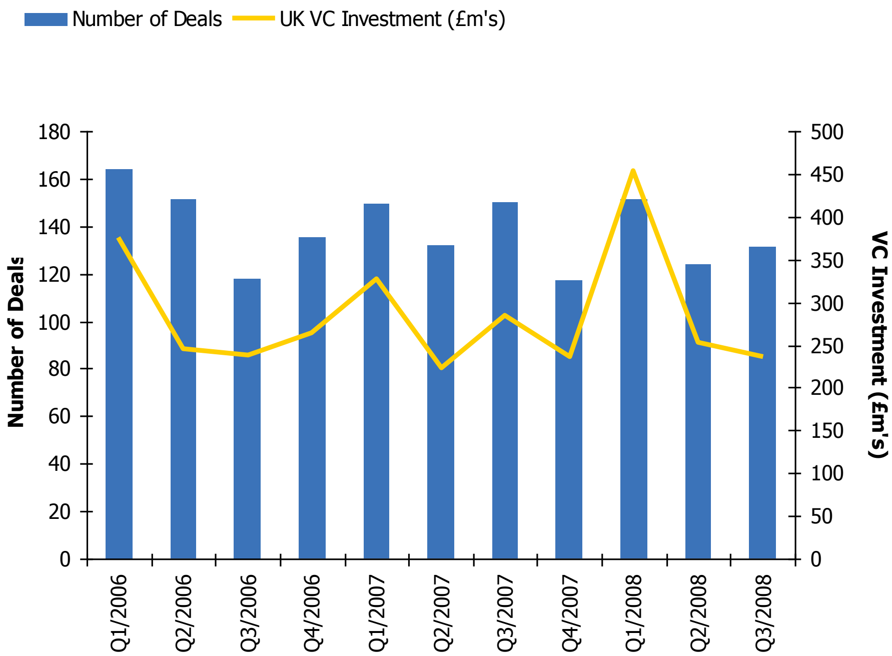

Figure 14: UK Venture Capital Investments from Q1/2006 to Q1/2008 (Source: Library House)

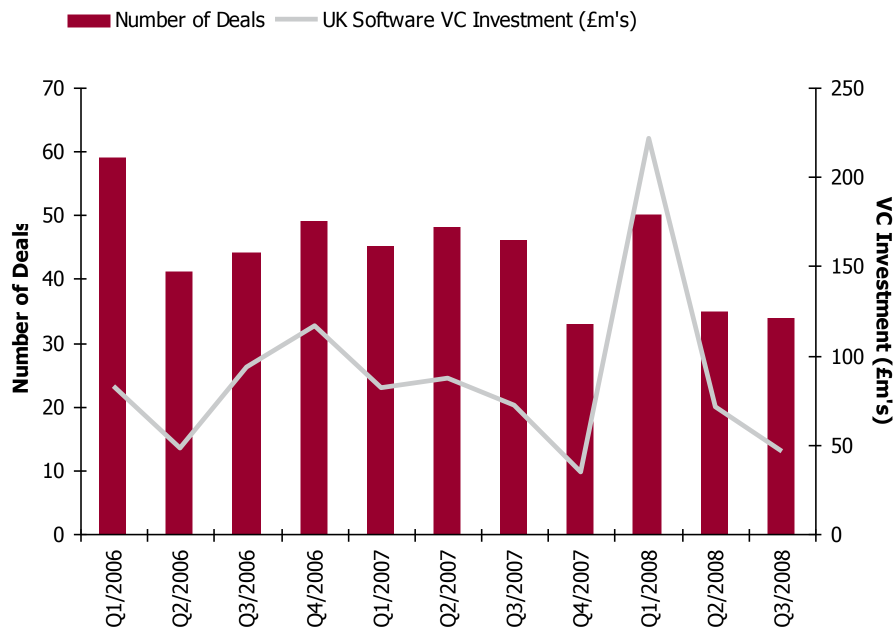

Figure 15: UK Software Venture Capital Investments Q1/2005 to Q1/2008 (Source: Library House)

Q4/2006, then went down by two thirds between Q4/2006 and Q4/2007, before increasing by a factor of 7 by the next quarter (Q1/2008). The high level of investment in Q1 2008 is primarily explained by a significant increase in the number of larger deals in this quarter. This will be discussed in greater depth later in this section of the report.

In order to gain a more complete perception of the UK venture capital industry's software sector, it was necessary to determine which investors were the most active, both in terms of the number of deals made, and in terms of the amount invested, and also to determine which companies have raised the most funds.

Table 3 shows the 15 most active venture capitalists investing in UK software companies in 2007, ranked by the total number of deals they were involved in. In order to gain an insight into each VC's investment behaviour trends, the data was analysed based on whether the investment was the first that was made, or a follow-up to previous investment made by the VC. This analysis revealed that Eden Ventures and Seedcamp were the most active first-time investors in new companies in terms of the number of deals they've made, each having made four deals. Brightstation Ventures invested the largest amount of funding (over three deals) in 2007. Scottish Enterprise and Eden Ventures were the most active follow-up investors by a significant margin in the number of deals made and amount invested respectively.

Given that venture capital funds tend to last five to ten years, with the fund only making its investments in one or two of these years, an analysis of the top investors in any one year may not be representative of the activity of that investor to the industry in general. **Table 4** shows a breakdown of the most active software investors between 2004 and 2007, to provide a more representative analysis over a longer period.

Analysis of **Table 4** shows that the Scottish Enterprise Fund was the most active investor in terms of number of deals made amongst all funds between 2004 and 2007, both in terms of first-time (20 deals), and follow-up investments (37 deals). Balderton Capital was the most active VC in terms of the amount of first time investment (£52.265m), with 3i the most active in terms of follow-up investment (£71.1m).

In terms of the actual venture capital software deals made in UK companies, some of the largest made since 2004 include:

- FX Alliance, who received a first round VC investment of £42m from Technology Crossover Ventures in Q3/2006. FX Alliance develops and runs an online portal which handles foreign exchange trading.
- Codemasters, who received a £30m first round investment from Balderton Capital in Q2/2005. Codemasters is a developer, and to some extent a publisher of video games. The company is one of the oldest UK games developers, and also one of the few which has managed to remain more or less independent.

Most Active Investors Making First Venture Funding Rounds 2007		
Company Name	Number of Deals	Total Syndicated Investment 2007 (£k)
Eden Ventures	4	1,956
Seedcamp	4	154
Balderton Capital	3	1,016
Bright Station Ventures	3	3,296
Ibis Capital	3	1,000
Partnership Investment Finance	3	850
Scottish Enterprise Fund	3	1,030
South West Ventures	3	1,290
South Yorkshire Investment Fund	3	185
The Capital Fund	3	1,222

Most Active Investors Making Follow-up Venture Funding Rounds 2007		
Company Name	Number of Deals	Total Syndicated Investment 2007 (£k)
Scottish Enterprise Fund	10	3,346
North West Equity Fund	5	1,949
Undisclosed Institutional Investors	5	4,959
Braveheart Investment Group	4	1,346
CREATE Partners	4	1,281
Eden Ventures	4	22,582
Amadeus Capital Partners	3	9,160
Balderton Capital	3	15,803
GEIF Ventures	3	1,281
Octopus Ventures	3	5,200

Table 3: Most active Venture Capital Investors into UK software companies in 2007 (Source: Library House)

Most Active Investors Making First Venture Funding Rounds 2004 - 2007		
Company Name	Number of Deals	Total Syndicated Investment 2007 (£k)
Scottish Enterprise Fund	20	9,110
Balderton Capital	14	52,265
Undisclosed Institutional Investors	14	14,373
The Capital Fund	12	3,677
Eden Ventures	9	5,030
North West Equity Fund	9	3,020
Enterprise Ventures Ltd (RisingStars Growth Fund)	8	1,400
Midven	8	4,359
Oxford Technology Management (Oxford Technology VCTs)	8	1,495
Viking Fund	8	925

Most Active Investors Making Follow-up Venture Funding Rounds 2004 -2007		
Company Name	Number of Deals	Total Syndicated Investment 2007 (£k)
Scottish Enterprise Fund	37	9,561
North West Equity Fund	25	5,396
Undisclosed Institutional Investors	25	33,894
Oxford Technology Management (Oxford Technology VCTs)	23	2,665
Quester Capital Management	15	32,481
3i Group	13	71,100
DFJ Esprit	12	43,644
Accel Partners	10	43,695
Foresight Venture Partners	10	12,073
Merseyside Special Investment Fund	10	4,642

Table 4: Most active Venture Capital Investors into UK software companies between 2004 and 2007 (Source: Library House)

- Picsel Technologies, who received a £25m fourth round of venture funding from several Japanese and UK investors in Q4/2006. Picsel develops software to enable media to be more easily streamed to mobile telephones.

As mentioned earlier in this section, Q1/2008 had an exceptional level of VC investment in the UK software industry (see **Figure 15)**. This was primarily because of an increase in the number of large deals in this sector. Examples of these include:

- Spinvox, who received a first round investment of £50.4m ($100m) by Toscafund, Blue Mountain, GLG Partners and the Goldman Sachs Group. Spinvox has developed an automated voicemail-to-text conversion service which automatically sends a transcript of any voicemail received to a predetermined SMS, blog page or email.
- MoneyExpert, who received a 3rd round investment of £25m by Technology Crossover Ventures. MoneyExpert runs a consumer comparison website, focusing on commercial financial products.
- Realtime Worlds, who also received a 3rd round investment of £25m, by CIM, WPP Group, Maverick Capital and New Enterprise Associates. Realtime Worlds is a video games developer with several very successful titles to its name.

Interestingly, of all of the companies involved in the largest deals since 2004, two of them, Codemasters and Realtime Worlds, were videogames developers. This is particularly noteworthy given that both companies are the only two venture-funded videogames developers in the UK, and is consistent with the observation that the majority of videogames companies do not receive venture funding.

Digital media and web companies appear to make up a significant proportion of the largest deals. This is perhaps because they are less cash-intensive than the rest of the population of companies that are venture funded. Supporting this hypothesis is the observation that, of all European trade-sales and IPOs since 2006, venture funded digital media companies have required an average of 22%

less funding in order to reach an exit compared to the venture backed population in general.

Part 2.02.5 The recent decline in venture capital

Figure 15 provides an interesting illustration of just what an exceptional quarter Q1/2008 was for the software industry. Comparing this to **Figure 14**, we can see that a large proportion of the Q1/2008 spike in venture capital investment was attributable to the large software deals mentioned in the previous section.

Since Q2/2008, the number of software deals seems to have stabilised at a lower level than the 2006 and 2007 average - 35 deals in Q2/2008 and 34 deals in Q3/2008 compared to a mean of 46 deals per quarter between Q1/2006 and Q4 2007. It is interesting to observe that the average deal size into software companies seems to have remained on the higher end of normal - £2m in Q2/2008 and 1.3m in Q3/2008 compared to an average over 2006 and 2007 of £1.6m. Q3/2008, whilst slightly below the £1.6m average, is still above the average deal size of Q2/2006 and Q4/2007.

When looking back to the UK's venture capital investments into all sectors, we see again that the number of deals has fallen in Q2/2008 and Q3/2008 when compared to 2006 and 2007 - 124 and 131 deals respectively, compared to a mean of 139.5 between 2006 and 2007. This is not, in itself cause for concern, especially when it is noted that the amount of money invested has remained fairly constant, exceptional Q1/2008 discounted.

Although less software deals have been made in Q2/2008 and Q3/2008, they are generally deals of a reasonable size. This trend holds true for all venture capital funded companies in the UK.

The software VC industry however appears to be well equipped to deal with the credit crunch and resultant economic downturn for several reasons. Firstly, the proportion of all VC investment and deals that involved software companies has remained relatively constant in the past two years (**Figure 15**), despite the fluctuations in absolute deal number and value (**Figure 14**). This suggests that software companies still represent a favourable investment opportunity to VCs.

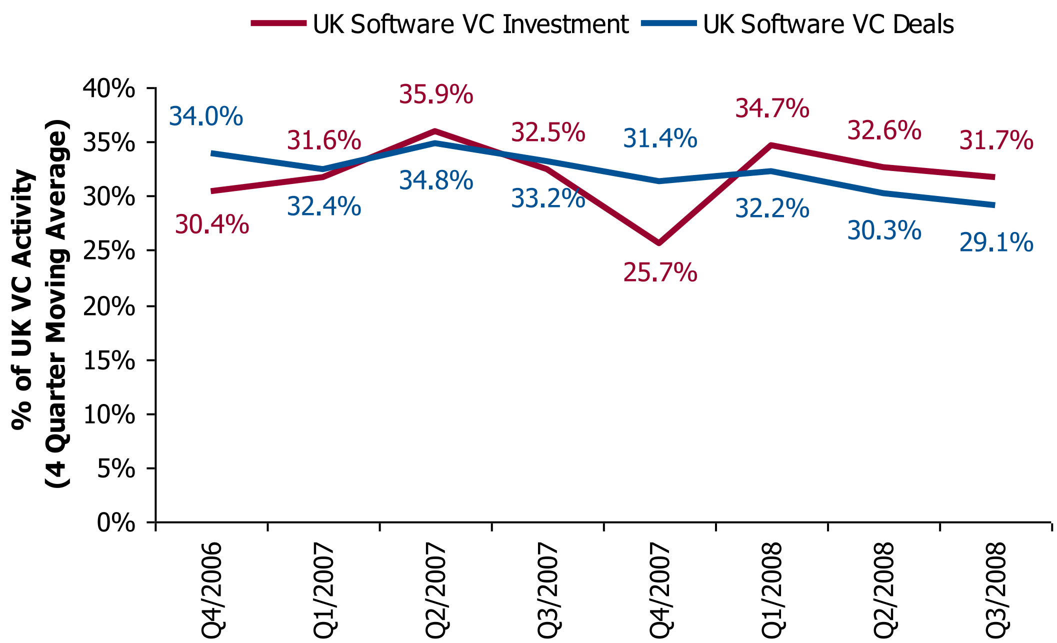

Figure 16: UK venture capital software investments as percentage of overall UK activity (Source: Library House)

Secondly, the software industry is perhaps a more attractive investment opportunity for VCs than other traditionally venture-backed sectors (e.g. Biotech or Cleantech) due to its lower capital requirements, especially for those companies operating online. Thirdly, due to the nature of venture capital, software VC investment is likely to fare better than other private equity deals such as mergers or buy-outs due to the absence of debt components in VC deals. Lastly, venture capitalists have to invest in companies regardless of the economic climate, as they have a pool of cash from which to invest, commonly referred to as a fund, which has already been pledged by the fund's limited partners, and as such, has to be spent. For these reasons, the software industry should retain a large share of what venture capital is invested, with finance remaining available for fledgling software companies with good ideas.

Part 2.03 Regional Distribution of UK VC-Backed Software Companies

We next examined where the software companies that received venture investment are located, to determine if there are any regions in the UK that are particularly active in this respect. A classification of the density of UK VC-backed software companies revealed that the highest density of software companies are found in the Cambridge, London and Edinburgh regions (see **Figure 17**).

Significant clusters of software companies are also located in Northern Ireland, Glasgow, Newcastle, Manchester, Birmingham, and the Oxford-Reading region. With regards to the South East, Cambridge and the South West of London have the highest density of software companies, followed by Bristol and the Birmingham-Oxford-Reading corridor (see **Figure 18**).

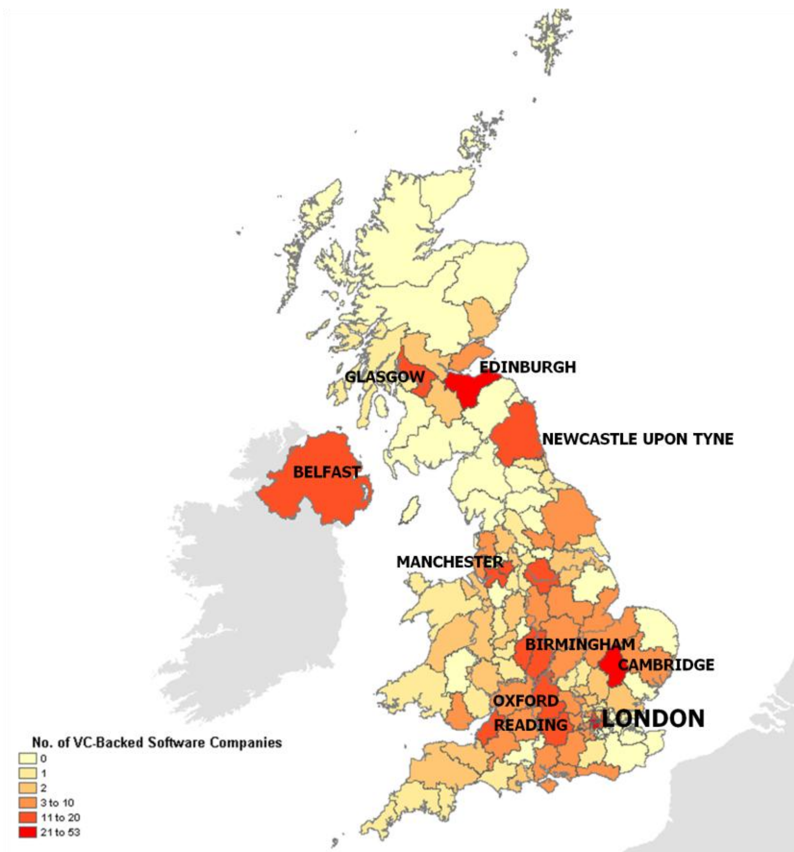

Figure 17: Density of VC-Backed Software Companies in the UK (Source: Library House)

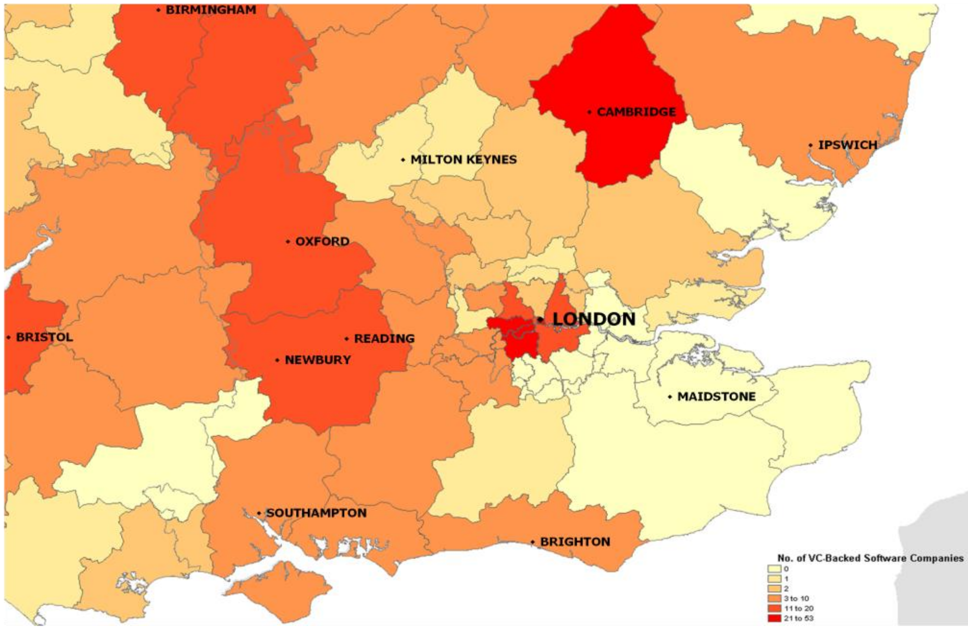

Figure 18: Density of VC-Backed Software Companies in the South East (Source: Library House)

A classification of the number of venture-backed software companies by region (see **Table 5**) reveals that London has the highest number (195), followed by the South East (87) and Scotland (61).

	Software Co's	All Co's	SW as % of Total
Northern Ireland	18	33	54.5%
London	195	430	45.3%
South West	41	109	37.6%
North West	47	136	34.6%
Scotland	61	190	32.1%
South East	87	300	29.0%
North East	17	59	28.8%
West Midlands	36	130	27.7%
Wales	14	55	25.5%
East of England	40	158	25.3%
Yorkshire and the Humber	24	96	25.0%
East Midlands	15	72	20.8%
All UK Regions	**595**	**1768**	**33.7%**

Table 5: Proportion of Venture-Backed Software Companies by Region (Source: Library House)

Interestingly, Northern Ireland had the highest proportion of venture-backed companies that were software companies (54.5%), followed by London (45.3%). Venture-backed software companies in the South East and Scotland made up 32.1% and 29% of all VC-backed companies in these regions respectively.

This suggests that London, the South East and Scotland are particularly important clusters of VC activity in the software industry, with software companies also being particularly important in Northern Ireland relative to its size.

Part 2.03.1 Regional Bias of Public and Private Investors

There are two major classes of VC investors, private, and public (typically governmental or regional public organisations such as RDAs). Of these two classes, private investors dominate the VC software landscape, having been involved in 89% of all deals between 2004 and Q1/2008 (see **Table 6**). Private investors also invest more than public investors, with the average deal size for private investors being 12 times higher than that for public investors.

However, public funds were strong in particular regions in the UK, such as the north. Public investors in regions such as the North East (64% of deals involving public investors), North West (58%), Wales (60%) and the Yorkshire and Humber area (60%) accounted for a significant proportion of all deals. In the Yorkshire and Humber region, only 3 out of the 15 software deals (representing £295k of the £4.4m or 7% of the total amount invested there), came without some sort of public involvement. This is most likely a result of active RDAs in these regions. An examination of the RDA budget by region as shown in **Table 7** reveals that this is indeed the case, with the North West, North East and Yorkshire and Humber regions having the highest, 5th highest and 3rd highest RDA budgets respectively. When normalised by the number of venture-backed companies, then these three regions have the highest RDA budget per company across the UK.

Like the North of England, Scotland also has a large public sector contribution, with a syndicated total of £23m invested with at least one private investor and a further £1m invested solely as public venture investment (see **Table 7**). This data excludes investment from financial awards and research grants, and looks only at venture funding from public sources.

Private investors were particularly active in the south, with London (83% of all software deals), and the East (88%), South East (79%) and South West (69%) regions of the UK being particularly popular. This was also true in terms of the amount invested. For example, in the London region, 94% of the £657m invested into software businesses, or £617m, came from private investors investing without any public involvement. £5.1m came from public sources investing alone, and a further £35m came from public sector investors investing alongside one or more private investors.

