Contributing to the debate...

The Demand for STEM Graduates and Postgraduates

CIHE STEM Policy Group
January 2009

Summary

The demand for graduates with science, technology, engineering and maths (STEM) skills is likely to increase faster even than the overall increase in demand for graduates. The workforce of the future will increasingly require higher-level skills as structural adjustments in the economy force businesses to move up the value chain. These jobs of the future will increasingly require people with the capabilities that a STEM qualification provides.

- Why is STEM important to the economy? The CIHE's research on the international competitiveness of UK business found that STEM skills are not only important in traditional STEM-related sectors: 24 per cent of employees in knowledge intensive service businesses have science and engineering degrees.

- New research jointly commissioned by CIHE with DIUS and the ETB from the University of Warwick on benchmark projections about business requirements for STEM skills reveals that, based on past employment figures, demand for STEM graduates and postgraduates will grow significantly faster than the average for all subject groups. This reflects both a demand for new jobs and demand to replace those retiring. These projections are based on a medium term view on the economy rather than taking account of the impact of the 'credit crunch' in the short term.

- Data from a pilot survey of the CIHE's member companies confirms this analysis. It shows that STEM graduates range from 30 to 98 per cent of their annual graduate intake, with this number expected to grow between 2010 and 2015.

- The falling share of young people choosing to study STEM subjects remains a concern, despite progress with maths take-up in secondary schools, especially for sectors that will increasingly rely on highly-qualified STEM graduates and postgraduates.

- The CIHE supports the STEM Framework developed by DIUS, and we urge all to back the set of transparent performance indicators that the CIHE, DCSF and DIUS are developing with the government's STEM High Level Strategy Group. However, these initiatives will require a long-term and consistent commitment to achieve sustainable change in the numbers of young people and then A-level entries into STEM subjects, especially physics.

- HEFCE's allocation of £350 million to boost STEM and other key vulnerable subjects over seven years to 2012 can only be the start of a turn around. The broad nature of the programme, involving partnerships of schools, universities, government, learned societies and the research councils has to be the right approach. But sustained effort is needed to change attitudes to STEM subjects and careers. Business must continue to play a prominent and more co-ordinated role in this.

- Employers and business organisations will have to market the attractions of STEM careers to get a clearer message to young students that studying a STEM subject opens a wide range of opportunities as well as being likely to lead to a more highly paid job.

Written by:
Keith Herrmann, Deputy CEO

The Council for Industry & Higher Education

Studio 11, Tiger House
Burton Street, London
WC1H 9BY

Tel: 020 7383 7667
Fax: 020 7383 3433
Email: cihe@cihe-uk.com
Web: www.cihe-uk.com

CIHE Action

The CIHE participates on the DIUS High Level Strategy Group on STEM where we are represented by Nick Winser, the UK Head of Country and main board member of National Grid. We also have our own STEM group of CIHE member companies chaired by Dick Olver, the Chairman of BAE Systems. We are working to:

- achieve a better understanding of business demand for STEM skills: the CIHE, DIUS and ETB will publish a report by IER Warwick in January 2009 which makes some medium term benchmark projections about future demand for STEM skills in the economy;
- develop greater coherence in business engagement with the STEM agenda by encouraging our member companies and others to collaborate more on the education and awareness raising initiatives they support in schools;
- develop a coherent set of KPIs to monitor outputs and outcomes in the STEM supply pipeline – we are working with DIUS and DCSF on this.

Introduction

In our response to the DIUS consultation 'Higher Education at Work' we stated the concerns of CIHE businesses on the critical shortage of STEM skills in the economy:

"We cannot stress too forcibly our concern at the critical shortage of graduates and post-graduates with STEM capabilities. This is a burning platform that has to be addressed or the UK will not remain competitive."