	Deals by Public Investors						Syndicated Deals by Public and Private Inverstors						Deals by Private Investors						Total				
Q1 2004 - Q1 2008	# Deals	%	# Deals Disclosed	Aver. Deal Size	Total Deal Amount (£000k)	%	# Deals	%	# Deals Disclosed	Aver. Deal Size	Total Deal Amount (£000k)	%	# Deals	%	# Deals Disclosed	Aver. Deal Size	Total Deal Amount (£000k)	%	# Deals	%	# Deals Disclosed	Aver. Deal Size	Total Deal Amount (£000k)
East Midlands	8	32%	6	215	1290	10%	6	24%	6	692	4150	32%	11	44%	6	1281	7689	59%	25	3%	18	729	13129
East of England	5	8%	4	609	2435	2%	3	5%	3	2407	7221	6%	56	88%	42	2888	121313	93%	64	8%	49	2673	130968
London	22	9%	19	270	5123	1%	22	9%	17	2045	34764	5%	209	83%	148	4167	616667	94%	253	33%	184	3568	656554
North East	16	64%	11	204	2244	16%	6	24%	4	910	3639	26%	3	12%	3	2733	8200	58%	25	3%	18	782	14083
North West	45	58%	37	309	11439	17%	14	18%	13	391	5082	8%	19	24%	9	5655	50891	75%	78	10%	59	1143	67412
Northern Ireland	1	9%	1	387	387	1%	4	36%	3	3267	9800	29%	6	55%	5	4822	24110	70%	11	1%	9	3811	34297
Scotland	9	11%	5	198	990	1%	46	56%	30	770	23086	19%	27	33%	24	4068	97641	80%	82	11%	59	2063	121717
South East	9	10%	8	303	2424	2%	10	11%	8	911	7285	6%	72	79%	55	2189	120399	93%	91	12%	71	1833	130108
South West	11	22%	9	340	3060	2%	5	10%	5	1567	7833	6%	35	69%	24	4694	112646	91%	51	7%	38	3251	123539
Wales	9	60%	7	309	2160	50%	3	20%	2	950	1900	44%	3	20%	2	148	295	7%	15	2%	11	396	4355
West Midlands	23	51%	19	366	6954	15%	11	24%	6	640	3840	8%	11	24%	10	3644	36437	77%	45	6%	35	1349	47231
Yorkshire and the Humbe	15	60%	11	220	2418	47%	7	28%	6	265	1590	31%	3	12%	3	367	1100	22%	25	3%	20	255	5108
Grand Total	173	23%	137	299	40925	3%	137	18%	103	1070	110189	8%	455	59%	331	3617.482	1197386	89%	765	100%	571	2362	1348501

Table 6: Breakdown of public, private and combined venture funding received by UK software companies since by UK region (Source: Library House)

Region	Total Number of Companies	Total Number of Public Listed Companies	Venture-Capital Backed Companies	RDA Budget (£m)	RDA £ per SME	RDA £ per VC-Backed	RDA Budget as % of GVA
North East	133,620	55	58	£282	£2,110	£4,862,069	0.79%
North West	444,150	188	148	£402	£905	£2,716,216	0.38%
Yorkshire and the Humber	349,930	96	100	£310	£886	£3,100,000	0.40%
East Midlands	327,300	47	70	£179	£547	£2,557,143	0.25%
West Midlands	376,315	74	137	£296	£787	£2,160,584	0.35%
East of England	512,455	165	163	£139	£271	£852,761	0.13%
London	757,685	1,054	437	£374	£494	£855,835	0.21%
South East	**740,785**	**291**	**300**	**£166**	£224	£553,333	**0.10%**
South West	417,910	95	108	£162	£388	£1,500,000	0.19%
England	4,060,150	2,065	1,521	**£2,310**	**n/a**	£1,518,738	**n/a**
Rest of UK	618,930	160	282				
United Kingdom	4,679,080	4,290	1,803				

Table 7: Breakdown of RDA Budget by Region (Source: BERR)

	Deals by Public Investors						Syndicated Deals by Public and Private Inverstors						Deals by Private Investors						Total				
Q1 2004 - Q1 2008	# Deals	%	# Deals Disclosed	Aver. Deal Size	Total Deal Amount (£000k)	%	# Deals	%	# Deals Disclosed	Aver. Deal Size	Total Deal Amount (£000k)	%	# Deals	%	# Deals Disclosed	Aver. Deal Size	Total Deal Amount (£000k)	%	# Deals	%	# Deals Disclosed	Aver. Deal Size	Total Deal Amount (£000k)
1	101	28%	81	284	23037	55%	197	55%	128	3219	412087	34%	58	16%	45	662	29775.63	27%	356	46%	254	1830	464900
2	49	25%	39	350	13643	33%	118	59%	85	3215	273304	23%	33	17%	24	1080	25911.12	24%	200	26%	148	2114	312858
3	14	12%	13	242	3149	8%	80	68%	69	4436	306068	25%	24	20%	19	1810	34397.64	31%	118	15%	101	3402	343615
4+	12	12%	7	260	1820	4%	68	67%	54	4127	222847	18%	22	22%	15	1340	20105.03	18%	102	13%	76	3221	244772
Grand Total	176	23%	140	297	41650	100%	463	60%	336	3614	1214306	100%	137	18%	103	1070	110189.4	100%	776	100%	579	2359	1366144.9

Table 8: Breakdown of public, private and combined venture funding received by UK software companies since 2004 by round of venture investment (1st, 2nd, 3rd or 4th+ Round; Source: Library House)

We next determined whether public or private investors have a preference for investing in companies in particular stages of development (i.e. early or late-stage). **Table 8** breaks down the public and private investor data by the stage of the venture funding round. Interestingly, this revealed that public funds tend to invest in early stage companies (i.e. those that have received the first round of funding), whereas private funds tend to invest in later stage companies. For example, only 27% of private funds go into first rounds, compared to 55% of public funds and 34% of investment syndicated with both private and public funds. Conversely, 49% of private funding (approximately £54m out of £111m) goes into businesses in their 3rd or later rounds of venture funding, compared to only 12% of public funding (without syndication with private investors).

Although private investors tend to prefer investing in later stage companies, early stage companies are vital for the development of the UK's innovation landscape, despite their increased risk. There is therefore a public interest in ensuring that early stage ventures receive the funding they require in order to grow to a stage at which they are likely to be picked up by a venture capital fund specialising in later stage investment, or perhaps looking for lower risks. Based on the data outlined above, it seems that public sector funds are doing a good job of supporting early stage software businesses in the UK.[40]

Part 2.03.2 Contribution of the Software Industry to European Venture Capital Activity

The contribution of the UK to European venture capital has always been that of a leading player, though over the last two years its dominance has began to slip. This is not so much a sign of the UK's failure, but more a sign of increased investment activity throughout the rest of the EU. As shown in **Figure 19**, the German and Israeli venture capital industries have become particularly strong. This is perhaps unsurprising given that both these nations have strong public-sector funding programs (e.g. High-Tech Gruenderfonds in Germany[41], and seed funds and other support from the Office of the Chief Scientist in Israel[42]). Israel also has significant amounts of cross-border investment with much of its private venture capital investment coming from the US[43].

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[40] See section 3.1.3

[41] http://www.high-tech-gruenderfonds.de/htgf/index.php?id=102

[42] http://www.iserd.org.il/images/public/Cooperations/ICT/Documents/TheIntellectualCapital3.pdf (see Pages 9-11)

[43] http://www.investinisrael.gov.il/NR/exeres/A19A138D-87A7-416B-8D62-1C968E035E13.htm

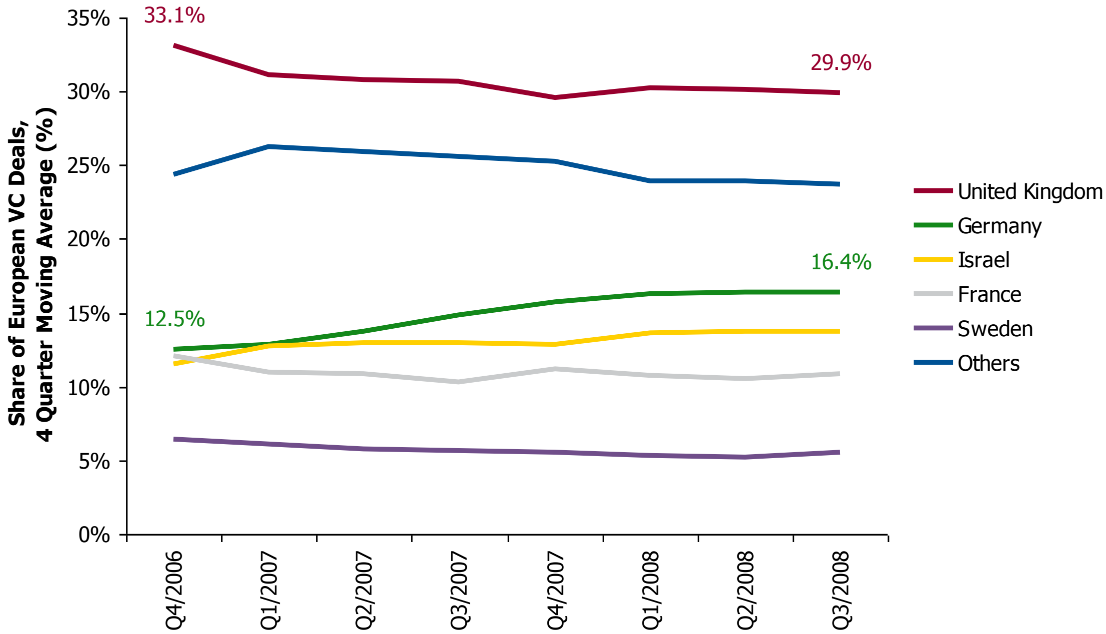

Figure 19: Venture Capital Investment of Various Nations as a Percentage of total EU activity (Source: Library House)

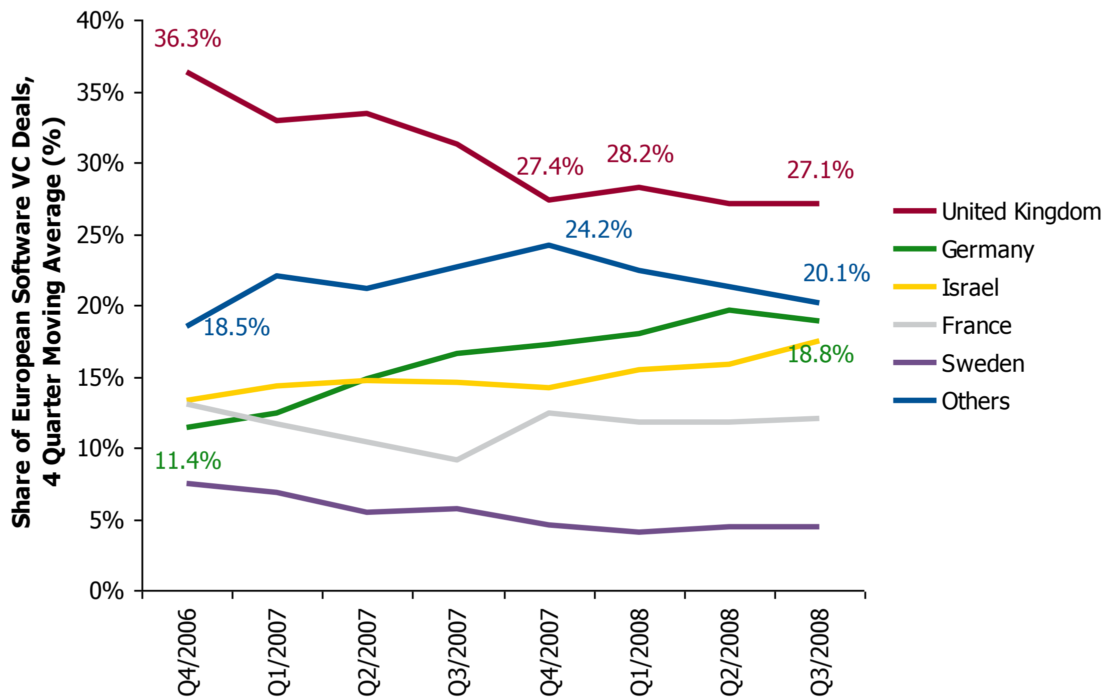

Figure 20: Software Investment of Various Nations as a Percentage of EU total (Source: Library House)

The increasing importance of the German and Israeli venture capital industries is also reflected in the software sector (see **Figure 20**), with the proportion of

European Software VC deals that involved German and Israeli companies increasing by 90% and 53% times respectively between Q4/2006 and Q3/2008 (44 up to 84 in Germany, 39 up to 60 in Israel). In comparison, the proportion of European Software VC deals that involved UK companies decreased by almost a third in the same period, although levels have stabilised in the past two quarters. Importantly, the UK is still involved in the highest proportion of European software VC deals, representing a quarter of all deals, compared to a fifth of all deals for Germany, for example.

However, European software companies seem to becoming a more attractive investment opportunity for VCs than those in the UK, which could be a worrying sign for the UK software companies if this trend continues. Whilst the proportion of UK VC deals involving UK software companies has decreased from around 35% in Q4/2005 to 29% in Q3/2008, German and Israeli VC deals involving software companies now make up 38% and 40% of all VC deals in these countries, up from 24% and 35% respectively in Q4/2005 (see Figure 21). A similar increase was also observed for Ireland, with deals involving software companies making up 51% of all Irish VC deals in Q3/2008 compared to 35% in Q4/2005, setting an impressive trend over the last year.

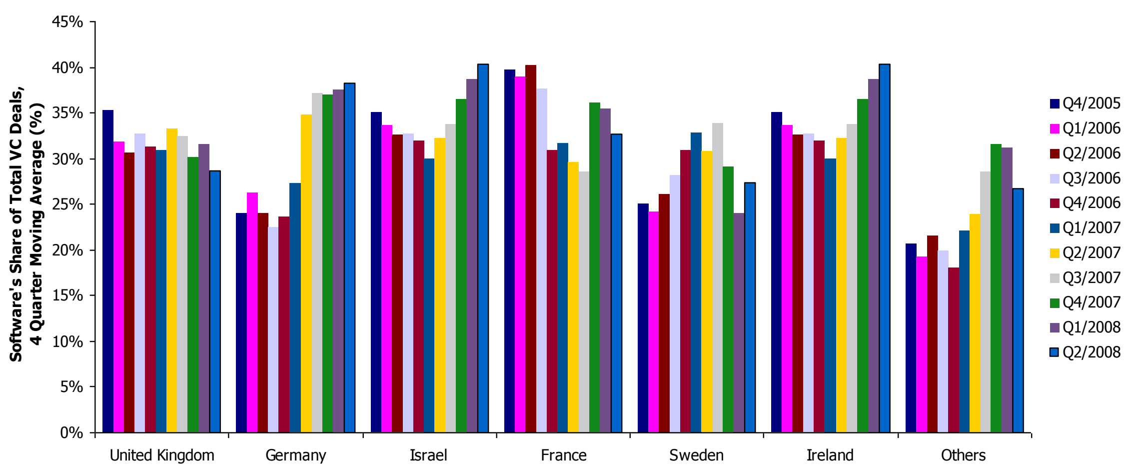

Figure 21: Relative weighting towards software amongst different European nations (Source: Library House)

Taken together, although the UK is still the most important country within Europe with regards to VC activity in the software industry, recent trends indicate that its importance is decreasing. Coupled with the increasing importance of software deals in the total VC activity in countries such as Germany, Israel, and to a lesser extent, Ireland, it is possible that UK software businesses may find it harder to raise finance in an increasingly Euro-focussed venture capital market.

Part 2.04 University Research

Part 2.04.1 University Research

The research that is undertaken at universities is an important source of knowledge that can be transferred to industry. One aspect of this knowledge is the discovery of new technologies that can arise from such research. There are two established methods of developing these new technologies with a view towards commercialisation. These are: the formation of a new company based on the technology created by the university, which is commonly referred to as a spin-out, or the licensing of the technology to an already established company.

Part 2.04.2 Software Spin-Outs

The formation of Spin-Outs in a particular sector can be an important indicator of the general health of that sector, as well as the importance of universities and academic research. We examined spin-out formation in the software sector over time, using our internal Library House database of venture capital funded companies. This is shown in **Figure 22**, and will allow us to determine whether there have been any significant changes in software spin-out formation over time.

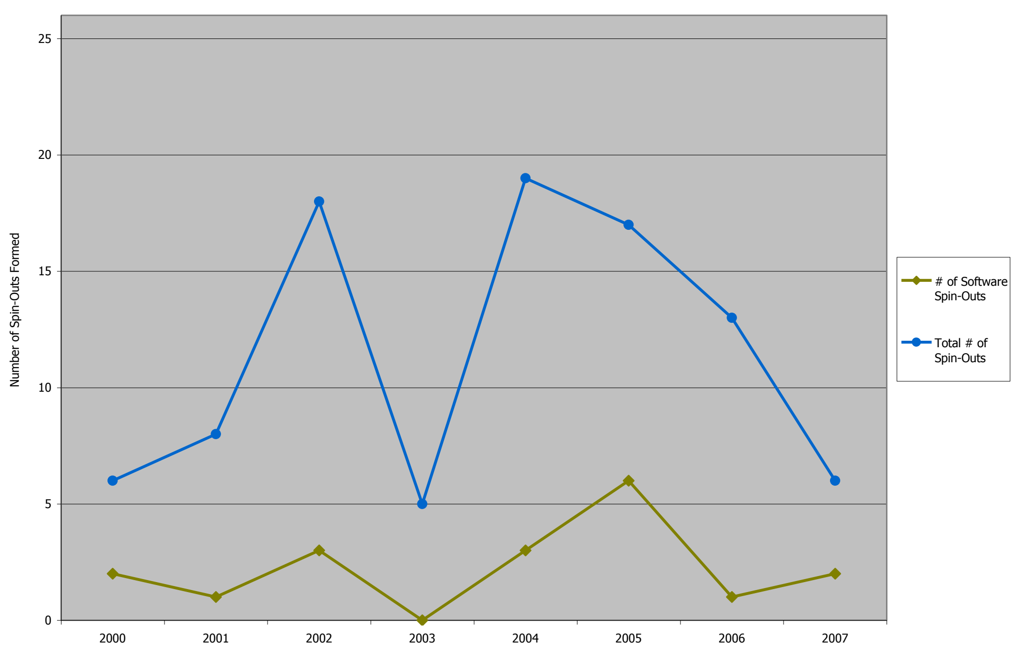

Figure 22 –Number of Venture-backed Software Spin-Outs Formed since 2000 (Source: Library House)

Figure 22 shows that the number of venture-backed software spin-outs formed has not changed significantly between 2000 and 2007. The number of venture-backed software spin-outs formed varied slightly between 2000 and 2002, before dropping in 2003, and then peaking at 6 spin-outs in 2005, before declining to 2 spin-outs in 2007. This trend was generally mirrored in the total number of spin-outs formed (**Figure 22**).

However, the decline in numbers since 2005 could be due to the fact that many spin-outs formed in 2006 and 2007 may not have received venture capital funding yet. Given that it can typically take up to 2 years for a new company to receive funding, it is likely that the actual number of software spin-outs formed in 2006 and 2007 will eventually be venture funded, similar to 2005 levels.

Part 2.04.3 Importance of Software Spin-Outs

In the analysis it was important to consider the importance of software spin-outs were in terms of the total spin-out activity of universities. To address this question, the percentage ratio of the number of venture-backed software spin-outs formed in each year and the total number of venture-backed spin-outs formed was calculated. This is shown in **Figure 23**, and revealed that between 2000 and 2007 the percentage of venture backed spin-outs formed that were software companies was identical between 2000 and 2007 (both 33%), although there was significant variation in these seven years.

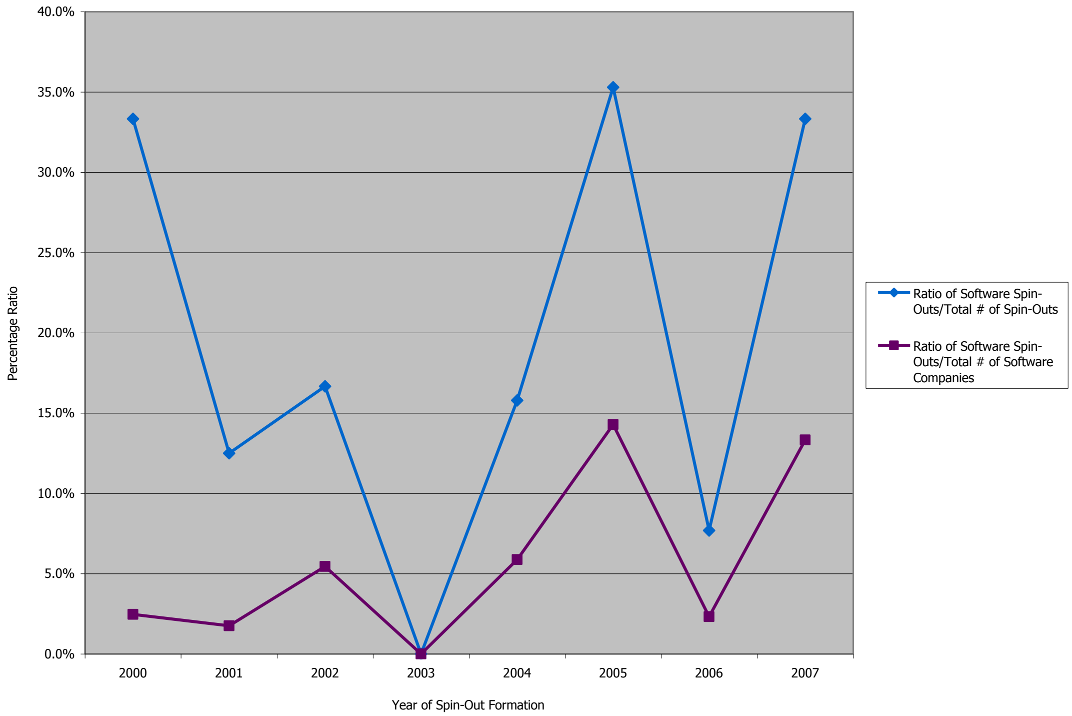

Figure 23: Contribution of Venture-backed Software Spin-Outs to Total Venture-backed Spin-Out Formation and Software Company Formation (Source: Library House)

There was a decline of 20.8% between 2000 and 2001, followed by a 4.2% increase between 2001 and 2002, and a further 16.7% decline between 2002 and 2003. However since 2003, when no software company spin-outs were formed, the percentage of venture-backed software company spin-outs increased significantly by 35.3% up until 2005. Although there was a 27.7% dip between 2005 and 2006, which could be due to the 1-2 year potential lag in companies receiving venture funding, there was a strong recovery of 25.6% between 2006 and 2007, bringing the numbers back to the levels observed in 2000. Given the potential venture funding lag, it is likely that both the 2006 and 2007 numbers will improve over time, which is a positive sign for the software industry.

Taken together, this suggests that since 2003, when the formation of software spin-outs was out of favour, software spin-outs have generally played an increasing importance in spin-out formation in general. Furthermore, the fact that the percentage of spin-outs that are software-oriented is now back to the level seen in 2000 is a further positive sign for the industry.

Part 2.04.4 Importance of Software Spin-Outs to the Software Industry

The analysis suggests that software spin-outs are forming an increasing proportion of the total spin-out activity of universities, what is the importance of these to the software industry. Unlike more research intensive disciplines such as the life sciences, it can be easier to form software companies rather than biotechnology companies which often require more investment (**Part 2.01**)

The next step of the analysis determined the percentage ratio of venture-backed software spin-outs to the total number of venture-backed software companies for each year. This is also shown in **Figure 23** and reveals that, except for a dip in 2003, software spin-outs are also forming a greater proportion of the total number of venture-backed software companies that are formed. Having represented only 2.5% of all venture-backed software companies formed in 2000, spin-outs now represent 13.3% of all venture-backed software companies formed in 2007.

Although the number of venture-backed software companies in 2007 was significantly lower than in 2006 (43 to 15), it should be noted that companies can require 1 to 2 years following their formation to receive venture funding. Thus the full extent of venture funding that will be received by companies founded in 2007 may not be apparent until 2008-09. Nonetheless, calculating the percentage ratio of venture-backed software spin-outs formed to the total number of spin-outs should provide a good estimate of the importance of the software industry in spin-out activity.

Taken together, the analysis suggests that the formation of software spin-outs is becoming more attractive, and if this trend continues, suggests that universities may have an important role to play in the future of the software industry.

Part 2.04.5 Software Licensing

Part 2.04.6 Time-Series Analysis of the Number of Software-only Licences

Licensing is an important method of transferring new technologies from universities to companies. Licensing can also be a quicker means of commercialising new technologies than spin-out formation, due to the established expertise of the licensee company in technology commercialisation, as well as potential synergies with other products in the company. Furthermore, licensing can allow the commercialisation of new technologies that may not be suitable in a spin-out environment, such as those not robust enough to base a company on but still novel enough to potentially generate revenue when developed by an established company. For example, a new technology developed by a university that increases the capacity of hard drives may not be suitable to base a spin-out on, but if licensed to the appropriate company could generate a significant source of revenue for both the university and the company.

In order to examine the importance to the software industry further, a time-series analysis of software licensing using data from the Higher Education-Business and Community Interaction (HE-BCI) Survey published annually by the Higher Education Funding Council for England (HEFCE) was performed. Two main measures are published in the HE-BCI Survey, the number of software-only licences and the income generated from these licences.

The number of software-only licences can be a good indicator of the volume of software-related activity between universities and companies. A time-series analysis of the number of software-only licences from 2002-03 to 2006-07 is shown in **Figure 24**.

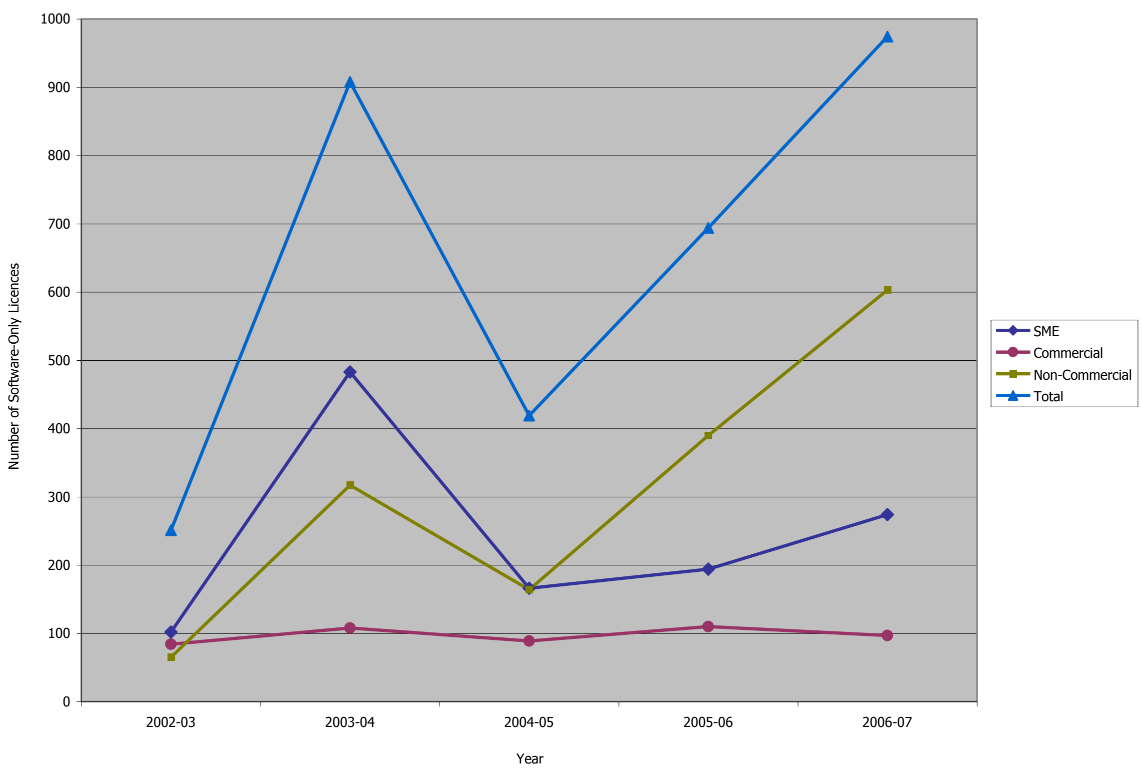

Figure 24: Time-Series Analysis of the Number of Software-Only Licences by Sector (Source: HE-BCI Survey)

This reveals that apart from a dip between 2003-04 and 2004-05, the number of software-only licences has increased significantly from 2002-03 to 2006-07.

Between 2002-03 and 2006-07 there was a 288% increase in the number of software-only licences, from 251 licences in 2002-03, to 974 licences in 2006-07. This suggests that the interaction between universities and companies in the form of licensing has increased over time.

During the analysis it was determined that there are three major sectors that universities can licence their technologies to which are SMEs, Large Commercial Organisations or Non-Commercial Organisations. A breakdown of the number of software-only licences by sector is shown in **Figure 24** and revealed that the initial growth in software-only licences between 2002-03 and 2003-04 was primarily mediated by an increase in licences to SMEs (by a factor of 4.7), and to a lesser extent to Non-Commercial Organisations (by a factor of 4.9). This was also true for the following drop in software-only licence number between 2003-04 and 2004-05 (a 66% drop in software-only licences to SMEs, and a 48% drop to Non-Commercial Organisations).

The subsequent increase following the drop in 2004-05 was primarily mediated by the significant growth in the number of software-only licences to Non-Commercial Organisations (an increase of 267%), and to a lesser extent SMEs (an increase of 65%).

From 2002-03 to 2006-07 there was only a 15% increase in the number of software-only licences to Large Commercial Organisations, compared to a 168% increase to SMEs, and an 827% increase to Non-Commercial Organisations.

Taken together, this suggests that the interactions between universities and companies through licensing has increased significantly since 2002-03, primarily mediated through an increase with Non-Commercial Organisations, and to a lesser extent SMEs. This is an encouraging sign for the software industry as it suggests the volume of software-based research that is being commercialised is increasing. The lack of growth in the number of licenses to Large Commercial Organisations since 2002-03 is however a cause for concern.

Part 2.04.7 Income from Software-only Licences

The income generated from licences is generally considered as a good indicator of the quality and impact of the interaction between Universities and Companies. For example, if a university licences a software-based technology to a company that generates a significant amount of income for the university, then it is likely that this technology has high value and impact, and as such could also generate significant revenues for the company.

Figure 25 shows a time-series analysis of the income from software-only licences from 2002-03 to 2006-07 using data from the HE-BCI Survey.

This shows that income from software-only licences has increased by 19.3% between 2002-03 and 2006-07 (from £3m to £3.6m). This overall increase was characterised by a 28.2% decrease between 2002-03 and 2003-04 (£3m to £2.15m), followed by a stabilisation phase until 2004-05 (£2.15m to £2.3m), and then a 79% increase between 2004-05 and 2005-06 (£2.3m to £4.15m). Although there was a slight decrease of 13.9% between 2005-06 and 2006-07 (£4.15m to £3.58m), it is important to note that the values from 2006-07 are still significantly higher than those of 2002-03.

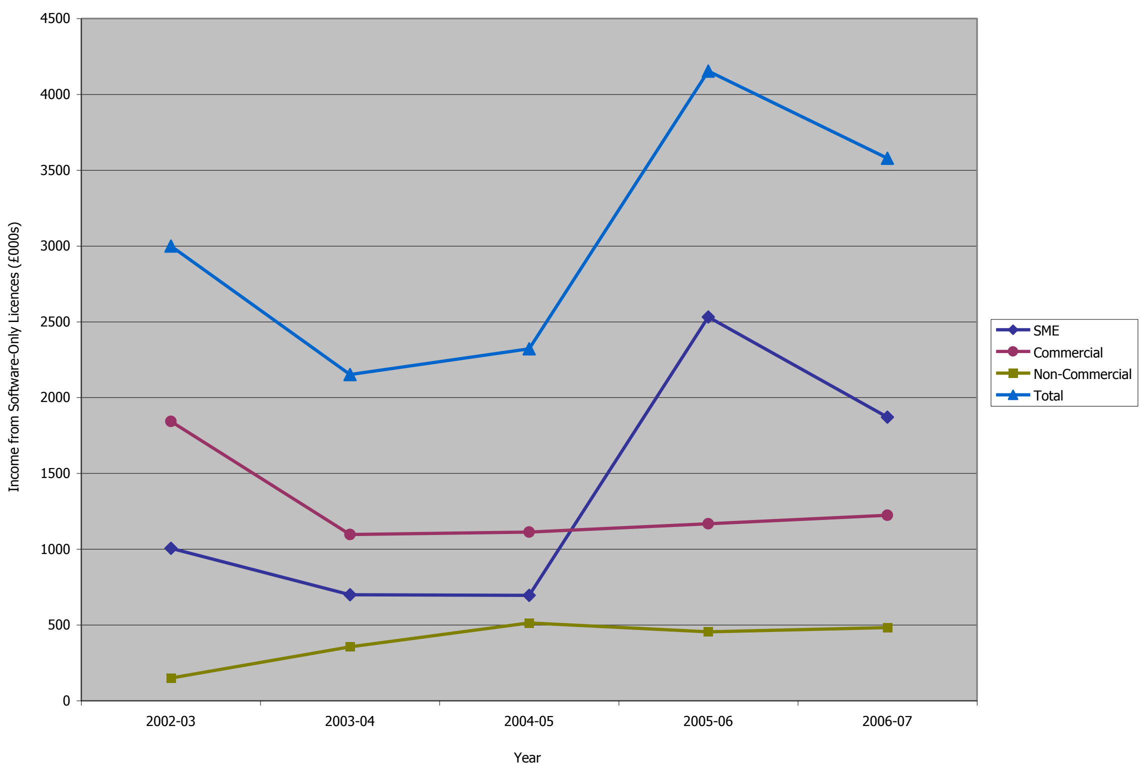

Figure 25: Income from Software-Only Licences by Sector (Source: HE-BCI Survey)

Part 2.04.8 Average Value of Each Software Licence

Although the increase in licensing income over time is an encouraging sign, a calculation of the average values received per software licence (see **Figure 25**) reveals that they have decreased since 2002-03. For example, the average value for each licence to all types of companies decreased by 68.9% between 2002-03 and 2006-07. This was mediated by corresponding decreases across all sectors with a 42.5% decrease in the average value for each software licence to a Large Commercial Organisation, a 31.3% decrease for licences to SMEs, and a 65.2% decrease for licences to Non-Commercial Organisations.

Taken together, this suggests that although the numbers and income from software-only licences have increased over time, the average value of each of these licences has decreased. These observations raise an important question: is it better to have more licences, but of lesser average value, or less licences with a higher average value?

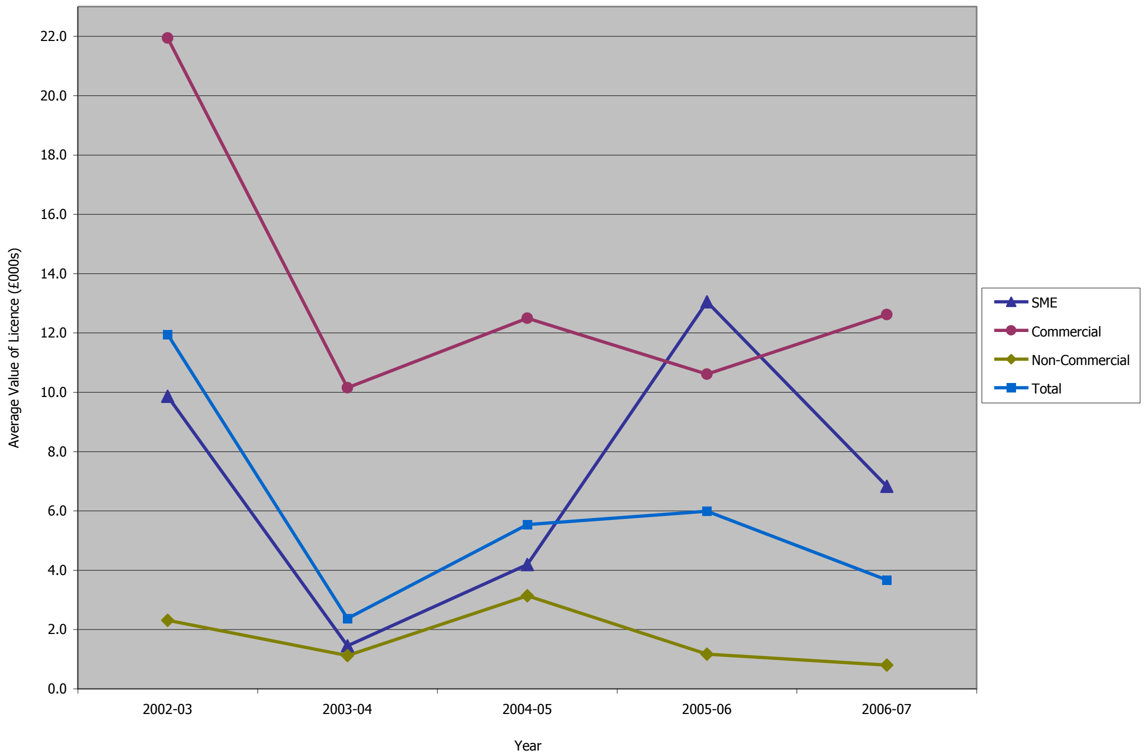

Figure 26: Average Value of Each Software Licence by Sector (Sources: HE-BCI Survey and Library House)

On the surface, it might be better to have more licences but of lower average value because this results in a greater interaction of universities with companies, which is more desirable in a socio-economic sense. However this must be balanced against the potential impact of the technologies that are licensed. For example, a licence with a high value that eventually generates a significant source of revenue for the company that buys the licence is more desirable for that company. In contrary to this, it is also desirable by companies have 10 licences of lower value though impact on the industry is not positive in general.

Part 2.04.9 Importance of Software Licences to the Total Licensing Activities of Universities

To further evaluate the interactions of universities with companies the analysis next determined how important software licences were to the total licensing activities of universities. To that end it was calculated what the percentage ratio of the number of software licences to the total number of licences from 2002-03 to 2006-07, shown in **Figure 27**.

This shows that the percentage of licences that were software-only has decreased slightly since 2002-03, from 33.1% of all licences in 2002-03 to 29.6% of all licences in 2006-07. However, it is important to note that the contribution of software-only licences has increased steadily since a trough in 2004-05, from 20% to 29.6% in 2006-07.

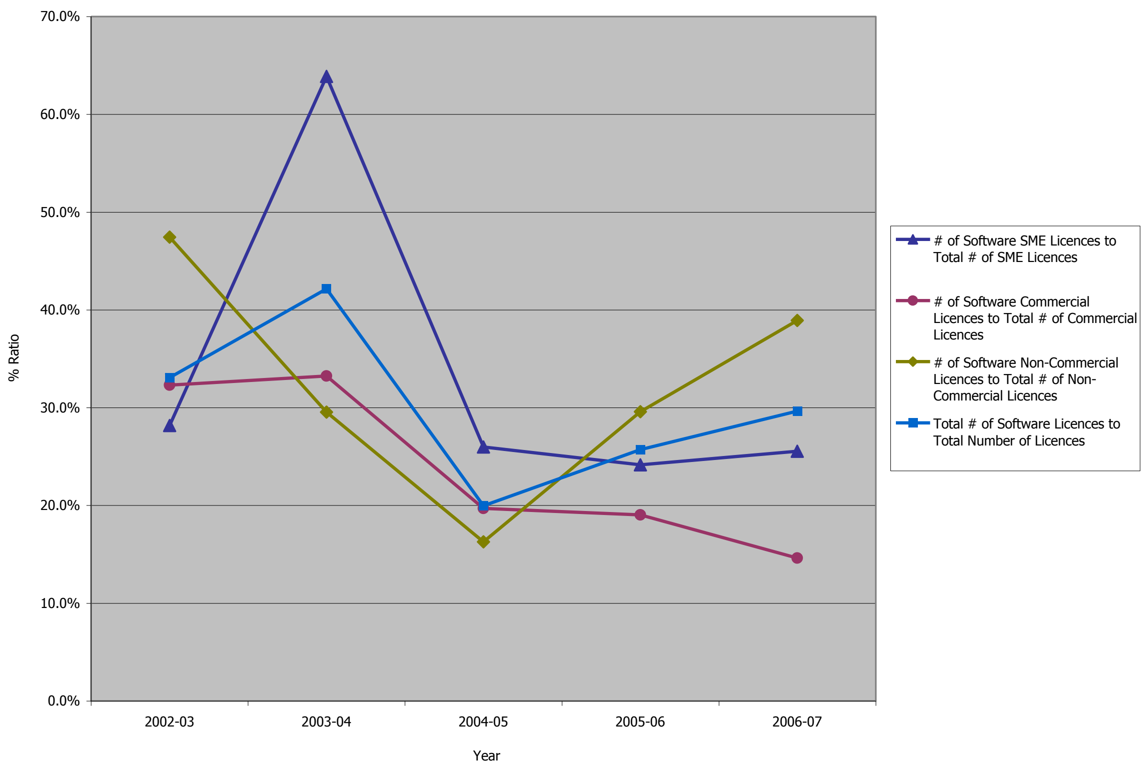

Figure 27: Time-Series Analysis of Percentage Ratio of the Number of Software-Only Licences to the Total Number of Licenses (Sources: HE-BCI Survey and Library House)

In terms of licensing to different types of companies, licensing with SMEs has shown the greatest variation. After a significant increase in the proportion of licences that were software-only between 2002-03 and 2003-04 (from 28.2% to 63.9%), and a subsequent decrease the following year (to 26%), the proportion of licences that were software-only has stabilised around 2002-03 levels (25.5%). The Non-Commercial sector was also volatile, with a decrease in the proportion of licences that were software-based between 2002-03 and 2004-05 (from 47.4% to 16.3%), before a recovery between 2004-05 and 2006-07 (to

38.9%). In contrast, there has been a steady decline in the proportion of licences that are software-based in the commercial sector from 32.3% in 2002-03, to only 14.6% in 2006-07.

Taken together, this suggests that since the dip in 2004-05, software licences are forming a greater proportion of licences in general, primarily due to an increase in the proportion of software licences amongst Non-Commercial Organisations.

On performing a similar analysis with the ratio of software-only licensing income to the total licensing income of universities, (**Figure 28**), it was revealed that software licences generally form a smaller proportion of the total licensing income in 2006-07 than in 2002-03 (11.5% to 8.9%). This has been mediated by drops in all sectors, with software licences contributing a lower proportion of income for the Non-Commercial sector (23% in 2002-03 to 8.6% of all licensing income in 2006-07), Commercial Sector (9.2% to 6.2%), and the SME sector (18.4% to 12.4%).

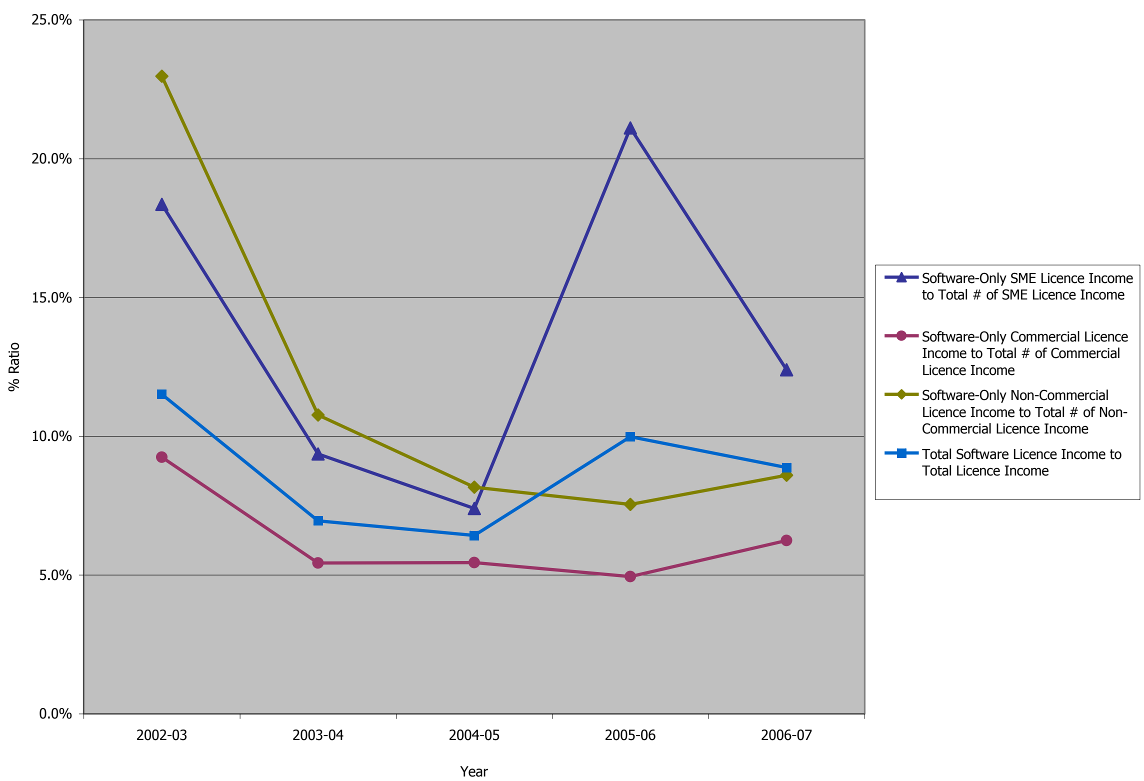

Figure 28: Percentage Ratio of Software-Only Licensing Income to Total Licensing Income (Sources: HE-BCI Survey and Library House)

Taken together, this suggests that software licences are generally important to the total licensing activities of universities, forming around 30% of the licensing number and 9% of the income. Although this is not proportionally representative, this may be likely due to the increased income received from life sciences-based licences which can generate more income for the university.

Part 2.04.10 Conclusions

This analysis suggests that the relationship between universities and companies, at least through licensing and spin-out formation, is in good shape. Following a trough in 2003, the number of venture-backed software spin-outs has increased and is likely to stabilise or increase in the coming years once more data is available, whilst the percentage of spin-outs formed that were software spin-outs has also significantly increased following the low of 2003. This suggests that software spin-outs are having an increased importance in spin-out formation in universities. In addition, software spin-outs are also becoming more important for the software industry in general, having formed an increasing proportion of the software companies formed since 2000.

The state of software licensing is also similarly positive. The numbers and income from software-based licences have increased between 2002-03 and 2006-07, driven by corresponding increases in licensing to the Non-Commercial and SME sector. The stagnation of the contribution of the Commercial sector in terms of licensing however is a cause for concern. Furthermore, although the average value per licence has dropped since 2002-03, this may not be a bad thing due to the heavy increase in the number of licenses, suggesting a greater interaction between universities and companies. In addition, following a dip from 2002-03 to 2004-05, the proportion of licences that are software-based have increased (both income and number), suggesting that software-based licences are once again playing a more important role in the general licensing activities of universities. Taken together, this paints a promising picture for the commercialisation of computer science/software-based research in UK universities.

Section 3 Building on the Strengths: The Growth of the UK Software Economy

Ian Livingstone

Entertainment & Leisure Software Publishers Association

Computer games represent a relatively new entertainment medium; a compelling interactive experience that entertains millions of people around the world. However, video games are often misunderstood. The notion exists that they mostly have violent content. Contrary to the media perception, in 2007 less than 3% of titles released in the market were given an 18 rating accounting for 5% of units sold. More than half the games sold were appropriate for children under seven. In fact quiz and puzzle games are the most popular genres overall.

According to the BBC's State of Play report, 65% of 25-35 year olds play games. Games are no longer a solitary activity; nearly half of all games are played by two or more people together. Professor Kevin Durkin of the Psychology Department of the University of Strathclyde points out that "research dispels the notion that game-play encourages children to become isolated, locked in their rooms for hours with a computer. In fact, most children prefer to play games with their friends or their family." This trend is increasing rapidly with consoles like Nintendo's Wii where we now see grandparents playing Wii Sports with their grandchildren. Games are played by young and old, male and female and have become a part of mainstream culture. There is a wide variety of gaming platforms and a wide variety of content. Content diversity is increasing as more people in society enjoy the pleasure of playing games. Older people are playing Brain Training on their Nintendo DS, interactive exercise is available with Wii Fit, millions of wanna-be rock stars are playing Guitar Hero on their consoles, housewives play premium casual games online, many millions of people are playing free-to-play flash games on their browser, there are hundreds of sports games, puzzle, simulation and strategy games and massively-multiplayer online games for young and old. Club Penguin has millions of children playing fun games with their virtual penguins. Games are a learning tool as gamers learn about puzzle and problem solving, choice and consequence, intuitive learning, management and of course manual dexterity.

Economically, video games are a great asset to the UK. Even without government help, tax breaks or a supportive press, video games today contribute 0.75% to GDP and the industry employs over 22,000 people. What the UK video games industry needs is support rather than criticism. In a very competitive global industry, all is not well in UK studios. There is a skills shortage in the industry that suffers from a lack of computer scientists, mathematicians, artists and animators. The UK is also the most expensive country in the world in which to make video games. There are naturally cheap labour markets in Asia and India and subsidised markets in the West. UK development studios face many challenges and risk becoming at best work-for-hire outfits without IP ownership as they are sold, relocate or go out of business unable to raise working capital. A change in the perception of video games would help to boost the industry eco-system.

Computer and video games is the preferred choice of entertainment of today's youth. Games are fun and exciting, and advances in technology allow different gaming experiences to happen. Greater access to high speed broadband is bringing people together. User generated content, customisation, and personalisation in social network games is creating a joined up gaming world.

Part 3.01 The UK Software Company Landscape

The barometer identified changing trends within the UK software industry landscape based upon ONS data, which shows changes over a 7 year period in the number of software companies in the UK, employment rates and turnover figures.

The breakdown of data within the software industry depicts figures for the number of enterprise groups within the software industry, number of enterprises, number in employment as well as turnover figures for the industry at large. From the available data it is possible to identify changing trends within the UK software industry landscape over the period from 1999 to 2006.

The UK software industry has shown strong growth in the period 1999 to 2006 (latest figures available). Across the industry, turnover has increased by 67%, from £30.20bn to £50.34bn (see **Figure 29**) and employment has grown by 20%, from 358,361 to 430,472, creating 72,111 new jobs in the period (**Figure 30**).

However, the success shown by the industry as a whole is not evenly spread. The gains made by small, medium and large firms have not been mirrored among the "micro" companies, those employing less than 10 people. In this segment the number of companies (**Figure 31**) and number of employees has declined and overall turnover has been stagnant. Micro companies employed 47% of the UK software industry workforce in 1999 but only 32% in 2006. There has been a small recovery in the last two years of the period surveyed, but the overall picture for the micro companies is still clearly negative compared to the rest of the industry.

The data shows clearly that larger companies benefit from economies of scale. UK software companies employing 50 or more staff have an average turnover per employee that is more than 50% higher than those that employ less than 10 (**Figure 31**). This does not however mean that the micro companies are inefficient. In fact, from 1999 to 2006, turnover by employee in the micro segment grew by 22% to £80,387.

What is the reason for the relative decline in the smallest software companies? One possible explanation is an increasing difficulty of recruiting and retaining talent to work in such companies. The larger companies are clearly able to offer more attractive remuneration packages, more secure employment, and clearer career paths. In an environment where the output of university graduates in the relevant STEM subjects is in decline, attracting talent is becoming ever more difficult. The prospect of starting or joining a small software company may also have become less attractive after the dotcom bubble burst in 2001, and the negative perception of a technology career being "uncool" or at risk from jobs shifting to offshore locations could also have been a factor.