STEM capabilities underpin our economy. Organisations in all our high added value sectors on which this country relies depend on those with STEM skills. As our report *'International Competitiveness and the Role of Universities'*[1] highlighted, knowledge intensive service businesses have 24% of their employees with science and engineering degrees (and 20% with other degrees). CIHE business leaders consider there to be a critical shortage of graduates with numerical abilities. This will only get worse given the current age profile of their workforce. The leaders and managers of the future have to be numerate. Currently we are vulnerable as a nation as our businesses and university STEM departments are over-reliant on overseas postgraduates in particular. There are skill shortages across the range of STEM disciplines as well as in particular specialisms (from electrical and power systems engineers to pharmacologists with in vivo animal experience). There is a particular need to persuade more girls to study STEM subjects. Businesses are recruiting maths graduates from India and other Asian nations.

"...Businesses can do more through better co-ordinating their messages and approaches and taking more students on placements."

The fragility of our position against global competition needs to be addressed by opening the eyes of the young to the opportunities that studying a STEM subject offers and by continuing to train more teachers in STEM disciplines[2]. There is a societal disinterest in STEM and a lack of awareness of the exciting careers and opportunities it offers. Businesses can do more through better co-ordinating their messages and approaches and taking more students on placements. The school curricula needs to be modernised; the 14-19 Diplomas offer a way forward provided teaching capacity can be built and clear pathways and high quality careers information, advice and guidance (IAG) offered.

Support for the national STEM framework

We support the STEM Framework developed by the STEM Director and urge all to support the set of transparent performance indicators that we are developing with the Government's STEM High Level Strategy Group. The Government needs better advice on future business demand for STEM graduates.

We support the role being played by the nine regional Science Learning Centres with which the National Centre have a specific remit to enhance the continuing professional development of science teachers. We also support the *'Transition to Teaching'* initiative that supports the transitioning of STEM staff from business to teaching either on a full-time or part-time basis.

[1] Richard Brown, International Competitiveness and the Role of Universities, CIHE: London, 2007

[2] Hugh Smith, STEM Review: the Science, Technology, Engineering and Maths Supply Chain, CIHE: London, 2007

Since the STEM issue spans all sectors, the CIHE, the CBI and UKCES in partnership might consider establishing a STEM business supremo to articulate a more coherent business voice on this burning issue. It is crucial that we work with the National STEM programme and the four HEFCE-funded projects. And now that HEFCE has appointed the University of Birmingham[3] to lead their national STEM programme in partnership with the Royal Society of Chemistry, the Institute of Physics, the Royal Academy of Engineering and a consortia of mathematics societies, it is likewise crucial that the business sector continues its full support to these projects and works to support plans beyond 2012.

All parties need to be more co-ordinated and focused on getting the message to young people that studying a STEM subject opens a wide range of exciting career opportunities. Young people need to appreciate that studying a STEM subject can enable them to address such compelling issues as climate change, disease and poverty as well as developing the next generation of aero engines, drugs and financial or IT service products. There are too many well-meaning but sub-critical initiatives from too many organisations. We need as a nation to focus on getting more school teachers to have relevant subject specific skills. It is inspirational teachers with up-to-date subject knowledge who inspire young people. The CIHE also welcomes the *ETB Visiting Lectureship* scheme that supports business people engaging closer with schools and colleges. We support graduates and also undergraduates better informing young learners as they can relate to what turns them on. Universities have to have more of their costs in delivering STEM covered by the funding councils and hence from Governments across the UK. The STEM issue is a UK issue.

The Warwick IER Research

The Warwick Institute for Employment Research (IER) provided the primary analysis that underpinned the Leitch Report and its call for at least 40% of the workforce of 2020 to have higher-level qualifications to match the projections for jobs at that level. We invited the IER to develop this analysis further so as to identify the STEM component of that future projected demand at HE level. In order to produce the benchmark projections, the IER used the Labour Force Survey (LFS) data to extend previous work on projections of employment by qualification level as published in *Working Futures*[4]. The main innovation is the use of the LFS to assess recent historical developments in the pattern of employment by subject/discipline for those qualified at degree level and above.

The LFS includes information on the subject of qualifications for those qualified at degree level and above and although this is limited in value because of small sample sizes for a very detailed sectoral analysis, it can provide some useful insights into broad demand trends for STEM subjects.

It should be emphasised that such projections have their limitations. They take no account of changes in the flows emerging from the educational system (the supply side). They conflate both supply and demand influences, and indicate the numbers that might be expected if recent trends continue.