With the UK software industry as a whole growing so strongly, should we be concerned about the relative decline in the smallest companies? Maybe this is an industry that is maturing and consolidating, and these trends are all signs of the increasing health of an industry which has been too dependent on less efficient and stable small firms. This argument has some merit, but the strength of the micro segment of the industry is important. The size of this segment reflects the balance between the new companies starting up and those that either go out of business or grow into larger companies. A great deal of innovation also comes from this segment of the market, as evidenced by the new and innovative Web 2.0 companies. Although the micro companies still represent a significant proportion of the industry, if this segment continues to shrink, this must eventually have an impact of the growth of the software industry as a whole, so this is an issue that deserves our attention.

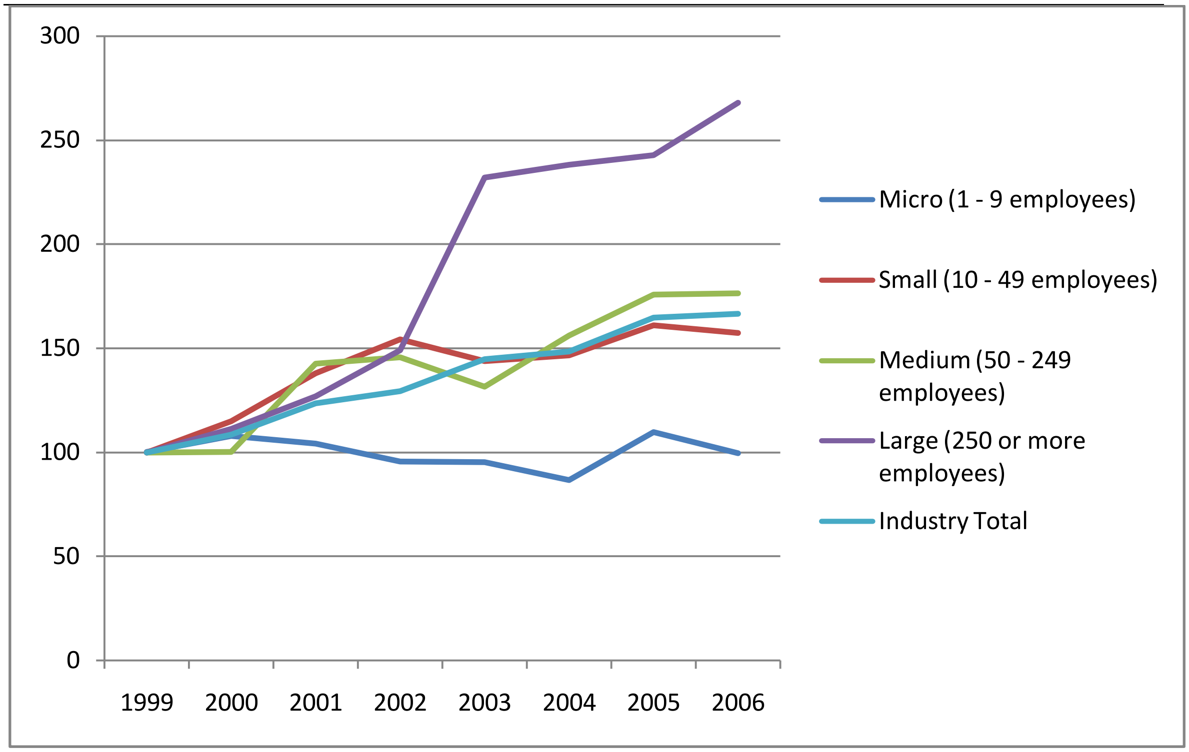

Figure 29: Combined UK Software Industry Turnover, Index 1999=100 (Source: ONS 2008)

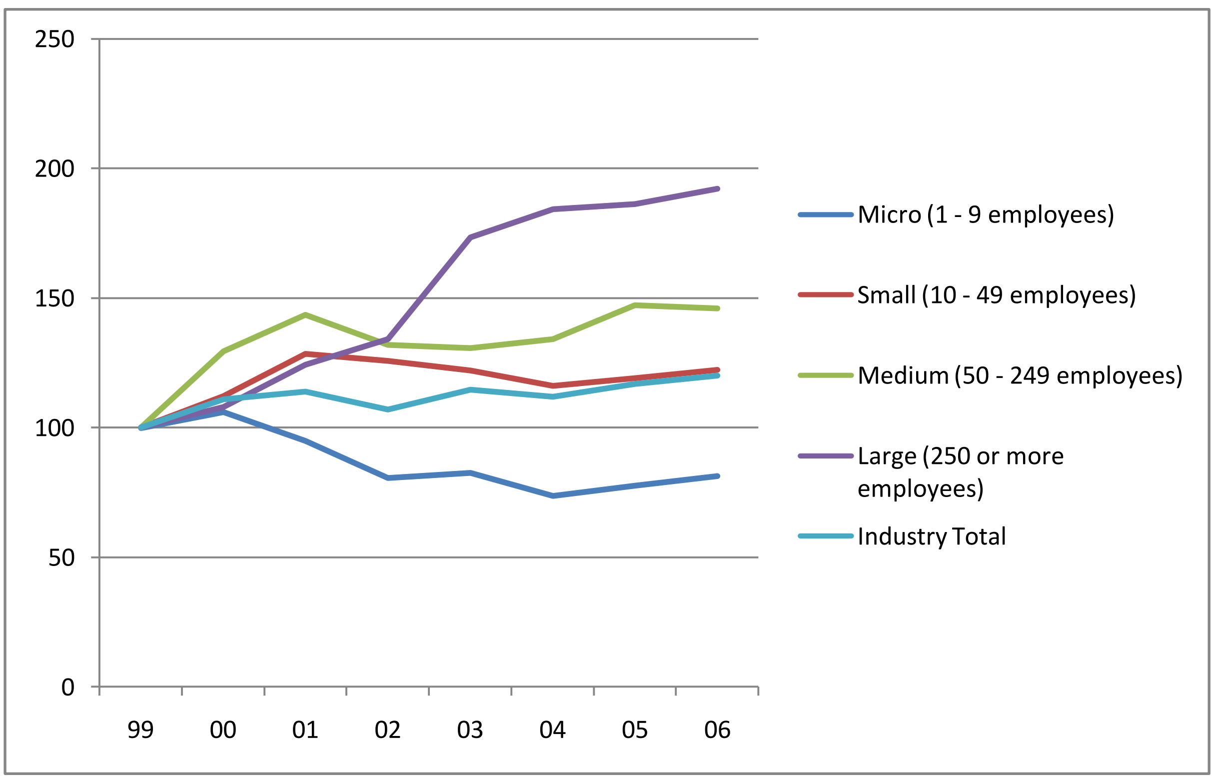

Figure 30: Combined UK Software Industry Employees, Index 1999=1000 (Source ONS 2008)

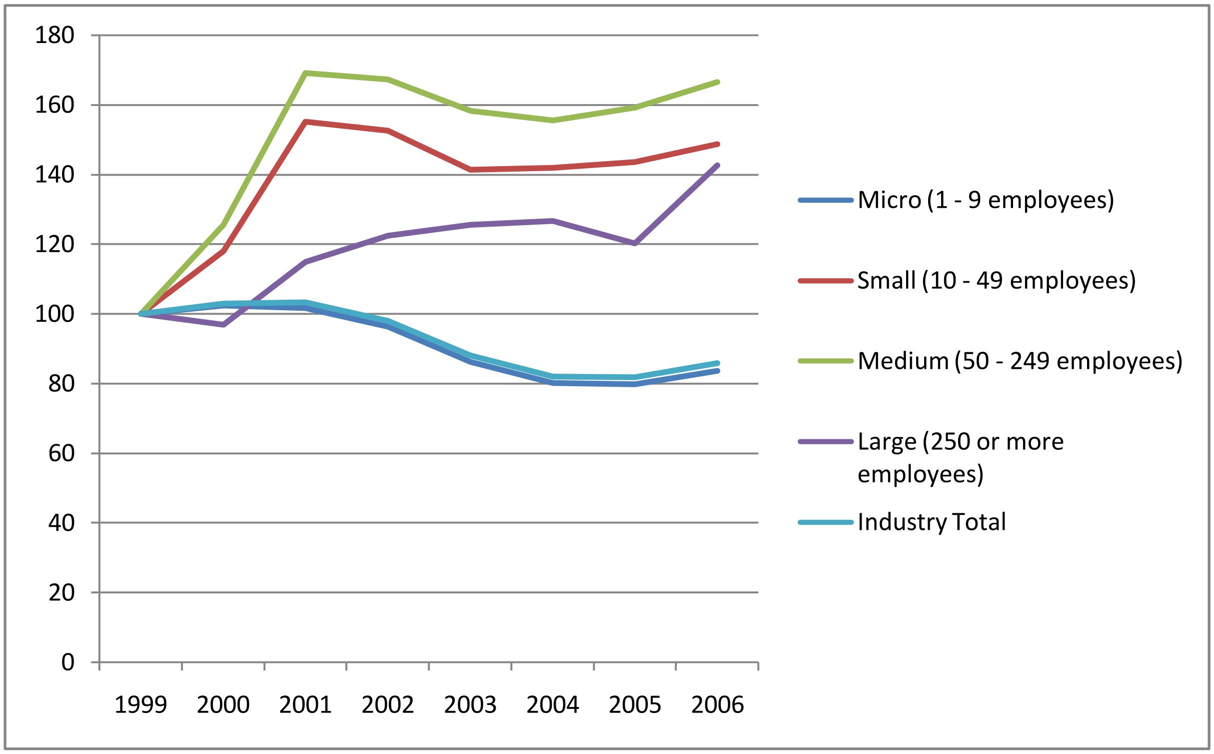

Figure 31: Combined UK Software Industry, Index 1999=100 (Source: ONS 2008) conform pictures

Part 3.02 Outsourcing and Offshoring

Offshoring and outsourcing have the potential to offer many benefits to software companies and the software industry as a whole, but there are challenges that need to be overcome. This section will look into how the use of outsourcing and offshoring is changing, how the software industry will benefit from it and what problems will likely be faced and need to be surmounted.

Numerous reports and articles, including the previous two Developing the Future reports[44] [45], have discussed the issues of outsourcing and offshoring but there remains much doubt, uncertainty and dispute about the growth, scope and effects of these activities. Symptomatic of the uncertainty surrounding this controversial area is that there remains no universal definition for offshoring and outsourcing.

[44]http://download.microsoft.com/documents/UK/developingthefuture/Developing%20_The_Future_07.pdf

[45]http://download.microsoft.com/documents/UK/citizenship/Developing_the%20_Future2006.pdf

Offshoring and outsourcing collectively refer to moving business functions outside of the company's existing operations. For this discussion offshoring will refer to the transfer of a business process to another country (even if it remains within the same company) and outsourcing will refer to a business process being carried out by a different company, regardless of the geography (see **Table 9**).

	Same Company	Different Company
Same Country	Internal Relocation	Outsourcing
Different Country	Offshoring	Outsourcing and Offshoring

Table 9: Offshoring vs. Outsourcing

Progress in technology, facilitating easy and rapid global communication, and lower barriers to trade between nations have seen the use of offshoring increase substantially. In the decade preceding 2004, service offshoring by the UK increased by 35%, with manufacturing offshoring increasing by 54%[46], and recent reports[47] project that the global outsourcing market would continue to grow at a steady pace in 2008, with a forecast growth rate of 8.1%. It is also predicted[48] that the global ICT industry could reach a borderless state by 2015, with companies sourcing services from around the world with no regard to the company's location, driven by rapid IT growth in developing nations.

However, this growth of offshoring is often portrayed in a negative light. A well known figure released by the Forrester Group in 2002 claimed that within the next 15 years, 3.3 million American white-collar service jobs (500,000 in IT) would move offshore, leading to an 'overseas exodus'. A 2004 Forrester Group report (referenced in the 2006 Developing the Future report) stated that Europe would lose 150,000 pure IT jobs by 2015. As will be seen in later sections, these numbers likely do not paint the whole picture.

These negative portrayals are widespread and usually focus on the issue of job losses. This is likely because, regardless of the benefits to the economy that offshoring might provide, there is a cost to the individuals involved. Immediately

[46] Leverhulme Centre for Research on Globalisation and Economic Policy, '*Offshoring and the UK economy'.* 2008

[47] Gartner*, 'Gartner on Outsourcing'*, 2007-2008.

[48] Gartner Press Release, 2008

after offshoring, those whose jobs have been moved will have to seek other employment, but may not have the suitable skills to move into a different, available opening. There may be a period of unemployment, or a requirement to take a lower wage, resulting in a cost to the individual. It is this effect that the media focuses on to paint offshoring in a negative light.

These negative media portrayals result in a corresponding negative public view. A 2006 Deloitte and YouGov survey[49] highlighted that the UK public perceive offshoring to be an increasing threat, with 82% believing enough jobs have moved offshore already, only 4% of respondents supporting the continuation of offshoring and 32% believing UK companies should be forced to bring jobs back to the UK.

Part 3.02.1 Why do software companies offshore?

The traditional and most recognised reason for engaging in offshoring is the ability to tap a pool of similarly trained labour but for a much reduced labour cost (see **Table 10**), a so-called 'labour arbitrage'. This is most significant in services where the human capital is often the highest cost factor. By outsourcing the services the company also doesn't need to spend the time or costs sourcing them each time from the market, or the costs of incorporating the services into its own organisation. Alastair Mitchell, CEO and Co-Founder of Huddle, a London-based start-up developing a web-based collaboration platform, stated that the key drivers for its decision to offshore currently a small aspect of its development process and in the future all of its development work, to an office in the Czech Republic were 'cost, and speed of scaling'. This cost reduction is strongly supported by a survey carried out by Deloitte[50] which showed that, out of its 300 respondents from mid-sized or large companies making use of outsourcing, 83% reported that their projects to outsource IT or BPO functions had met their ROI goals of slightly above 25%.

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[49] http://www.deloitte.com/dtt/press_release/0,1014,sid%253D2834%2526cid%253D137088,00.html

[50] Deloitte, *'Why Settle For Less?, Deloitte Consulting 2008 Outsourcing Report',* 2008

Country	Hourly Wage (€)
Russia	9
China	14
India	7
US	44
Germany	54

Table 10: Average hourly wages of programmers, by country: GEP report and Deutsche Bank Research, 2004

By reducing costs (and as introduced later, increasing sales) through offshoring and outsourcing some software tasks, companies can become more profitable. This will give UK companies who take advantage of these benefits a competitive advantage on a global stage.

There is a further benefit: by outsourcing many of the low-end tasks, the expensive internal team can focus on higher value tasks. This enables the company to more efficiently work at value creation, since the higher value tasks can be targeted at creating more value for the company which the low-end tasks are much poorer at doing. A Freeform Dynamics survey[51] of 202 UK companies on behalf of Microsoft supports this split of outsourced IT tasks, with typically offshored tasks falling in the tail end of the development process, the most likely being coding of applications and software/application testing, while higher value tasks, such as design and architecture, and resource and project management, more likely to be retained internally. This is as it should be since developed countries, such as the UK, have a strong knowledge economy and it is these knowledge-based jobs which will serve as the countries advantage when compared to developing nations, which can leverage a large pool of low-skilled but cheap labour. By balancing these differences and focussing on areas where they have comparative advantages, all countries can benefit.

This process of companies and countries succeeding by focusing on tasks generating high value is in line with the idea of a Venturesome Economy introduced by Amar Bhidé[52]. He proposes that upstream innovations, research

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[51] Jon Collins, Freeform Dynamics, *'IT on the front foot: Sourcing, architecture and the progressive IT organisation'*, March 2008

[52] Amar Bhidé,*The Venturesome Economy: How Innovation Sustains Prosperity in a More Connected World*

and the high-level discovery of new technology, rapidly come to be used across the globe and as such do not provide a large unique benefit for the country that discovered them. More valuable for the discovering country are intermediate-level, downstream innovations involving harnessing the research produced abroad and creating value on top of it. This process requires a large amount of customisation to optimise the technology for the home market, a process which benefits from interactions and a closeness with the consumers and the sales and marketing teams targeting them. This makes these kinds of tasks less suitable for offshoring and shows an area where domestic teams can focus to create the most value.

Central to the idea of the Venturesome Economy is that consumers play a venturesome (or entrepreneurial) role, and that it's their willingness to try new products that drives this intermediate level innovation. The UK software industry therefore greatly benefits from the high level of technology adoption in the UK.
There are other benefits to be had from offshoring and one of the more important of these is access to a broader pool of talent than might be found at home. Limited availability of talent in the home location will act to prevent the company from scaling as rapidly as it might desire, whereas making use of a broader pool of talent will help to ensure its growth isn't limited by resources of labour. This driver for offshoring is supported by interviews with executives at software companies.

Alastair Mitchell raised the ability to scale up a business more rapidly as the other reason it was using offshoring (other than cost). He said that, while Huddle had been able to attract a very high quality of talent in London, the company had chosen to transfer some of its development process to offshored locations because of the 'ease of which [talent] is available and the way in which there is the setup to do it...you can take lots of talent in one go and rapidly scale up'.

Mark Emanuelson of Cisco Systems spoke about the reasons for his company shifting a lot of its development to India: "A lot of early offshoring was built on low-cost labour and arbitrage, but that's just part of the IT story – a new driver is, how do I get more intelligence? – that's the real business driver."

Kristian Segerstrale, CEO and Co-Founder of Playfish, a London-based casual games company, stated that it isn't 'so much about geographic advantages in themselves, it's much more about where you find talented teams that you can work with', referring to the company's offshored software teams in Beijing and Tromsø.

Using independent teams revealed an additional benefit for Playfish in that 'there is a certain advantage with a games company to split your work into different studios because they acquire a different kind of creative identity over time, a different kind of personality, which enables you launch products which have a slightly different personality and target different types of people.'

Part 3.02.2 Is offshoring bad?

There are also downsides and limitations to offshoring: A common misconception is that the total population of the developing countries will be rapidly mobilised to take part in the growth of offshoring, while there are numerous barriers to this. India, despite having a large pool of well educated workers, still has two thirds of its population working in agriculture, and only slightly more than half of its citizens are able to read and write. Additionally, the World Bank's Global Economic Prospects 2008 report shows that while the pace at which technology spreads among countries has increased dramatically over the past two centuries (84 years in the 1800s for a new technology to spread to all developing countries, decreasing to 26 years in the 1950s and 18 years by 1975), this technology does not spread as quickly within countries. In a 2005 World Bank publication[53], India ranked 98 out of 128 countries of an index measuring the ability of a country to create, absorb and diffuse knowledge.

Also worth remembering is that, while labour is generally significantly cheaper in an offshore location, the types of tasks offshored tend to be lower-value roles in the development process; the higher value tasks are more often kept in house. Popular recipients of offshoring, such as India, are able to offer these low value tasks but their ability to offer high-value ones is limited. As the developing countries' IT sectors mature, the range of services offered may increase, but hand-in-hand with this is an increase in costs and salaries; wages in India's IT sector over the previous few years have been increasing on average by 12-15 per cent annually[54]. Simon Williams, CEO of Smith Bayes, states that it has purposely not used offshoring since it is focussed on high-end activities such as product design, usability, and interface, and comparing that level of talent offshore with developed countries 'the total cost is not very different'.

[53] Carl Dahlman and Anuja Utz, WBI Development Studies, The World Bank Institute, '*India and the Knowledge Economy: Leveraging Strengths and Opportunities, Overview*', April 2005

[54] Nasscom Chairman, Lakshmi Narayanan, September 2007

Additionally, in order to get the benefits of the Venturesome Economy introduced earlier, companies in developed countries are encouraged to focus on the intermediate tasks; downstream innovation to customise, and increase the value of, upstream developments. These innovations require input from consumers and sales and marketing teams and as such are not well suited for offshoring.

The earlier reports of the growth of offshoring must also be put in perspective. Despite the 35% and 54% respective growths of manufacturing and service offshore outsourcing in the decade preceding 2004, the 2004 levels only represent 3.9% of service output and 5% of manufacturing output.

In the software sector specifically comprehensive and accurate data regarding offshoring is hard to come by. One way of looking at this is to consider the balance in trade in services being imported into or exported from the UK. This will not be completely accurate since, as was stated previously, offshored services may cost less than the same services carried out domestically but should give a good idea of the overall effect.

The data in **Table 11** shows the countries ranked by the ratio of the amount by monetary value of computer and information services they provide to the UK (offshoring from a UK perspective) to the amount of services they export.

The first thing to be seen from this is that, looking at the numbers for the global total, the UK, despite perceptions of it being heavily dependent on offshoring, exports more than double the amount of computer and information services than it imports. So, while the UK does offshore some of its computer services, it also benefits from the offshoring activities of other countries: Offshoring isn't a one-way street. An example of this mentioned previously in this report is JP Morgan's European Technology Centre, locating its European software development centre in Glasgow which, as of December 2006, was to employ 900 people creating jobs and bringing money into the UK.

However, the ratio of imports to exports of computer services does seem to be growing over time (**Figure 32**), possibly suggesting an increase in offshoring and a decision to focus more on the domestic market.

Table 11 also shows that India, a location commonly held up as a major recipient of offshoring, has the highest ratio of imports to exports: it provides over 6 times the amount, by monetary value, of computer and information services to the UK than it receives. The next highest (of those with disclosed information) is Canada with a ratio of just over one. However, despite this high ratio, India does not dominate as an offshoring location when considering the total size of imports: The US provides over three times as much computer services to the UK than India does, with Germany a close second in terms of services provided. Ireland also beats India, and several other European countries such as France and the Netherlands are not far behind.

Countries	Exports (£m)	Imports (£m)	Ratio of Imports to Exports
India	30	202	6.73
Canada	29	34	1.17
Germany	637	542	0.85
Singapore	24	15	0.63
European Union (EU27)	3,457	1,555	0.45
Global Total	6,489	2,658	0.41
United States	1,505	615	0.41
France	382	155	0.41
Denmark	111	39	0.35
Netherlands	382	112	0.29
South Africa	60	17	0.28
Japan	29	8	0.28
Ireland	1,179	266	0.23

Table 11: Ratio of computer and information service imports to exports into and out of the UK in 2006. Source: The Pink Book: 2007 edition, Office of National Statistics

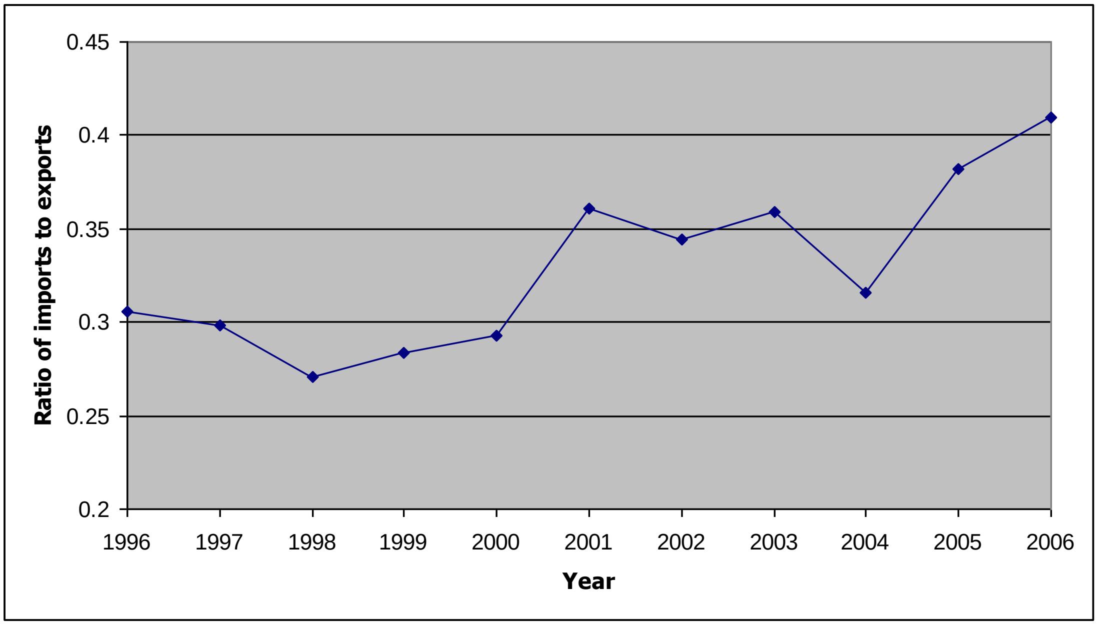

Figure 32: Ratio of global total of computer and information service imports to exports into and out of the UK, 1996-2006

Another potential issue is the hidden costs to offshoring. Earlier stated benefits of offshoring included the savings made in labour costs by offshoring due to the lower average wages in developing countries. However there are additional costs associated which complicate this equation and delay the rewards. In the early stages there are outlays of time and money in setting up the service: the management time spent selecting the most appropriate service provider, or if offshoring but not outsourcing, the work associated in setting up another office in a new geography; the time spent in transitioning internal processes to offshore locations, during which time there may be doubling up of resources as well as the time spent training the new manpower; time and money spent in developing existing company processes to ensure they are ready to interact with, and receive input from, offshore teams; and the cost of laying off existing staff (if necessary) including the payment of retention bonuses to ensure staff remain to impart knowledge during the transition.

Then there are then the costs of managing the offshore process on an ongoing basis: the additional requirements for management, invoicing, auditing, tracking logged time, and quality assurance, amongst others. Andrew Yates, CEO and Co-Founder of Artesian Solutions, stated that his company didn't offshore outsource any of its development process because the overheads were 'massive' and as the company was at a pioneering stage it wasn't practical. He spoke about the difficulties of the management process, saying, 'these kind of resources don't think for you, they just do for you, so typically the relationship is that for two code writers you need one analyst to drive them.'

These costs means that it could be some time before the company sees major cost benefits from offshoring, indeed the overall effect could be negative for the initial setup period. The difficulties and upheaval might also highlight the wrong or inefficient use of resources in the pre-existing model.

Overall however, offshoring can be seen to benefit and strengthen the economy. A recent report from the Leverhulme Centre for Research on Globalisation and Economic Policy (GEP)[55] showed that between 1994 and 2004 offshoring created an extra 100k jobs in Britain and increased the turnover of British firms by GBP 10bn. If these same changes were to occur again, Britain would see a net increase in service employment of 2% and a net increase of output of 2.9%, though there would be seen an average wage drop of 2%. Manufacturing would see a larger increases and no decrease in salary. For the average firm this would translate to an increase of six employees per firm in manufacturing and one in services, as well as sales increases of £600,000 and £237,000 respectively.

Part 3.02.3 Other challenges

As the previous section shows, outsourcing and offshoring are not easy to do and will require time and money to initiate and to keep in operation. However, there are other challenges.

Geographically moving functions to an offshore location has several associated issues. The need for new infrastructure implementation if not already present, increased time and costs associated with organising face-to-face meetings as well as transferring any physical item between the two locations, and difficulties in communication due to time differences which increase as the overlap in conventional work hours decreases are all difficulties which will need to be overcome.

Another challenge associated with offshoring is the global diversity of cultures, especially in how they apply to business. Factors such as attitudes to work, negotiations or processes will all have effects on the success of the offshoring project, but perhaps a larger barrier is that of language. Since communication of

[55] Leverhulme Centre for Research on Globalisation and Economic Policy, '*Offshoring and the UK economy*'. 2008

requirements is key, especially when the project and requirement managers are likely to be in one place and the coders in another, any barriers to this communication will cause serious problems. Even small factors such as misinterpreting slang or colloquialisms may have an effect. Analysis looking at a broad range of UK companies[56], shows that potential offshoring locations would significantly increase their attractiveness to UK companies if their English ability increased to that of English–speaking nations: China, and East European countries such as the Czech Republic, would see their probability of attracting offshoring approximately doubling

Related to these issues is the problem of law and tax codes, such as employment laws and VAT regulations, differing significantly from country to country, again posing problems.

A final, and often overlooked, issue is one of data security; the transmission of personal and confidential information to third parties opens up many more possibilities of lost or compromised data, resulting in loss of consumer confidence and punishment by regulators.

These points, and an additional desire to work with locations for which there are historical ties, have led many companies to move to offshoring locations closer to home, to reduce some of their effects. Offshoring to nearby countries is often termed 'nearshoring'.

This move was shown in the Intellect 2008 Software and IT Services Report[57] where, of its UK-based survey respondents who outsource R&D functions, the percentage who chose Asia as an offshore location for R&D fell from 55% to 44% between 2006 and 2007, with Western Europe seeing a large increase (18% to 28%), and Eastern Europe and North America also increasing. Anecdotally, Alastair Mitchell of Huddle stated that the factors influencing his company's decision to keep its development team nearshore in Czechoslovakia were a combination of 'timezones, language, culture'.

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[56] Leverhulme Centre for Research on Globalisation and Economic Policy, '*Offshoring and the UK economy'.* 2008

[57] Intellect, *'Software and IT Services Report: The Year Ahead'*, May 2008

To give an idea of the current state of offshoring, a Freeform Dynamics survey[58] of 202 UK companies on behalf of Microsoft discovered that four out of five of respondents made use of outsourcing services within the software development lifecycle, ranging between nine tenths of large (10,000 or more employees) companies outsourcing, dropping to two thirds of mid-market (250-1000) companies. Significant factors shown to affect outsourcing uptake were how important to the business IT was viewed and whether it played a tactical or strategic role.

The Deloitte Consulting 2008 Outsourcing Report: Why settle for less?[59] showed that, across a range of geographies, significantly fewer mid-market companies were involved in offshoring of IT or BPO tasks than larger companies and this trend seems to hold true as the companies get smaller. Since SMEs account for 99% of European businesses (ESA) and it is these that are being looked at to grow rapidly it is clear how important it is to the economy that they perform well. The Deloitte report also points out that many of these companies are not achieving the results they should from the use of offshoring, with many respondents reporting some level of company-outsourcer conflict, and many expressed disappointment with the outsourcers' overall ability to provide continuous process and technology improvements. Explaining this, three quarters of service providers in the survey said that client companies were not operationally prepared for the process, not having a good enough understanding of their processes (with little process measurement in place) and how this would have to change with outsourcing. This lack of solid development processes, more likely to be an issue with SMEs, will stop companies making the most of outsourcing.

Andrew Yates of Artesian Solutions also highlighted the difficulties facing software SMEs. He said that for a big company releasing the next version of its software, 'going from version 6 to version 7', writing the specifications might take six months but these could then be broken into sections to be outsourced individually, which would not be possible for an early stage company not sure where it was going. He also said that unlike small companies, larger enterprises have 'all of the various methods and tools in place to check in and check out code and validate it. And [their] QA cycle is properly based – [they] can probably

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[58] Jon Collins, Freeform Dynamics, *'IT on the front foot: Sourcing, architecture and the progressive IT organisation'*, March 2008

[59] Deloitte, *'The Deloitte Consulting 2008 Outsourcing Report: Why settle for less?'*, 2008[59]

QA it for as long as it took [them] to write it'. It was for these reasons that the company had chosen not to outsource any of its development processes.

Nevertheless, offshoring enables small companies to make the first step in becoming international, giving them a foothold and experience in a different geography, and improving their global branding. There are benefits to be had in making this move to international status since reports[60] show that multinational enterprises perform significantly better than their counterparts in areas such as turnover, productivity, export levels, salaries and capital intensity.

A final challenge to offshoring is its bad reputation and association with job losses. The Intellect Software and IT Services report[61] shows a positive swing in the attitude amongst software companies towards globalisation, going from 59% believing it would have a neutral or negative impact in 2006 to 57% believing it had a positive or very positive impact in 2007, but companies do not operate in isolation and so still remain vulnerable to the public and media perceptions of offshoring. If these perceptions cause UK companies to avoid offshoring and the associated move to globalisation then they will miss out on the benefits to be had, and become less competitive as a result.

Part 3.02.4 Conclusions

In conclusion, offshoring and outsourcing have a key role to play in modern economics and can provide benefits to all participants involved. It can result in improvements to the economies of the countries as a whole and improve the bottom line of the individual firms participating, as well as providing them with a wider range of talent and international experience. However, there are challenges that need to be overcome to see these benefits and implementing a programme of offshoring remains a difficult task, especially among smaller companies. Issues such as management overheads and geographical, cultural and legal barriers all provide potential pitfalls to the unprepared. Offshoring done well should be beneficial, but there is the risk of doing it wrong.

Part 3.02.5 Recommendations for government and industry action

There remains much uncertainty on the future of offshoring and its future effects on the UK economy, especially its impact on the software industry. The

[60] Leverhulme Centre for Research on Globalisation and Economic Policy, '*Offshoring and the UK economy'.* 2008

[61] Intellect, *'Software and IT Services Report: The Year Ahead'*, May 2008

government should strive to address this deficit by undertaking an extensive study involving surveys of companies within the sector to ascertain details on the growth and spread of offshoring, its potential long term effects on the industry and the prevailing perceptions of offshoring.

Offshoring is often portrayed in negative light in the media and in public perception, which will be damaging for the UK becoming a truly global economy. Both government and industry have to do more to educate the public on the benefits of globalisation to counteract the sensationalist negative slant often given to it, lest companies and the industry as a whole miss out on the benefits to be had.

Software SMEs have difficulties in implementing offshoring programmes because they often do not have stable development practices, quality control systems or rigid specification processes. This holds many young companies back from seeing the benefits of offshoring. The government should seek to educate its graduates, knowledge workers and small companies in formal development processes and best software engineering practices.

Additional barriers stand in the way to small companies, including cultural and language barriers, legal issues and data security concerns. The government should do more to ensure that children from a young age are educated to take part in a global economy, encouraging and enforcing the teaching of additional foreign languages and also educating them, through schools, on different cultures around the globe. The government should endeavour to compile a knowledge bank on the legal and tax systems from around the world, so that small companies can be better prepared for offshoring, and it should create guidelines and rules on how sensitive data should be handled and how this can be applied to offshoring to reduce potential issues.

Finally, this section has discussed the idea of a Venturesome Economy and how consumers drive intermediate-level innovation. The government and those involved in the software industry should better educate the public in the benefits to them of adopting new technologies, as well as providing the systems and infrastructure, such as high-speed broadband, to enable early adoption. The government should also balance out its support of upstream research and development with support for the companies involved in creating customised value within the domestic market.

Part 3.03 Digital Media

Part 3.03.1 Introduction

Technological innovation has always had an impact upon traditional media, from handwritten documents to the Gutenberg press and now to e-ink displays, from radio to satellite audio and digital high definition broadcasts. In today's digital age, the speed at which technology is changing has affected the media industry faster than ever before. Digital media or Mediatech[62] is omnipresent in everyday life, from Google to Wikipedia searches for knowledge acquisition, to BBC iPlayer to YouTube for entertainment and from Bebo to Facebook for social interaction. Mediatech has opened plethora of avenues which form a manifold of opportunities and challenges for any business.

Part 3.03.2 Defining Mediatech

In order to look at Mediatech companies within the software industry Mediatech companies must be defined. As the data source for this analysis originates from Library House, their Mediatech definition is used as a base definition. The Library House definition defines Mediatech companies as those that are involved in supplying content, services, and directly-enabling technologies for video, music, games, entertainment, publishing, search, and community. At the time of the authoring of this report, Library House was tracking nearly 2,500 companies worldwide that meet the Mediatech definition. As the definition alludes to, Mediatech companies are split into two primary sectors: content and service providers, and enablers – as shown in **Figure 33** below.

[62] In this section, digital media will be defined as that used by Library House (defined within this section)

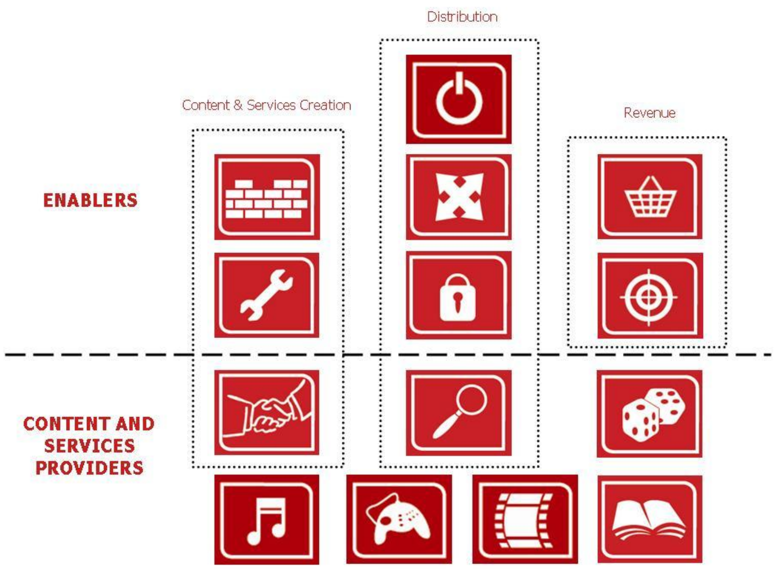


Figure 33: Mediatech sectors (source: Library House)

Content providers are companies which create the content to which consumers read, watch, play, or listen. Service providers make that content available to consumers. For example, it is content provision when a studio films a television series; but service provision when iTunes sells a downloadable episode of that TV series. Library House divides content and service providers into seven sub-sectors according to the type of content involved, for example video, games, or music and audio.

Enablers are companies whose products or services directly assist content and service provision. A product or service that a consumer uses to view or listen to content is a direct enabler, as are products and services used by content and service providers themselves. It is of interest to note that Library House's definition of Mediatech excludes indirectly-enabling technologies. Two hypothetical examples of companies which would fall outside our definition for this reason are: a company which designs semiconductors used in video games consoles; and a company which has developed a radio access technology for wireless broadband.

The seven enablers sub-sectors may be grouped into three functional categories: revenue, which includes both content retailers as well as companies within the advertising ecosystem; distribution, which consists of companies whose technologies aid content discovery and distribution, as well as manufacturers of devices used to view or play content; and content and service creation, which includes providers of tools and platforms used to make content and operate content services.

Two categories of content and service providers - community & sharing and search & directory – also play a role as enablers. Search & directory services such as Google lead users onwards to other content and services, and so play a role in distribution. Community & sharing services are platforms for user-generated content, and as such are enablers of content and service creation.

Part 3.03.3 Current Landscape

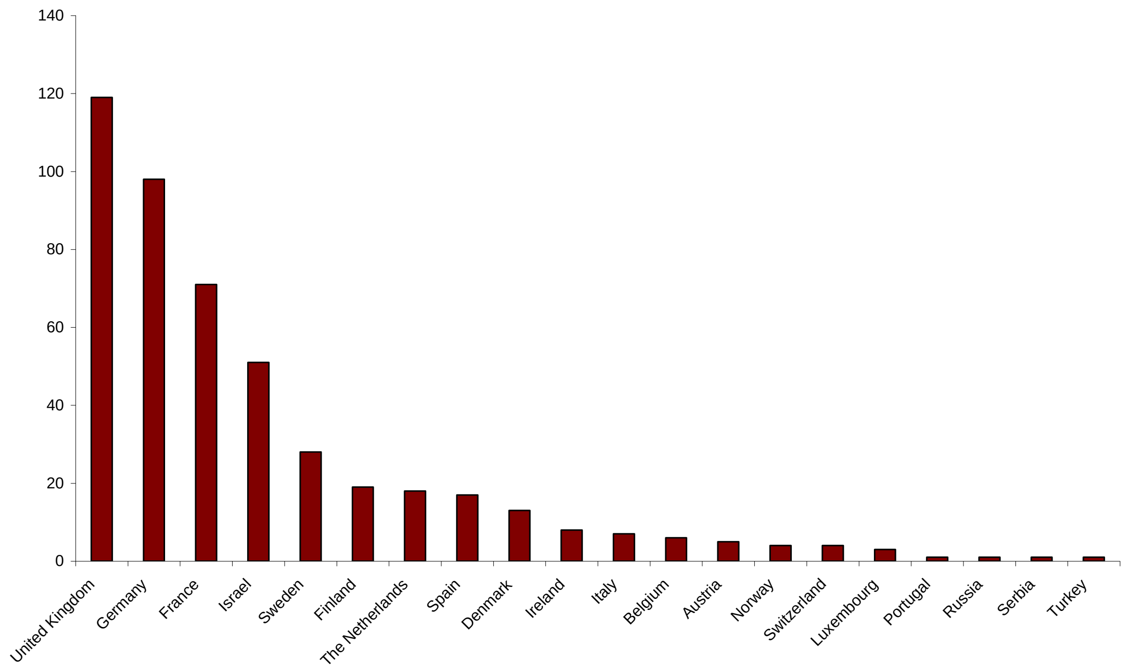


Figure 34: Composition of all 475 European Venture-backed Mediatech companies (Source: Library House)

Using the definition above, the Library House data was used to analyse the number of venture backed[63] Mediatech companies within the UK Software industry. The European Mediatech companies and the previously identified software companies were compared. It was found that of the 2,207 software companies identified, 475 were venture backed European Mediatech companies with the UK having the highest concentration of these type of companies, making up 25% of the entire landscape, as shown in **Figure 34**.

[63] As previously reported within this report, venture backed companies are used as a proxy for company innovation. The best venture capitalists seek out investments that challenge markets – high-risk strategies that shake up incumbents and whose success offers correspondingly high returns.

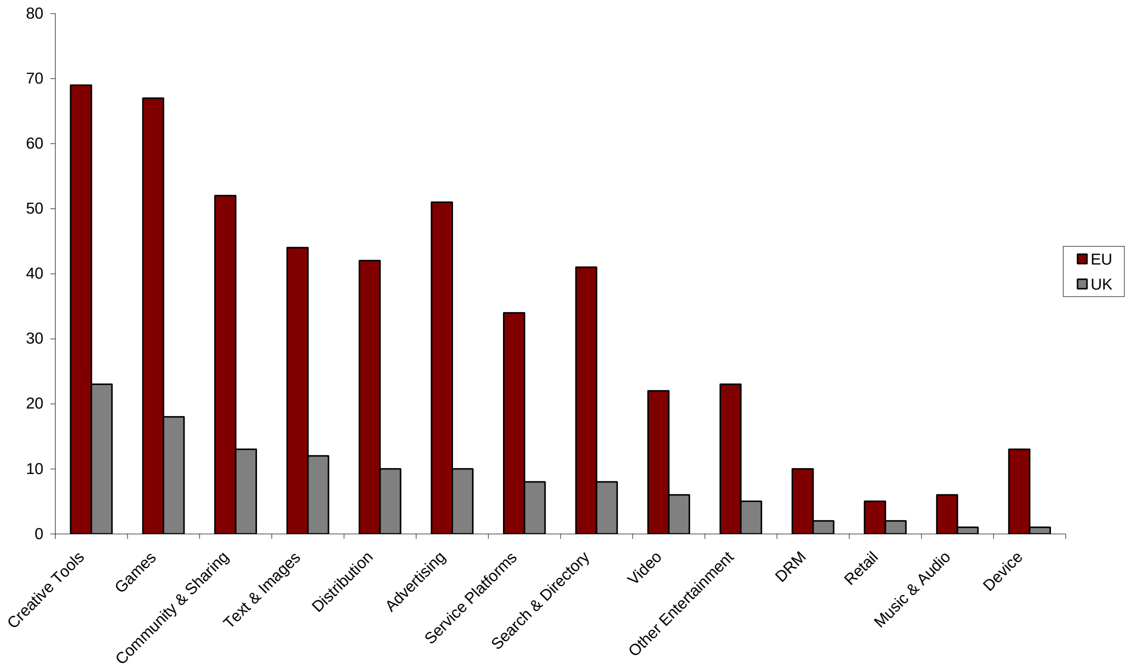


Figure 35: Dispersion of EU vs. UK venture backed Mediatech companies (Source: Library House)

In accordance with the Mediatech definition, the UK companies were divided into the sub-sectors and it was found that 19% of all the companies belonged to the Creative Tools sub-sector followed closely by Games. In **Figure 35** the dispersion of the UK Mediatech venture backed companies versus the EU venture backed companies is depicted. It can be seen that in general the UK follows the EU trends in sub-sector proliferation, however it can be seen that the UK does not have as strong an onus on Advertising, Search & Directory and Device related MediaTech companies.

As discussed previously in the venture capital section of this report, the software industry has seen a slight slow-down in investment which has translated across to the number of deals with UK based Mediatech deals. Though the impact is low at this time, it will be interesting to if the venture capital community keeps to this trend due to the extreme cautiousness shown lately in the Library House Quarterly briefing.

Part 3.03.4 Drivers

As MediaTech is relies on consumer interaction and branding to provide forms of revenue, it is essential that not only should their media be engaging but also be accessible to all potential customers. As with all traditional companies, MediaTech companies require some form of distribution channel. The primary form of distribution for MediaTech companies – especially those within the UK software industry – is internet-centric. It is essential to not only see how the community embraces the internet but also the level of penetration and growth of the internet infrastructure.

Though the internet penetration throughout the UK has always been relatively high – over 50% since 2002 – the proportion of broadband penetration has in comparison been quite low. This is shown clearly by the data from the OFCM report (2008) illustrated in **Figure 36**. As can be seen, since 2002, broadband penetration has grown substantially over the past 6 years, increasing from less than 5% to over 50%. This suggests that with the growth of this overall penetration, there will be more of an audience for the higher bitrate intensive MediaTech offerings. At the same time, ownership of PCs is rising at the same rate as all internet connections.

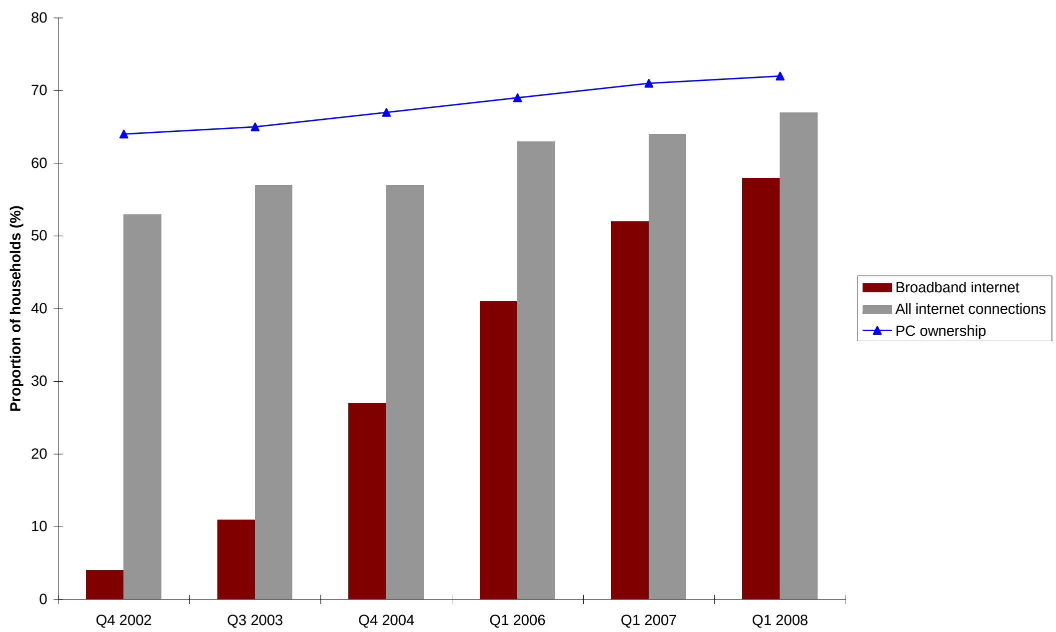


Figure 36: Proportion of internet penetration and home pc ownership (Source: Library House based on Ofcom data)

In analysis of the data in the 2008 ONS report, "Internet Access 2007", it was found that seven of the twenty ONS classifications of internet usage were found to encompass the majority of the MediaTech companies, as shown in **Figure 37**. Note that the areas which are denoted as MediaTech activities are not exclusive and in reality maybe encompassed in some of the "Regular Internet Usage" activities.

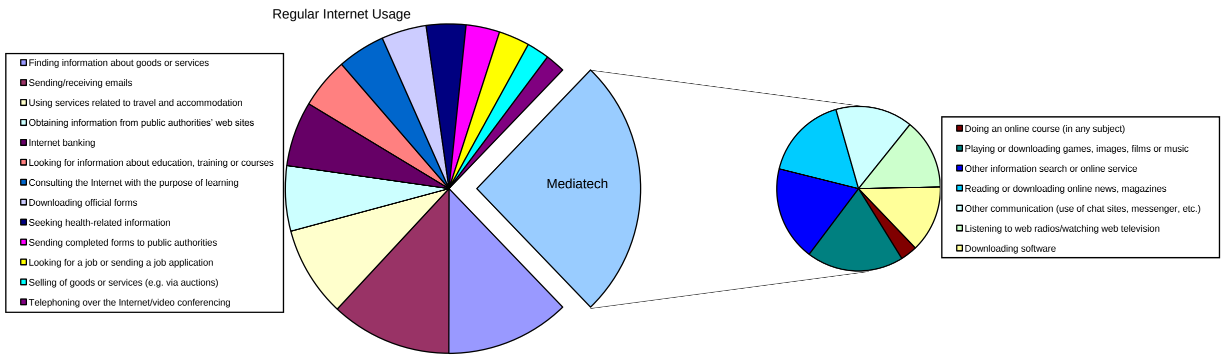


Figure 37: Internet activities 2007 (Source: Library House utilising ONS data)

Part 3.03.5 Last.fm

Though the UK has had limited international success stories in the realms of MediaTech, none of them however has been as impressive as the fairytale story of Last.fm. What started off as a university project and a number of developers sleeping in tents on a nearby roof has become one of the internet's largest and most visited radio stations and music community environments.

Technically, Last.fm started in the late 20th century, and it was not until the founders started working closely with Richard Jones in 2002, that Last.fm became the entity we know it as today. Richard Jones created the Audioscrobbler plug-in and API as a university project, whilst still at the University of Southampton. Audioscrobbler allows the collection of artists and titles listened to by the users, and through data analysis looks at other users who had similar listening styles and then would make suggestions or allow suggestions to be made by friends, and hence brings together the community and music aspects together, whilst allowing the user to expand their music portfolio.

In the early days of the company, funding was scarce due to the overall wariness of VC's in investing in companies after the dotcom bubble burst. However in 2003, Last.fm started seeing limited funding from two rounds of business angels, but however in August of 2006 received its first round of venture capital funding from UK based investor, Index Ventures who invested £2m. With this investment and the business acumen brought in by Index Ventures – Index ventures have been responsible for a large number of internet success stories including Skype and CommQuest – led to the 2007 trade sale of Last.fm to CBS for £140m, making it the largest UK Mediatech sale at that time.

Part 3.04 Video Games

Part 3.04.1 History, background, introduction

In the late 1970's, the availability and affordability of platforms such as the Sinclair ZX Spectrum, the BBC Micro and the Commodore 64 encouraged the early adoption of home computers in the UK. Games initially arose on these platforms as the work of bedroom programmers in a hobbyist setting, but as the medium became more popular, the first commercial developers of games for home computers began to emerge. UK developers began to achieve some prominence in the late 1980's, notable examples being Acornsoft (Elite, Magic Mushrooms) and 4Mation (Granny's Garden).

Through the 1990s, UK developers continued to enjoy a prominent position, responsible for some of the world's most popular titles, as well as the commercially successful. Developers such as Codemasters (Operation Flashpoint, Sensible Soccer), Psygnosis (Lemmings, Wipeout), Eidos (Tomb Raider, Hitman) and DMC (Grand Theft Auto) have all served to redefine the boundaries constantly, and in doing so helped to form the modern day perception of games and gaming. This section aims to examine where the UK stands now as a producer and publisher of video games and to see what more can be done in order to ensure the continued growth of this important section of the software industry.

Part 3.04.2 Current Situation

Ian Livingstone, founder of publishers Eidos PLC and spokesman for the Entertainment and Leisure Software Publishers Association (ELSPA) - the trade body for UK video games publishers - describes the UK as having been a global leader in video games for 25 years, thanks in part to Clive Sinclair, who made affordable computers available to the masses in the late 1970s. However, the consensus of Mr Livingstone and other veterans of the games industry is that whilst Britain is still at the forefront of games development, this is no longer a national competitive strength as it once was. Video games currently account for 0.75% of the UK's GDP. 75.9m units were sold in the UK in 2007, up 16% from 2006. The UK market was worth 1.72bn in 2007, and this figure is up 26% on 2006. [64]

[64] ELSPA performance figures 2007

In order to understand the problems facing games developers and publishers, it is necessary to take a closer look at what goes into the production of a successful game. The requirements have changed greatly since the 1970s, but a flawed image seems to prevail of games being produced by, as Livingstone put it, “two blokes in a garage”.

Whilst this was once fairly accurate, it is no longer the case, as a brief look into the development of any currently successful title will demonstrate: Grand Theft Auto IV (or “GTA4”), released April 29th 2008, lived up to expectations that it would break existing records for videogames sales. The development of the game required a team of over 100 people, and took four years and tens of millions of pounds to complete, development costs which are orders of magnitude greater than those of the early 1970s pioneers. The rewards are, however, also far greater. The title is the most recent in a series which has been popular since its debut in 1997, and it sold 3.6m copies on its first day of release, growing to a total of 6m after seven days. It took in $500m of sales revenue in that record-breaking first week. To put this in perspective, the highest box office taking of any movie in a first week is $239m (The Dark Knight). It seems likely that in future, publishers will pay close attention to video game releases when considering the launch date of their movies, an unprecedented situation.

Part 3.04.3 Nation for hire?

Ian Hetherington founded the highly successful publisher Psygnosis, which published several popular titles for both home computers and for Sony’s original Playstation including Lemmings and Wipeout, and is currently chairman of Realtime Worlds Ltd. Mr Hetherington feels that the current ownership structure of the UK’s games industry is flawed; consolidation has affected the industry significantly, with most UK developers and publishers having been acquired by larger American or Japanese corporations, such as Electronic Arts (EA), Sony or Sega. **Table 12** shows the acquisitions of UK developers made by Activision, a US based games publisher. These developers are mostly small scale operations, but large mergers also take place as the industry steadily consolidates e.g. Vivendi acquired 52% of Activision in a deal worth USD 1.7bn in June 2008.

Mr Hetherington himself has been involved in the sale of four companies to Sony over the years, including Psygnosis in 1993, and he explains that this is often the only economically viable option. Indeed, this was a concern raised by the majority of the games developers interviewed for this report. Mr Livingstone of ELSPA and Eidos expressed a worry that the UK has a base of highly skilled video games developers, but is in effect carrying out the development of blockbuster games on contract. "If things go the way they have been going," says Mr. Livingstone, "we are in danger of becoming a nation for hire."

Date	Target	Value (£m)
26/09/2007	Bizarre Creations Limited	Undisclosed
20/02/2007	Demon Ware Ltd	10.1
11/10/2002	Luxoflux Corp	5.8
22/05/2002	Z-Axis Ltd	14
02/04/2002	Shaba Games LLC	5.3
03/10/2001	Treyarch Invention	9.5

Table 12: Acquisitions by Activision Inc of UK games companies since 2000

David Bailey, chief executive of Short Fuze and formerly a member of the board of TIGA (The Independent Games Developers Association), rationalises this consolidation as being largely driven by the dynamics of the developer-publisher relationship, specifically a relationship in which the developers of games are largely at the mercy of their publishers. As shown by the discussion of Grand Theft Auto IV, a blockbuster title is an extremely labour-intensive undertaking, and once it is completed, the studio is left short of cash with a large number of employed staff. There is therefore a large risk associated with the development of a computer game, and one which has two immediate knock-on effects:

- Leading games developers do not tend to hire graduates.
- Developers tend to be acquired by publishers when this cash-shortage hits them.

Mr Bailey stated that developers have a minimum requirement of three years of experience, a period which usually corresponds to a complete product cycle. Mr Livingstone explains this second point as follows: "Because of the skills shortage and costs, the development studios themselves are under a lot of pressure. If they haven't got adequate funding when a project comes to an end, and unless they can get something already agreed upon, they suddenly have this huge cash crunch, because with these huge projects, up to 100 people working on a game, [the developers] have suddenly got this hole which can't be filled. There's been a tendency over the last few years for [development] companies either to go bust or to be bought out and they've been mainly sold to overseas publishers." He added that the UK is "the most expensive nation in the world in which to make games" in terms of taxation and the cost of hiring skilled staff.

There are no UK-based large scale publishers of computer games, and the tendency for developers to sell to foreign publishers is, as Mr Livingstone put it, "diluting the value of an industry which got off to such an amazing start in the '80s". There's a sentiment that the repatriation of the profits to the US or elsewhere, whilst not harming the industry in any way, remains a regrettable situation for UK PLC. Again, taking Grand Theft Auto as an example; the game was originally developed by Rockstar North (formerly DMA Design), a software house based in Edinburgh which was acquired by Take-Two Interactive in 1999. Rockstar has several studios throughout the UK, employing hundreds of highly skilled creative and technical staff. Take-Two will no doubt continue to re-invest their profits into new games to be developed in Scotland, but it is ultimately a successful US multi-national corporation, rather than a UK domiciled one.

According to Mr Bailey, games developers often have a strained relationship with their publishers. He suggests that tensions arise due to the distribution of risk. Mr Bailey explained that for most of the three years it will take to develop a top game, the publisher has very little capital invested; the publisher only begins to market and distribute the title immediately before and after launch. The publisher's risks are lower and more short-lived than those of the developer, who will be required to fund the three years of development at a consistently high spend rate in order to employ skilled staff, and there is of course no guarantee that the title will be a success. In addition, Mr Bailey believes that this situation is worsened for the developer due to the publisher's position of dominance; he stated that "all errors are made in favour of the publisher", and estimated that developers will routinely lose £1m per title due to poor accounting. He explained that a royalty audit costs around £15k per title, and many developers will not see the need to pay for one. Furthermore, publishers are under no obligation to fully disclose their accounts to the developers. Imposing this obligation and therefore enforcing royalty agreements may be one way in which government legislation could bring about a more stable environment for independent software developers to prosper in the UK.

Part 3.04.4 Challenges

Although many of the problems facing the games industry are equally applicable to any software company, or to most technology start-ups for that matter, there exist some specific challenges to the games industry.

The mainstream media's preoccupation with violent or mature content, in games never meant for children, may have damaged the reputation of the industry in the past, but there is now a more clear perception that games are an art form like any other. As Mr Livingstone put it, "it's a perception that's existed in the press[65] for years; we've been lambasted as evil monsters of society, poisoning children's minds etc." The Byron review[66] examined this perception, its focus being the effect of games and the internet on children's development and safety. The report was generally well received by those within the industry, and seen as a fair and thorough examination of the risks posed to children by digital content. Byron's conclusions call for more education of both children and their parents as to what content might be unsuitable for younger people, and as to what risks may exist, particularly with respect to online multiplayer gaming. More importantly however, the report acknowledges, perhaps for the first time in such a high-profile setting, the significance of video games as an increasingly integral part of British culture; "59% of UK 6-65 year olds (26.5 million people) play electronic games, 21.6 million play at least once a week."[67]

The report has been seen by some as marking something of a coming-of-age of electronic entertainment in this country[68]. With this changing perception, perhaps the industry will receive more support in the future, akin to that granted to film, theatre, music or opera.

Whilst arguments over the unfair mainstream treatment of video games may seem fairly innocuous, the context of how video games are perceived has already had a significant impact on the competitiveness of the industry in relation to that of France. European Commission legislation will grant tax credits to support activities deemed to be important to national cultural identity. Here in the UK, this applies to film, theatre, opera, and ballet and so on, but in January 2008, French video games studios successfully petitioned Christine Albanel, the cultural minister of Sarkozy's government, to consider video games a "culturally significant activity". Developers of games are now entitled to a 20% tax credit, subject to some content criteria, up to EUR 2m per studio per year. The stated

[65] Example: http://www.dailymail.co.uk/tvshowbiz/reviews/article-1017947/A-game-slick-8217-s-criminal.html

[66] The Byron Review, "Safer Children in a Digital World", commissioned by the Government and published in March 2008

[67] The Byron Review, p.144, section 6.5

[68] Richard Bartle – "We've won: get over it", Guardian.co.uk, April 28th 2008 - http://www.guardian.co.uk/technology/2008/apr/28/games.censorship

hope is that these measures will help encourage skilled French developers to seek employment in France, rather than abroad. [69]

Part 3.04.5 Skills:

Whilst the issue of a skilled workforce is discussed elsewhere in this report, the demands of the video games industry should not be overlooked. The UK Government deserves credit for recognising a potential skills crisis in the software industry, and for its attempts to ensure adequate numbers of skilled workers by way of university quotas. Mr. Hetherington in particular is critical of this move, however, saying the video game specific courses offered by universities in order to fill these quotas have so far been woefully inadequate, with only four out of around 81 of them having received accreditation from SkillSet, the industry governing body.

The industry sees the courses offered as being overly focused on creative and design skills, which are required, but which are of no use alongside a lack of programmers, artificial intelligence engineers, mathematicians and computer scientists. There is a feeling that the courses are offered simply to "fill quotas and get bums on seats at universities", and that these dumbed-down courses never had any hope of addressing the needs of the industry.

As Mr Bailey mentioned, most developers exclusively look for at least three years of relevant development experience due to the risky nature of developing a computer games title. It is understandably hard for graduates to get this level of experience outside of the industry. Hope exists in the form of the new popularity of casual gaming and low-tech titles, characterised by Nintendo's Wii system, the Nintendo's DS portable console, and by downloadable titles available over Microsoft's Xbox Live. These platforms re-open the opportunities for a bedroom programmer to acquire the experience necessary to become useful to the industry.

Furthermore, the increasing adoption of non-high street distribution platforms such as Valve's Steam, Microsoft's Xbox Live, Nintendo's WiiWare, or simple online games as are available on sites such as PopCap or Miniclip, allow developers to distribute their wares from anywhere in the world, entirely independent of a publisher. Any developer can now become a one-man games

[69] François Bliss de la Boissière, Gamasutra, "Video Games: Officially Art, In Europe", January 29th 2008
http://www.gamasutra.com/view/feature/3523/video_games_officially_art_in_.php?page=2

publisher, reducing the barriers to entry which might at first seem to be posed by the £100m price tag for a bleeding edge title such as GTA4.

Part 3.04.6 'Brain Drain':

Whilst it might be difficult to substantiate Livingstone's statement that the UK is "perhaps the most creative nation in the world", the UK does excel in fashion, music and art. However, there is genuine concern in the games industry that creatives are starting to be lured away, especially to Canada and the US, just as fashion designers might move to Paris or actors to Hollywood.

Publishers are "country agnostic"; if they don't have access to the skilled people they need, they will look elsewhere, as observed by all the interviewees mentioned. It's perhaps worth noting that Eidos has moved a large portion of its development work to a newly opened studio in Montreal. Mr Kristian Segestrale, chief executive of social games developer Playfish, helps us to see why these migrations take place by stating that "there is no reason for a developer not to move abroad". He suggests that Switzerland and Canada are popular destinations for migrant games companies because of the tax benefits, and he goes as far as to describe the UK's taxation system as "ludicrous", particularly the UK's capital gains tax.

Interviews with stakeholders in the games industry, from entrepreneurs like Segestrale to veterans such as Hetherington and Livingstone, have consistently vilified the government's taxation system. Capital gains tax is particularly unpopular, and Mr Bailey expressed his displeasure that the tax manual has increased in complexity over the years. However, when examined relative to the taxation schemes of other nations, the UK's fares very favourably. A recent Price Waterhouse Coopers report analysed many factors including total taxation rate and time required to comply, and ranked the UK 12th out of 178 nations. Germany was ranked 67th, the US 76th and France 82nd. Out of the G8 nations, the UK leads significantly in terms of ease of compliance, and fares favourably in terms of total taxation rate. Capital gains tax in the UK may be unpopular, but it is collected at a higher rate in the United States.

Perhaps it is less a question of what the UK is doing wrong, and more about what other nations are doing right: In the late 1990s the Canadian government pledged, as part of its wider knowledge economy initiative, to pump CAN$100m into its video games industry, especially in the Montreal region. Canada saw this as a long term investment, rather than a hand-out. Video games developers working in Montreal are now entitled to a 37.5 % salary rebate, and up to 40%

through tax credits as well. The universities in the area have also been overhauled in order to produce the skilled graduates that the industry requires. It is unsurprising that a number of international games companies have opened large studios in Montreal. The number of video games industry professionals working in the Montreal area has subsequently risen from around 90 in 2000 to a current high of 8000 – 9,000.[69] Many of these employees are foreign workers who have relocated to Canada specifically to develop games.

Whilst the French government has been seen to take this brain-drain seriously and act upon it by way of EU tax credits, the UK Government has declined to promote video games as a culturally significant asset. Instead of proactive change to prevent the outflow of more creative and technical talent, the UK Government's response to the pressure put on UK developers by the Canadian system was to file a complaint with the World Trade Organisation, on grounds of unfair competition. The WTO is likely to take five to ten years to come to any resolution, in which time the industry may well change dramatically.

It is clear that more must be done in order to ensure Britain's continued ability to compete in this global industry. It is also clear, taking the French initiative as an example, that at least one framework to make an effective change is already in place, courtesy of the European Commission. Our interviews gauged the feeling of the industry stakeholders as being somewhat indignant; one interviewee stated 'off the record' that the French are in some way "cheating" the system through their solution, but perhaps the sentiment is best summed up by Mr Livingstone:
"All we're asking for is a level playing field; we're not asking for hand-outs".

Section 4 Appendix I – Introducing the UK Software Economy Barometer

Part 4.01 Measuring the Health of the Software Industry

In recent years, models that evaluate the role and impact of the Information and Communication Technology (ICT) sector in regards to modern economies and societies have received interest from academics, economists and policy makers. The *OECD* has published several publications dealing with, both measuring and evaluating the ICT sector across different countries (OECD 2003, 2005, 2006).

To this day, the majority of models have limited their focus to specific areas of the software industry, an example being either skills or infrastructure, as in the 2003 report Digital Divide. None of the models developed have adequately met the challenge of providing a comprehensive model explaining all relevant aspects of an industry and its intra-sector ties.

An additional challenge to this is the developing of a robust methodology using accountable and publicly available and hence, verifiable data, which addresses the information needs of stakeholders and policy makers in a widely self-explanatory modality.

Part 4.02 The Software Economy Barometer

The aim of the Software Barometer is to benchmark the UK software industry from two different perspectives. Firstly, the barometer will allow tracking the development of the UK software industry over time and secondly, it will provide a starting point to extend the analysis into an international benchmarking exercise.

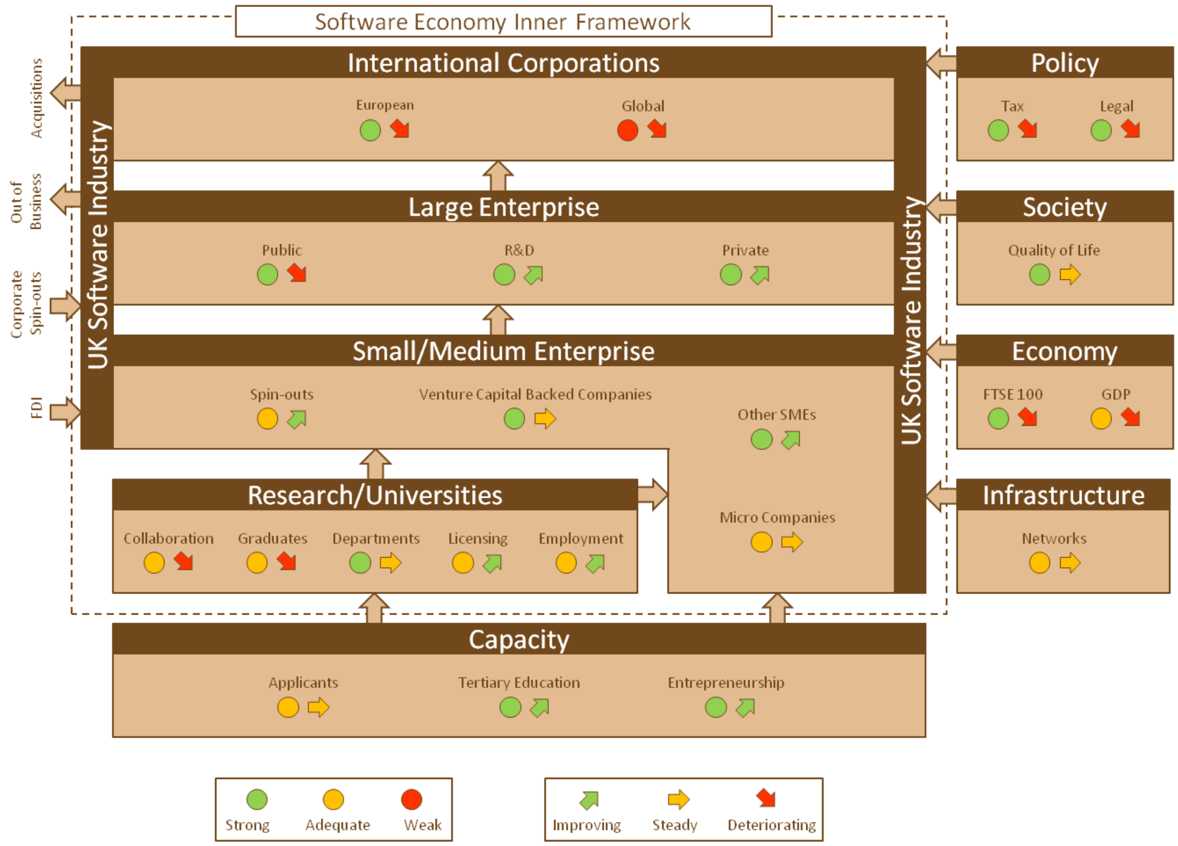


Figure 38: Overview of the barometer to measure the state of the UK software industry

Part 4.03 Quantitative Research

The barometer (**Figure 38**) is composed of two main frameworks, namely the surrounding conditions (outer) and the software industry framework (inner). The outer framework interacts with the inner framework through general factors that can affect any industry, not just the software industry. The key elements of the outer framework are the business, regulatory, technological and societal environment plus the capacity that is embedded in the entire population of the relevant geography.

The outer framework focuses on five areas that were identified as having the most significant impact on industry. These areas are specifically the business and legal environment, level of human development, macroeconomic indicators, IT-Infrastructure and capacity (education level and labour force). In terms of policy, the nation's tax and legal structures are examined to see the overall effect and attractiveness to those involved within the industry. Societal factors look at the overall well-being and living standards within countries. The economic landscape is examined in light of overall levels and general capital levels. As the name infers, IT Infrastructure looks at the infrastructure within the nation in relation to all ICT activity. The final area identified as capacity, involves the overview of the potential of the nation and its people to contribute to the success of the relevant industry.

The inner framework is predominantly focussed on organisations and activities within the software innovation landscape. The organisations can be divided into the two subgroups that are tied together through knowledge and technology exchange activities. These subgroups are:

a) Research sector (research organisations and higher education institutes)
b) Company landscape

The company landscape is sectioned in accordance to the size and degree of innovation of the companies. The main magnitudes of companies are corporates, large enterprises (LE's) and small to medium enterprises (SME's). All companies can be split into two groups, those that are mainly growth-orientated and those that are primarily known as other business, often including lifestyle businesses.

Part 4.04 Qualitative Analysis

In addition to the extensive data-driven analysis presented in this report, interviews were carried out with a number of key stake holders from a broad range of backgrounds, all of whom have expertise in one or more issues which had previously been identified as being of relevance to the UK software industry. The interviewees included entrepreneurs, investors, public sector bodies, relevant corporate representatives, trade group spokespeople, lawyers, academics and representatives from the financial services.

Interviews were carried out either by telephone, conference call, or face to face. Although any topic of interest and relevance to the report was open for discussion, the interviewees were asked some standard questions, of which they had been given a list prior to the interview itself. Questions were standardised in this way primarily in order to make sure that insights gained would be comparable between several interviewees. Although standardised questions allow a degree of cross-checking between interviews, many of the most interesting points came through freely discussing the issues at hand, and so the interviewers were careful to encourage this.

Part 4.05 How the Barometer works

The barometer consists of 23 key indicators as shown in **Figure 38** – note some of the indicators have been conglomerated in particular areas for ease of understanding within the table. The indicators were determined via the data collection procedure outlined in **Part 6.05**. As it can be seen each of the indicators has been allocated a current status level ranging from poor to world class, denoting the maximum healthiness level. Next to this, outlook arrows have been created, to depict the growth and trending of the particular area. These arrows were determined through trend analysis of the quantitative data from the barometer's raw data and also through gauging key individual's opinion via qualitative analysis.

Section 5 Appendix II – Software Economy Barometer Indicators

Area	Sub-Area	Latest complete year	Source	Organisations
Policy	Tax	2007	Paying Taxes 2008	World Bank, IFC and PWC
Policy	Legal	2006	Benchmarking European Tax and Legal Environments	EVCA
Society	Quality of Life	2007	Human Development Index	United Nation
Economy	FTSE 100 Index	2007	London Stock Exchange via Yahoo Finance	London Stock Exchange
Economy	Economic Growth (GDP)	2007	Internet Research	Treasury, ONS
Infrastructure	IT Infrastructure	2007		Ofcom
Capacity	Education	2007	Level of Highest Qualification	DIUS, Labour Force survey
Capacity	Entrepreneurship	2007	Total Early Stage Entrepreneurial Activity	GEM Consortium
Capacity	Applicants (cpSTEM)	2007	Higher Education Statistics Agency	Universities and Colleges Admissions Services
Research	Department (#, Size, Quality)	2003	RAE 2001	RAE (HEFCE, SFC, DEL, HEFCW)
Research	Graduates (cpSTEM)	2007	Higher Education Statistical Agency	Higher Education Statistics Agency
Research	Employment Rates (cpSTEM)	2006 (2006/07)	Prospects.ac.uk	Prospects.ac.uk
Research	Business Collaboration	2008	Knowledge Transfer Partnerships	Technology Strategy Board
Research	Spin-Out Formation (Venture Capital backed)	2006/2007	Library House	HEFCE
Research	Software Licensing Activity (# / Value)	2006/2007	HE-BCIS	HEFCE
Companies	Software Company Landscape (#, Employment, Turnover), Micro Companies, Other SMEs and Private	2006	Company Statistics 1994 to 2006	ONS
Companies	Venture Capital Backed Companies (Financing Rate)	2007	European Venture Intelligence	Library House
Companies	Public Listed Software Companies	2007	European Venture Intelligence	Library House
Companies	R&D Companies	2007	DIUS R&D Scoreboard	DIUS
Companies	Europe IT	2008	Truffle 100 List	Financial Times
Companies	Global IT	2008	FT Global 500	Financial Times

Figure 39: List of Indicators and Sources

Part 5.01 Policy: Tax

In the inaugural World Bank and PWC "Paying Taxes Report" (2008), the UK was placed 12th within the league table of 178 countries. The majority of western countries were placed lower than the UK, some included Switzerland (15), Germany (67), US (76) and France (82). It is interesting to note that the majority of the countries that placed within the top ten were countries located in the Middle East.

	Rankings			
Economy	Ease of paying taxes	Tax payments	Time to comply	Total Tax Rate
United Arab Emirates	4	31	2	3
United Kingdom	12	10	22	52
United States	76	21	122	102

Indicator Table 1: Paying Taxes Ranking 2008

Part 5.02 Policy: Legal

The EVCA reports "Benchmarking European Tax and Legal Environments" provided by the EVCA ranks countries around the world based upon the tax and legal environment for the development of private equity and venture capital. The scoring system is between 1 & 3, with 1 representing more favourable conditions, and 3 representing less favourable conditions.

After being in the number 1 position for 2003 and 2004 the UK had the lowest scoring, meaning that it had a highly favourable tax and legal environment for business, however in 2006 it dropped to third place after Ireland and France.

Table 1: Overview of results 2006, 2004 and 2003

Results for 2006[1]		Results for 2004[2]		Results for 2003[3]	
Country	Total Score	Country	Total Score	Country	Total Score
Ireland	1.27	United Kingdom	1.26	United Kingdom	1.20
France	1.36	Luxembourg	1.49	Ireland	1.58
United Kingdom	1.46	Ireland	1.53	Luxembourg	1.67
Belgium	1.51	Greece	1.75	Netherlands	1.79
Spain	1.52	Netherlands	1.76	Italy	1.96
Greece	1.55	Portugal	1.81	Greece	1.96
Netherlands	1.60	Belgium	1.82	Total Average	2.03

Indicator Table 2: EVCA Benchmark Results 2003, 2004 and 2006

Part 5.03 Society: Quality of Life

The Human Development Index published (2005, 2006 and 2007/2008) by the UN is an annual publication calculating indices, combining normalised measures of life expectancy, literacy, educational attainment, and GDP per capita for countries worldwide.

Over the last three reports the UK has constantly been placed within the 12-20 rank range.

HDI rank [a]		Human development index (HDI) value 2005	Life expectancy at birth (years) 2005	Adult literacy rate (% aged 15 and above) 1995-2005[b]	Combined gross enrolment ratio for primary, secondary and tertiary education (%) 2005	GDP per capita (PPP US$) 2005	Life expectancy index	Education index	GDP index	GDP per capita (PPP US$) rank minus HDI rank [c]
HIGH HUMAN DEVELOPMENT										
1	Iceland	0.968	81.5	.. [d]	95.4 [e]	36,510	0.941	0.978	0.985	4
2	Norway	0.968	79.8	.. [d]	99.2	41,420 [f]	0.913	0.991	1.000	1
3	Australia	0.962	80.9	.. [d]	113.0 [g]	31,794	0.931	0.993	0.962	13
4	Canada	0.961	80.3	.. [d]	99.2 [e,h]	33,375	0.921	0.991	0.970	6
5	Ireland	0.959	78.4	.. [d]	99.9	38,505	0.890	0.993	0.994	-1
6	Sweden	0.956	80.5	.. [d]	95.3	32,525	0.925	0.978	0.965	7
7	Switzerland	0.955	81.3	.. [d]	85.7	35,633	0.938	0.946	0.981	-1
8	Japan	0.953	82.3	.. [d]	85.9	31,267	0.954	0.946	0.959	9
9	Netherlands	0.953	79.2	.. [d]	98.4	32,684	0.904	0.988	0.966	3
10	France	0.952	80.2	.. [d]	96.5	30,386	0.919	0.982	0.954	8
11	Finland	0.952	78.9	.. [d]	101.0 [g]	32,153	0.898	0.993	0.964	3
12	United States	0.951	77.9	.. [d]	93.3	41,890 [f]	0.881	0.971	1.000	-10
13	Spain	0.949	80.5	.. [d]	98.0	27,169	0.925	0.987	0.935	11
14	Denmark	0.949	77.9	.. [d]	102.7 [g]	33,973	0.881	0.993	0.973	-6
15	Austria	0.948	79.4	.. [d]	91.9	33,700	0.907	0.966	0.971	-6
16	United Kingdom	0.946	79.0	.. [d]	93.0 [e]	33,238	0.900	0.970	0.969	-5
17	Belgium	0.946	78.8	.. [d]	95.1	32,119	0.897	0.977	0.963	-2

Indicator Table 3: United Nation – Human Development Index 2007/2008

Part 5.04 Economy: FTSE-100

Using results gained from Yahoo Finance Historical FTSE results, the daily price records for the FTSE 100 between 2004 and 2008 where broken down into respective years. The Closing Prices for each day were used to determine the average annual price movements in the FTSE 100, by summing up the total closing price throughout the year and dividing by the number of trading days within the respective year. This gave an indication of the change in FTSE over each year in question.

In addition the closing prices for each day within the specific year were sorted in ascending order to determine the high and low points of the FTSE 100 within the specific year, in order to illustrate the margin of movement throughout the year between the highest and lowest closing points.

The FTSE 100 has shown constant growth from 2004 to 2006, followed by a drop in 2007 to a level under the average level in 2005.

FTSE 100 Yearly Averages Based on Daily Results at Close				
Year	High	Low	Average	Index
2008	6479.4	5150.6	5855.039	0.5301317
2007	6732.4	5858.9	6403.46	0.623423
2006	6260	5506.8	5920.315	0.5490109
2005	5638.3	4783.6	5160.641	0.4411384
2004	4820.1	4287	4521.3	0.4395048

Indicator Table 4: FTSE 100 Development 2004-2008

Part 5.05 Economy: GDP

Using results gained from Measuring Worth concerning historical GDP figures for the UK, the figures for both real and nominal GDP were included for the period 2004 to 2007. These figures demonstrated the percentage by which the UK's GDP fluctuated. Special attention is given to the figures for real GDP as these measure the size of an economy adjusted for price changes and inflation. Nominal GDP has not been adjusted for inflation or price changes.

The difficulty in obtaining and agreeing on this data lies in the fact that GDP figures can vary depending on a range of different factors as well as agreeing on which to include, and therefore how GDP is calculated appears to differ depending on the source consulted. The GDP figures gained from Measuring Worth were agreed upon as they closely reflected the GDP results that were gathered from the ONS and Treasury websites.

The GDP growth was at its peak in 2004 (3.26%) with a sharp decline in 2005 to 1.84%, but grew 3.10% in 2007.

Annualised Growth Rate for GDP in UK between 2004 & 2007		
Year	Nominal GDP %	Real GDP %
2004	5.91	3.26
2005	4.19	1.84
2006	5.32	2.84
2007	n/a	3.1

Indicator Table 5: GDP Growth 2004-2007

The recent downturn in the world economy will lead to a much lower GDP growth rate in 2008, with UK economy contracting by 0.5% in the third quarter. The recession that the economy is now in is likely to continue, and possibly worsen, in 2009.

Part 5.06 Infrastructure: Networks

Using National Statistics data we calculated the penetration and growth rates for internet, computers and broadband in Great Britain (note: Figures for the UK are only available for 2006 and 2007).

Households with Internet access by country and region (GB and UK, 2005, 2006 and 2007)			
Region	2005	2006	2007
South West	55.00%	59.00%	69.00%
London	53.00%	63.00%	69.00%
East of England	57.00%	64.00%	67.00%
South East	62.00%	66.00%	65.00%
Scotland	53.00%	48.00%	60.00%
East Midlands	59.00%	55.00%	59.00%
North West	52.00%	54.00%	56.00%
Wales	54.00%	52.00%	57.00%
West Midlands	56.00%	53.00%	56.00%
Yorks & Humber	50.00%	52.00%	52.00%
North East	44.00%	54.00%	52.00%
Northern Ireland	-	50.00%	52.00%
England	55.00%	59.00%	61.00%
GB	55.00%	57.00%	61.00%
UK	-	57.00%	61.00%

Indicator Table 6: Internet Access by regions

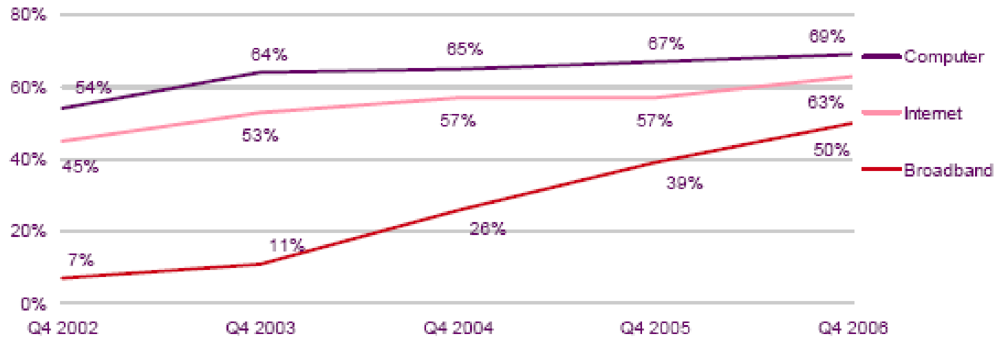
Households with access to the Internet (Great Britain 2002 to 2007)			
Year	Per cent	Households	Growth Rate
2002	46	11.02	n.a.
2003	50	11.88	7.80%
2004	51	12.16	2.36%
2005	55	13.26	9.05%
2006	57	13.93	5.05%
2007	61	14.94	7.25%

Indicator Table 7: Internet Access in Great Britain

Meanwhile, the increasing availability of computers in the home with a broadband internet connection made it easier for consumers to quickly upload and share data-hungry media such as pictures, audio and video. By the final quarter of 2006, 69% of homes had a computer and, of that proportion, 72% had a broadband connection, up from 58% in Q4 2005 (Figure 1.32).

Figure 1.32 Take-up of computers and the internet in UK homes

Proportion of individuals (%)



Source: Ofcom research

Indicator Table 8: Availability of Computers and the Internet

Part 5.07 Capacity: Tertiary Education

The data provided by the DIUS Labour Force Survey provides a detailed percentage breakdown by year, of the levels of educational attainment throughout the country. Levels of education increase up to Level 8. Focus is given to those attaining above Level 4 education and the levels of results are displayed accordingly as a percentage of the population. As expected, the higher the level of education, the greater the decrease in population achieving such levels.

The percentage of people (aged between 19-59(woman)/64(men)) trained to level 4 and above has constantly increased since 2001 from 25.2% to 30.9% in 2007.

Time series	All people aged 16-59/64 (k)	Level 7-8	Level 4-6	Level 4 and above	Level 3	Level 3 and above	Level 2	Level 2 and above	Below Level 2	No qualifications
		Percentage of people aged 16-59/64 qualified at each level[1]								
2001	30,287	4.4	19.4	**23.7**	19.3	**43.0**	21.7	**64.7**	20.1	15.2
2002	30,476	4.6	20.0	**24.6**	19.6	**44.2**	22.0	**66.2**	19.7	14.2
2003	30,668	5.0	20.5	**25.5**	19.6	**45.1**	21.6	**66.8**	19.4	13.8
2004	30,916	5.2	21.0	**26.2**	19.4	**45.6**	21.5	**67.2**	19.4	13.5
2005	31,184	5.9	20.9	**26.8**	19.7	**46.5**	22.0	**68.5**	18.7	12.8
2006	31,404	6.3	21.9	**28.2**	19.3	**47.4**	22.1	**69.5**	18.2	12.3
2007	31,582	**6.7**	**22.3**	**29.0**	**19.7**	**48.7**	**21.6**	**70.3**	**18.2**	**11.5**

Indicator Table 9: Level of Qualification in the UK Population

Part 5.08 Capacity: Entrepreneurship

The data provided by GEM UK denotes the percentage of the population each year that are in involved in Total Early Stage Entrepreneurial Activity (TEA) in participating G7 and BRIC Countries. The table also includes a G7 average for each year. The TEA covers two of four phases of the business growth cycle between the Conception and Persistence phases, namely the Firm Birth phase. This includes the "Nascent entrepreneur" phase which involves setting the business up, and the Owner-Manager phase of a new business (up to 3.5 years old). The tabular results show the UK to follow a similar trend to that of the G7 average throughout the six years depicted.

The UK has the second highest TEA of all G7 countries after the US. The UK has regularly outperformed the G7 average, but the gap between the US and the UK has constantly become wider over the years.

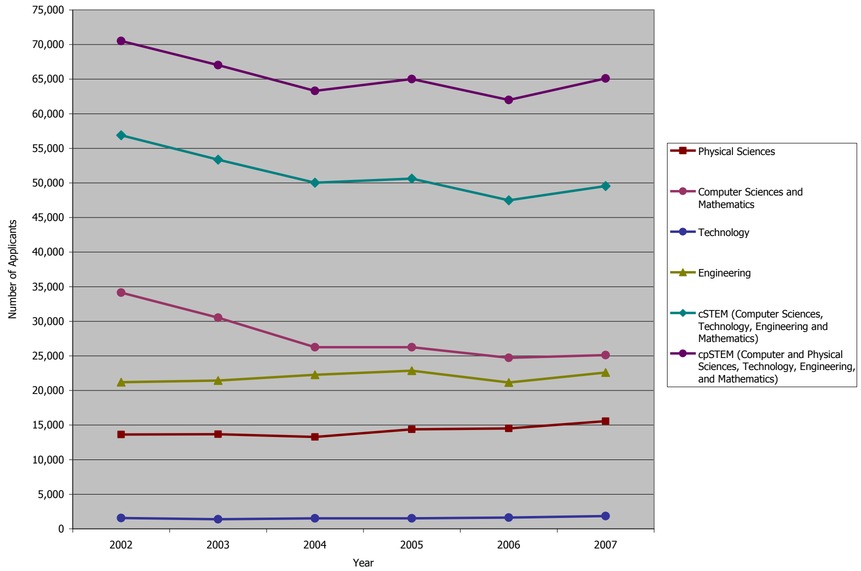
	2002	2003	2004	2005	2006	2007
UK	5.38	6.36	6.25	6.22	5.79	5.56
Canada	8.8	7.99	8.84	9.33	7.1	-
France	3.23	1.62	6.04	5.35	4.4	3.17
Germany	5.16	5.2	5.07	5.39	4.2	-
Italy	5.9	3.18	4.32	4.94	3.5	5.01
Japan	1.81	2.78	1.46	2.2	2.9	4.34
US	10.51	11.94	11.33	12.44	10	9.61
Brazil	13.52	12.89	13.48	11.32	11.7	12.72
Russia	2.51	-	-	-	4.9	2.67
India	17.87	-	-	-	10.4	8.53
China	12.37	10.51		13.72	16.2	16.43
G7 average	5.83	5.58	6.19	6.55	5.41	5.54

Indicator Table 10: TEA Rates for 2002-2007

Part 5.09 Capacity: Applicants

The data provided by the Universities and Colleges Admissions Service (UCAS) provides a detailed delineation between the number of applicants from each discipline, broken down by calendar year.

The number of applicants to the cpSTEM courses has decreased by 7.7% between 2002 and 2006. This is primarily due to a 23% drop in the number of applicants for Computer Science and Mathematics.



Indicator Table 11: Time-Series Analysis of Applicant Number for the cpSTEM Subjects

Part 5.10 Research/Universities: Departments

The results of the RAE 2001 were used to calculate the benchmarks for Computer Science departments and all UK research departments. The RAE Ratio was determined by calculating the ratio of the number of departments with a 5 or 5* rating over the total number of departments.

Overall the 80 Computer Science departments achieved in average a RAE 2001 Ratio of 4.16[1-5 Scale] (3.95[1-6 Scale, 5*=6]) which is below the UK average of 4.21(1-5 Scale) (4.06[1-6 Scale, 5*=6]) for all 2,589 research departments participating in the RAE 2001.

Rank	Absolute Number of largest STEM departments:	No.	Availability (Scaled)
1	Computer Science	80	100.00%
2	Biological Sciences	76	95.00%
3	Other Studies and Professions Allied to Medicine	75	93.75%
4	Applied Mathematics	58	72.50%
5	Physics	50	62.50%
6	General Engineering	48	60.00%

Indicator Table 12: Number of STEM Departments (RAE 2001)

Rank	Most Available Departments	No.	Availability (Scaled)	Average Quality
1	Business and Management Studies	97	100.00%	3.52
2	History	95	97.94%	4.49
3	English Language and Literature	89	91.75%	4.40
4	Education	83	85.57%	3.83
5	**Computer Science**	**80**	82.47%	**4.16**
6	Biological Sciences	76	78.35%	4.34
7	Other Studies and Professions Allied to Medicine	75	77.32%	3.63
8	Art and Design	75	77.32%	3.97
9	Psychology	73	75.26%	3.97

Indicator Table 13: Availability of STEM Departments (RAE 2001)

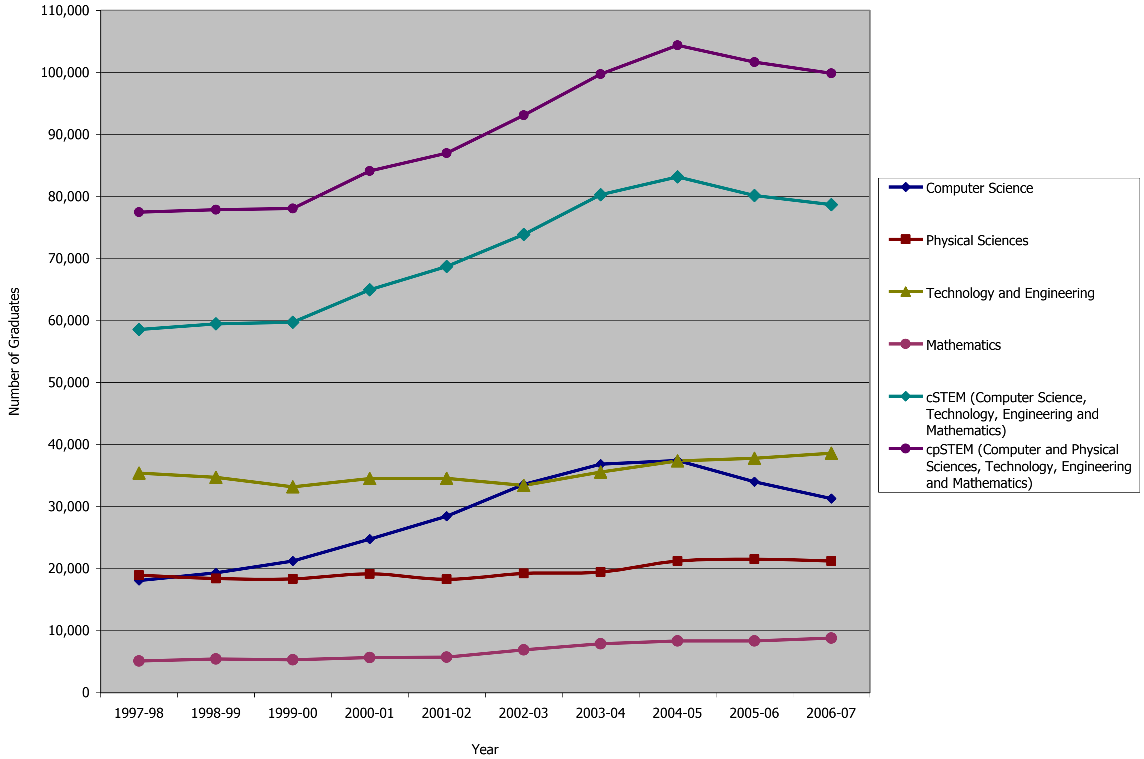
Rank	Largest Number of FTE per Department	FTEs	No. Departments	Average FTE
1	Business and Management Studies	2,555	97	26.34
2	Hospital-based Clinical Subjects	2,473	31	79.79
3	Biological Sciences	2,417	76	31.80
4	Education	2,045	83	24.64
5	History	1,720	95	18.10
6	Art and Design	1,669	75	22.25
7	Physics	1,668	50	33.36
8	**Computer Science**	**1,560**	**80**	**19.50**
9	English Language and Literature	1,519	89	17.07

Indicator Table 14: Largest Departments by FTEs (RAE 2001)

Part 5.11 Research/Universities: Graduates

Data was obtained from HESA, which provided a breakdown of graduate numbers by discipline, and academic year. This differs from UCAS data used for applicant number, which is broken down by calendar year. However, UCAS data was represented in the HESA dataset in the following academic year (i.e. 2004 UCAS data was represented in

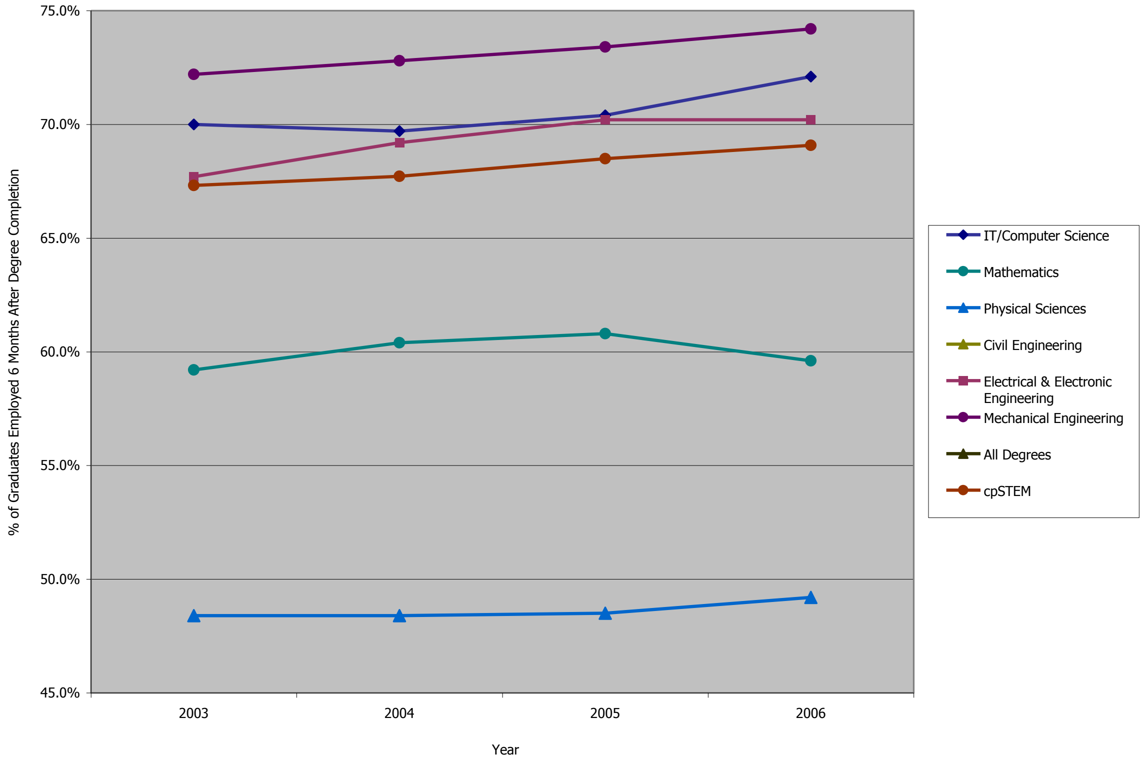
The number of graduates designated in the cpSTEM courses (computer and physical Sciences, Technology, Engineering and Mathematics) has increased by 29% between 1997-98 and 2006-07, but has dropped by 4.3% since 2004-05. The rise and fall in cpSTEM graduates has primarily been mediated by a similar rise (between 1997-98 and 2004-05) and fall in Computer Science graduates (between 2004-05 and 2006-07).



Indicator Table 15: Time-Series Analysis of the Number of Graduates of cpSTEM subjects between 1997-98 and 2006-07

Part 5.12 Research/Universities: Employment

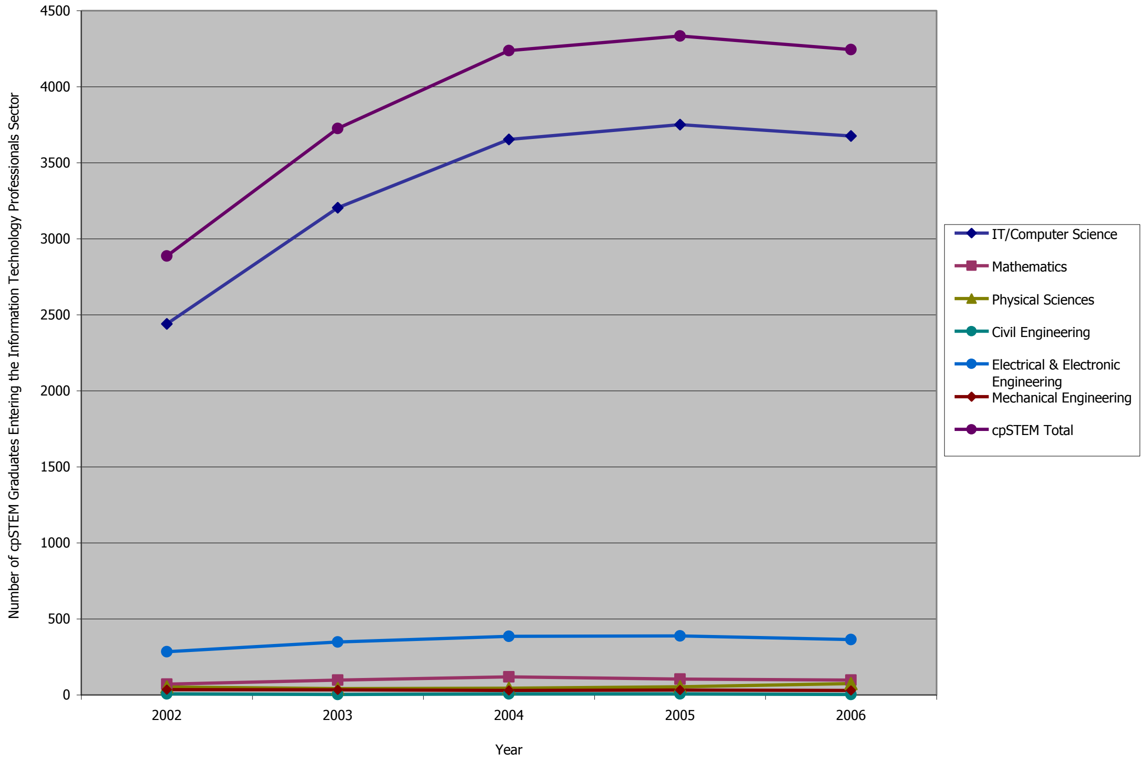
The employment rate for cpSTEM graduates has increased by 1.8% between 2003 and 2006. This was primarily mediated by a corresponding 2.1% increase in the employment rate of Computer Science/IT graduates, and a 0.8% increase for Physical Science graduates, and a 0.4% increase for Mathematics Graduates. The increase in cpSTEM graduates was higher than that for all HEI degrees.



Indicator Table 16: Time-Series Analysis of the Percentage of Graduates that are Employed 6 Months after Completion of their Degree

Data was obtained from Prospects.ac.uk, using data from the Destination of Leavers of Higher Education Survey (DLHE) from HESA, which performs a survey of graduates 6 months following the completion of their degree. Data is classified by subject/discipline, and by year. The number of cpSTEM graduates entering the IT Professionals sector was calculated by multiplying the percentage in employment (including those in work and employment) by the number of those entering the sector, and multiplying the corresponding value by the total number of survey respondents.

The number of cpSTEM graduates entering the IT professionals sector has increased by 14% between 2003 and 2006. This is primarily due to a 14% increase in the numbers of Computer Science/IT graduates entering the sector, and a 5% increase in the numbers of Electrical and Electronic Engineering graduates entering the sector.



Indicator Table 17: Time-Series Analysis of the Number of New cpSTEM Graduates that are employed in the IT Professionals Sector

Part 5.13 Research/Universities: Collaboration

Using the two "Knowledge Transfer Partnerships" databases "all completed KTPs" and "current KTPs" collaborations between universities and companies were identified. The database covers more than 4,400 completed and more than 400 current partnerships since 1985.

The analysis was based on the "Tech" areas defined in the database. The main areas involving software are:

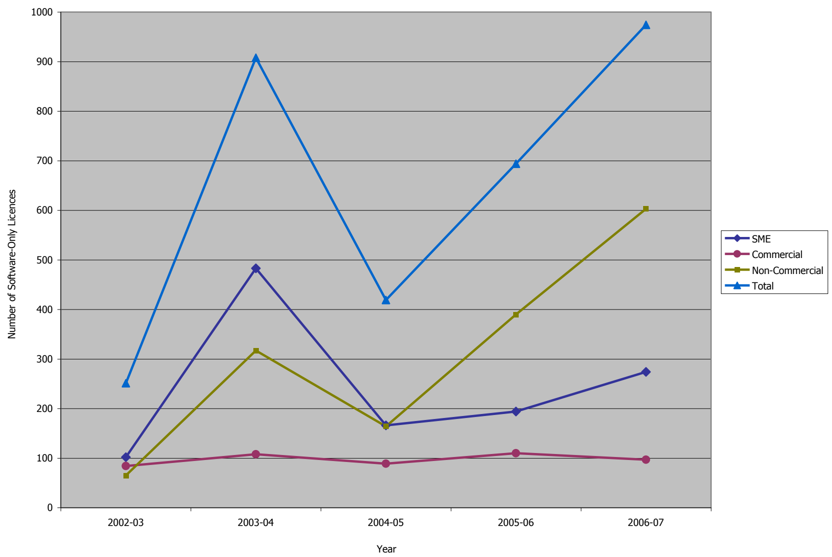
- Advanced Information Technology
- Computing (excluding application to Manufacturing Engineering)
- Electronic Commerce
- Multimedia

The ratio of computer related KTPs to all KTPs per year dropped significantly from around 50% in the 2000-2001 to slightly above 30% in 2007.

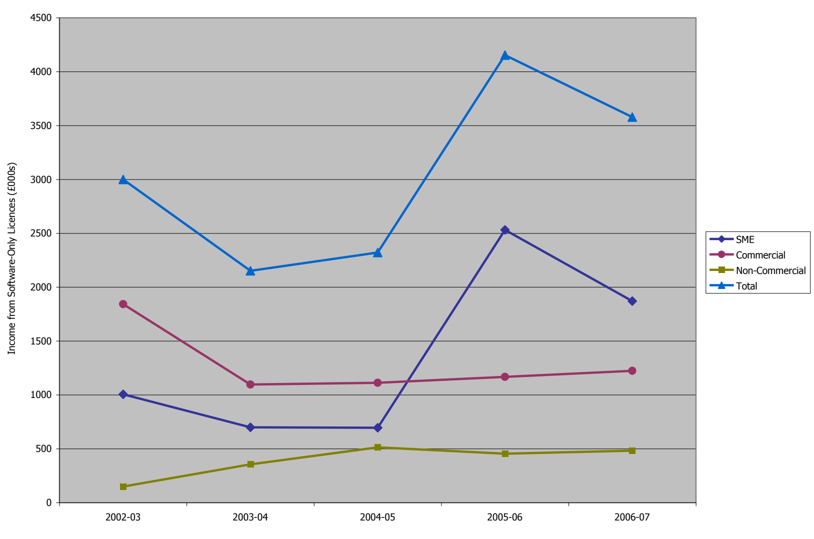
Part 5.14 Research/Universities: Software Licensing

Using data from the HE-BCI surveys from 2002-03 to 2006-07 it was possible to calculate the relative importance of software licensing agreements.

The number of software licensing agreements has increased from 251 in 2002-03 to 974 in 2006-07, while the income has increased from £3m to £3.58m. The income from Large Commercial Organisations has dropped (£1.8m to £1.2m) whilst the licensing income from SMEs (£1m to £1.87m) and Non-Commercial Organisations (£150k to £483k) have increased.



Indicator Table 18: Time-Series Analysis of the Number of Software-Only Licences by Sector

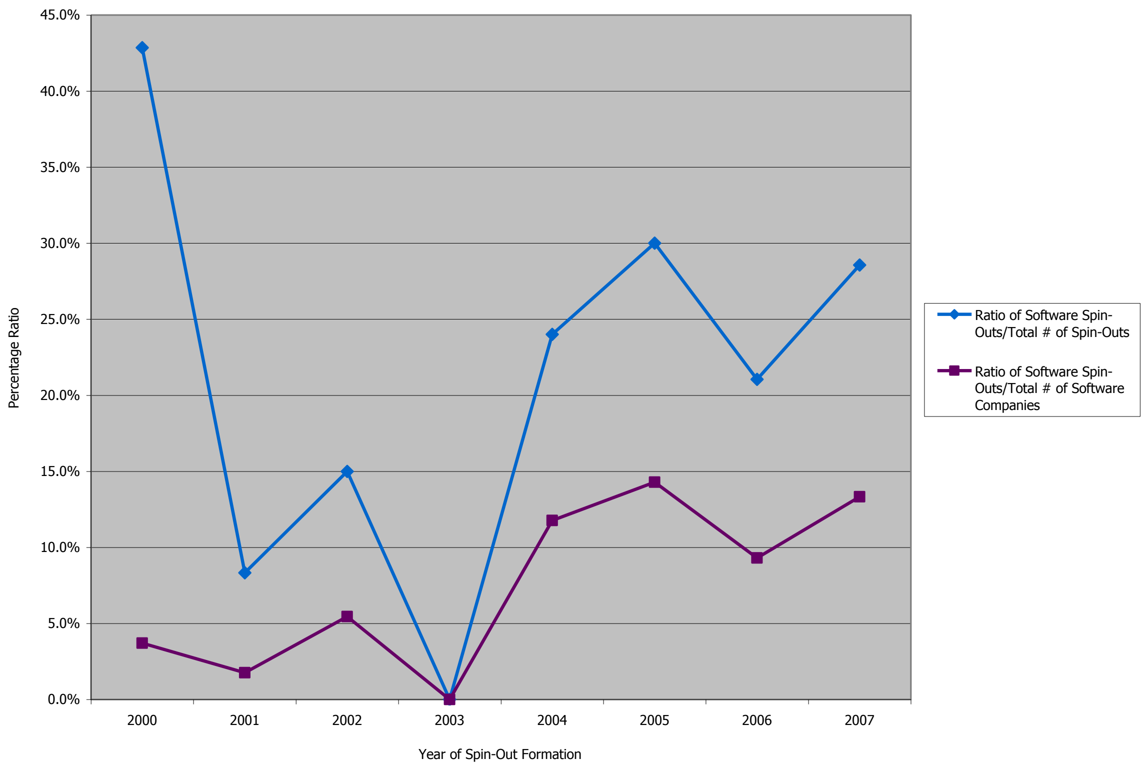


Indicator Table 19: Time-Series Analysis of Income from Software-Only Licences by Sector

Part 5.15 SME: Spin-outs

Using the Library House data set on venture backed companies, it was possible to determine the importance of software spin-outs founded from 2000 to 2007 to the total number of spin-outs, and the total number of software companies.

Following a dip between 2000 and 2003, software spin-outs are forming a greater proportion of the total spin-out activity of universities (28.6% of all spin-outs in 2007). Furthermore, the proportion of venture-backed software companies that are spin-outs has increased from 3.7% to 13.3% of all software companies.



Indicator Table 20: Contribution of Software Spin-Outs to Total Spin-Out Formation and Software Company Formation (Source: Library House)

Part 5.16 SME: Venture Capital Backed Companies

Based on the Library House European Venture Database we calculated the number of UK venture capital backed software and overall venture capital backed companies.

By dividing the UK software companies by the total number of UK venture capital backed companies we received a ratio we used as an index figure.

Approximately 30% of all UK venture capital backed companies are software companies.

Year	No. of Non-Software Companies receiving first round of investments	No. of Software Companies receiving first round of investments	Grand Total	Percentage
2004	195	77	272	28.31%
2005	184	89	273	32.60%
2006	189	97	286	33.92%
2007	182	86	268	32.09%
Grand Total	**750**	**349**	**1099**	**31.76%**

Indicator Table 21: Venture Capital backed Software Companies

Part 5.17 Enterprise: Micro, SME, Private

Please see analysis in Part 3.01 The UK Software Company Landscape.

Part 5.18 Enterprise: Public

This indicator is based on an analysis of software companies listed on the London Stock Exchange and the number of Initial Public Offerings using data from Library House.

Part 5.19 Enterprise: R&D

This indicator is based on analysis of the DIUS R&D Scoreboard.

Part 5.20 International Corporations: European

By examining the FT Euro 500 for each year from 2004 to 2008 inclusive, companies specifically in the field of Software and Computer Services in Europe were sought out. Their respective ranks within the 500 were taken and recorded for each year. This allowed the finding of how many and which companies are in the Euro 500 as well as their particular ranking among other companies within the same industry.

The only UK software company listed is the Sage Group which has last rankings of 344 in 2004 to 490 in 2008 and is in danger of dropping out of the list (LogicaCMG has to be classified a software services company). Overall most software companies have lost their ranking over the years. However, internet service providers like United Internet and Iliad could improve or at least keep their rankings.

List	Sector Rank	Europe Rank 2008	Europe Rank 2007	Europe Rank 2006	Europe Rank 2005	Europe Rank 2004	Company	Country
Europe	1	51	59	30	35	27	SAP	Germany
Europe	2	342	283	322	382	305	Cap Gemini	France
Europe	3	379	440	353	338		Dassault Systemes	France
Europe	4	445		484			United Internet	Germany
Europe	5	452	476	446			Iliad	France
Europe	6	490	415	369	364	344	Sage Group	UK
Europe	7	500					Indra Sistemas	Spain
Europe				421	387	338	Atos Origin	France
Europe				495			LogicaCMG	UK

Indicator Table 22: Largest European Software Companies

Part 5.21 International Corporations: Global

By examining the FT Global 500 for each year from 2004 to 2008 inclusive, companies specifically in the field of Software and Computer Services were sought out. Their respective ranks within the 500 were taken and recorded for each year. This allowed the finding of how many and which companies are in the Global 500 as well as their particular ranking among other companies within the same industry.

With SAP only one European company has been included in this list over the past five years (T-Online has to be classified as an internet service provider). This list is dominated by US corporates.

List	Sector Rank	Global Rank 2008	Global Rank 2007	Global Rank 2006	Global Rank 2005	Global Rank 2004	Company	Country
Global	1	7	3	3	3	2	Microsoft	US
Global	2	27	31	26	13	14	IBM	US
Global	3	56	51	60	279		Google	US
Global	4	62	65	77	66	60	Oracle Corporation	US
Global	5	109	135	82	97	85	SAP	Germany
Global	6	220	191	144	108	160	Yahoo!	US
Global	7	285	442	181	154	126	Yahoo Japan	Japan
Global	8	465	344	414	476		Infosys Technologies	India
Global	9	469	371	356	369		Adobe Systems	US
Global	10	481	318	367	406		Tata Consultancy Services	India
Global				430			Wipro	India
Global				441	405	377	Symantec	US
Global					381	350	Computer Associates Intl	US
Global					384	356	Electronic Arts	US
Global					399	393	Nintendo	Japan
Global					429	365	Softbank	Japan
Global					499	390	T-Online International	Germany

Indicator Table 23: Global Software Companies

Section 6 Appendix III – Defining the Software Economy

Part 6.01 Defining the 'software economy'

In order to properly analyse an industry, there requires a clear understanding of the companies that constitute the landscape. This allows a definite area of focus to be developed so that the resulting barometer will have both the longevity and accuracy. Thus in so saying, to create the Software Economy Barometer, a definition that encompasses the software company landscape was developed. Though this seems to be a relatively straightforward task, the problems arose from the fact that this definition of software must have the ability to be quantified and in so saying, parameters had to be created that relate back to quantifiable amounts. The question that needed to be addressed was if there existed a system that allowed a reliable quantification to be created.

The most common approach in classifying industry is the use of Standard Industrial Classification System (SIC System), that uses up to a four digit code (SIC-Codes) to differentiate between sectors. Several studies have utilised this classification system in the past, including Steinmueller in 1995, where the US SIC codes were used when quantifying the US software industry in the Berkeley International Computer Software Industry Project led by Mowery nbed (reference Stanford Computer Industry Project et al.). Taking previous research into account it was decided to look at the current UK SIC codes in use, which date from 2003. It was found that there have been attempts in the past to use UK SIC codes to identify aspects of the software industry – with varied results - the most recent being the NESTA and DCMS paper "Beyond the Creative Industries: Mapping the creative economy in the United Kingdom" paper. Nevertheless the use of SIC Codes required careful selection and validation procedures to ensure that the right codes are be used.

The UK SIC Code 2003 uses the division 72 for "Computer and Related Industries". In order to validate the quality of the division 72 as a proxy for software companies, it was necessary to look at the most reliable dataset at disposal. On analysis of all the VC backed software companies within the Library House dataset, it was found that the majority were placed within four distinct UK SIC code Groups of "72.2[70] – Software consultancy and supply"; "72.3 Data

[70] This class includes:

- analysis, design and programming of systems ready to go
- analysis of the user's needs and problems, consultancy on the best solution

Processing"; "72.4[71] Database activities" and "72.6 – Other computer related activities". It then became necessary to analyse the SIC codes on a larger scale and so the SIC code definition from both public companies and UK R&D Companies (DIUS 2007 R&D Scoreboard) was analysed. The public listed software companies on both the London Stock Exchange and the UK software companies – listed in the Truffles 100[72] - were analysed to further understand the distribution of these SIC codes. From this analysis it was found that 80% of all these software companies considered themselves to belong to either the UK SIC codes 72.2, or 72.6, with further desegregation of the 72.2 into 72.21 - Publishing of software, or 72.22 – Other software consultancy and supply. This was also found to be the case within the R&D analysis.

From these findings the following definition was developed.

A software company can be defined as an entity that has one or more of the following activities:

- Publishing of software – Either packaged software or acting as hosts of software for clients
- Acting as a software services company – Inclusive of software consulting firms which provide outsourced software development services
- Primary service is through website – This is only inclusive of companies that have developed proprietary software for access through a site – examples of this include Last.FM and bebo as software companies through this definition. This excludes companies that have a physical presence and have now created an online presence (i.e. this would be department stores that now have an e-store)
- Software developed specifically for proprietary hardware and is the core focus of the company – for example, ARM is considered a hardware

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- development production, supply and documentation of order-make software based on orders from specific users
- development, production, supply and documentation of ready-made (non-customised) software
- writing of programs following directives of the user

[71] This class includes database related activities

- database development
- data storage
- database availability

[72] The ranking of the top *100* European Software companies 2007

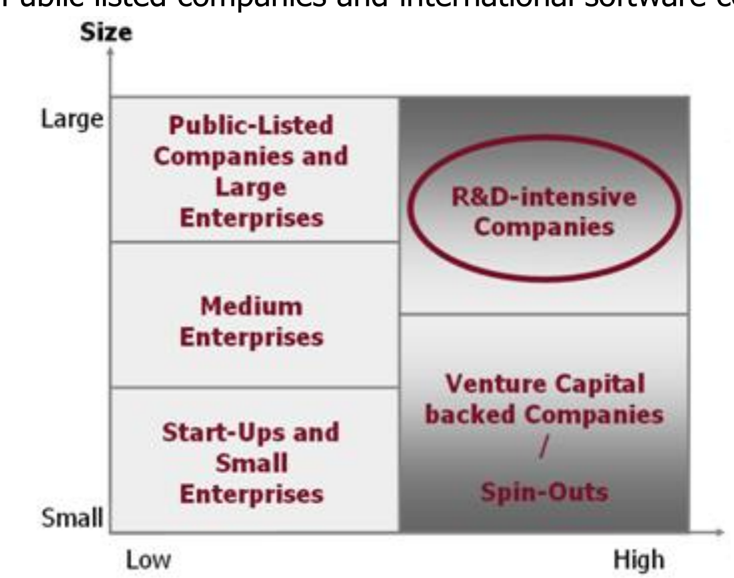
company despite the fact that they develop software, however game producers Microsoft are considered a software company despite the fact that they develop hardware and peripherals

Overall it was found that a reliable majority representative of the UK Software Industry can be ascertained by the following UK SIC codes i.e. 72.21, 72.22 and 72.6. These SIC codes as stated previously, make up 80% of the public companies on the London Stock Exchange and the Truffles 100 listing. It is the belief that this 80% is representative of 80% of the total software industry. This is due to the fact that the companies that exist in both of these lists are larger than the average SME; larger companies are required to provide more precise and comprehensive company data to Companies House. As this is generally not the case for the majority of SMEs, one would not expect a large onus placed upon submitting the correct SIC code to Companies House.

However, we assume that 80% of the software company landscape is represented through the SIC Codes groups 72.21, 72.22 and 72.6 and their use is currently the best available proxy to measure the software industry landscape. The approximate remaining 20% of the software companies are assumed to be spread across a number of different SIC Codes.

Part 6.02 Company Landscape

The company landscape can be divided into:
Small and medium sized companies
Venture Capital backed companies incl. university spin-out companies
Larger R&D companies
Public listed companies and international software corporates



Part 6.03 SME Sic Codes

Using BERR statistics on company SIC Codes, with a focus specifically on the software and computing industry (codes 722 & 726), tabular records dating from 1999 to 2006 with separating codes of 722 and 726 within each year up to 2006 were created. Within these yearly coded divisions, companies were separated into the four definitive groupings of Micro (1-9 employees), Small (10-49 employees), Medium (50-249 employees) and finally Large (250 or more) companies. The statistics that were focussed on for each coded division and year included the number of enterprises, employment numbers and annual turnover for each company within these sectors. This gave an understanding of how many companies there were in each year and thus the trend of change between years. The results were additionally displayed as percentages of the entire industry within each year, allowing accessible viewing of market share.

While the initial steps of this project looked at the 722 and 726 SiC Codes individually, combining these codes together, in order to gain a more holistic overview of the industry at large was undertaken. Tables and graphs were constructed on the same basis as described before, however were weighted according to the size of each SIC Code industry as to eliminate any biases.

Part 6.04 Methodology

One of the most important factors to the success and accuracy of any barometer is the method of comparison of differing components, and more importantly the ease with which it allows comparables to be made, be it by country, region or competing organisations. Arguably the easiest way in which to compare data is through either a rating or ranking system.

Ranking systems group entities in such a way that at least two items are compared against each other and thus allows a process to see which should come higher in the ranking. By differentiation according to a given grading scale (rating), rankings make it possible to evaluate complex information according to certain criteria.

Rating systems provide an assessment of institutions on a predefined scale. Ratings do not include the two aspects of operations and aggregation in the form of ranking lists. Nevertheless, ratings can be transformed into ranking groups or be part of rankings.

Due to the complexity[73] in developing predefined scales and the lack of normative and applied benchmarks, it was decided to take the ranking approach. For the development of a grading scale two reference points were available:

1. International comparison
2. Longitudinal comparison

An international comparison was the preferred approach, as it allowed the identification of absolute real life performances, hence created a best practice, which was defined as benchmark indicators. It also allowed for the longevity of the barometer, as when this barometer becomes more internationally focussed and looks at the health of the software industry globally, it will allow global benchmarking and rankings. In order to achieve this future international comparative, international data is required which is often not applicable because of availability or time restrictions and also that international indicators have to be scaled to account for different sizes of economies[74].

In the cases where international data was not available, a longitudinal approach was chosen. Instead of using a best practice reference point, the longitudinal data provide insights into the relative development of certain activities over time within an economy[75].

Part 6.05 Data Collection

A number of steps were undertaken during the data collection process to ensure that the Software Economy Barometer gave the highest level of transparency and the ability to be verified and replicated.

The steps involved the grading of public and freely available datasets as well as from a number of commercial databases. Whenever possible, the barometer used data that was public which leads to the transparency of the barometer and hence increases the acceptance by both public and analytical teams. The sources ranged from international statistical organisations such as OECD, EPO and UN

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[73] It is unclear which of the many aspects and activities actually extend the software industry and can contribute to the overall economic activities, e.g. which number of venture capital backed software companies or number of computer science students should be achieved?

[74] (Example 1B: There are more UK software companies per capita in the UK then in country XYZ; example 1C: the UK has the XYZ highest number of students in computer science).

[75] (Example 2A: The number of software companies has gone down from 200X to 200Y by Z%, note: there is no evidence that the number companies in 200X was respectable)

studies, but were also sourced on a national level to include ONS, HESA, DIUS and Companies House. As public sources are not as comprehensive, private resources such as the Dow Jones, Forbes, LSE and Financial Times were used for reference. To gain further insight it was also essential to access commercial databases such as Library House's European Venture Intelligence database and Zephyr's FAME database.

To achieve the best results, all raw data behind the indicators was collected, hence allowing an in-depth analysis from a variety of different and custom viewpoints to be undertaken.