"...the fastest growth in employment is expected to be for those qualified at the highest levels..."

The full report from the IER will be published in January 2009. The findings show that the fastest growth in employment is expected to be for those qualified at the highest levels (all subjects), while the number of those in employment with no or few formal qualifications is projected to decline. The report presents some benchmark projections of "demand" (numbers in employment) for STEM disciplines[5] based on an analysis of the historical trends in LFS data combined with the latest Working Futures projections of employment by sector and occupation. The report highlights the following trends and considerations:

[3] HEFCE has selected the University of Birmingham to host the national higher education programme for science, technology, engineering and mathematics (STEM) It will work with the current HEFCE-funded STEM demand-raising projects to develop the national programme, which will run from August 2009 The national programme will aim to deliver a sustained increase in STEM graduates, and satisfy the need for higher-level skills in these subjects among employers.

[4] See *Working Futures Qualifications Report* at : http://www.ukces.org.uk/Default.aspx?page=28)

[5] Strictly the results are the reflection of both supply and demand influences.

Graduate employment landscape:

- In 2007 graduates and postgraduates accounted for some 33% of those in employment across all sectors.
- People qualified at postgraduate level in STEM subjects accounted for some 1 million people in employment in 2007 (all industries).
- Those with a first degree in STEM subjects accounted for just over 8% of employment, some 2.5 million people.

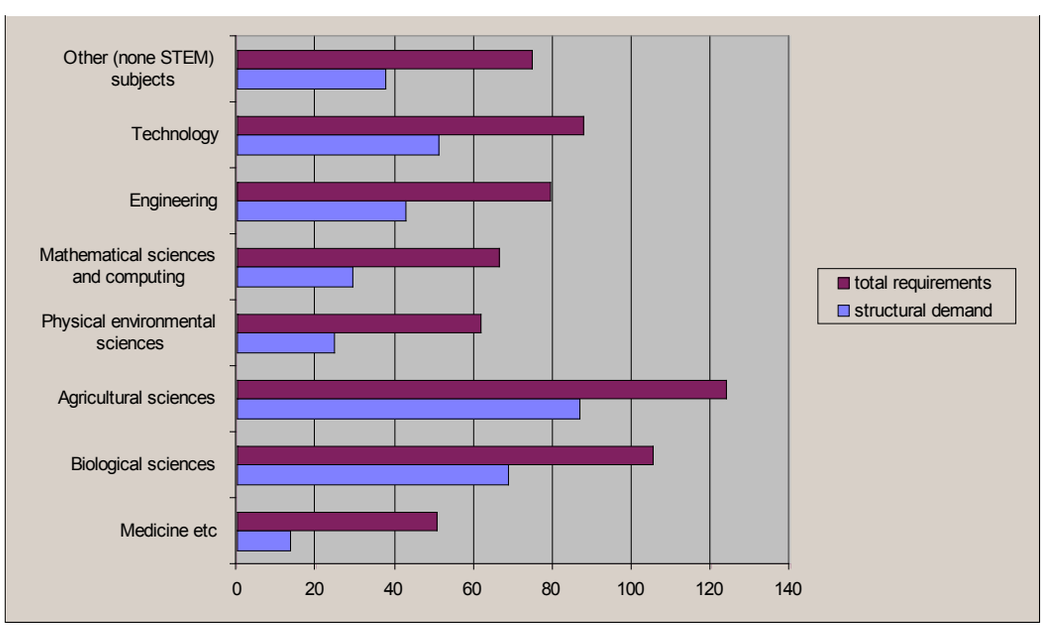
Sectoral analysis:

- In ***manufacturing*** the rate of growth of employment for STEM graduates is faster than elsewhere, despite the fact that overall employment prospects are poorer in this sector.
- The sector with the largest share of people employed who are qualified in STEM subjects at first degree level or above is ***non-marketed services*** (such as education, health, public administration, and defence).
- The ***business and other services*** sector accounts for even greater numbers of STEM graduates and postgraduates than the public sector – especially for those qualified in subjects such as mathematics and computing.
- Significant numbers are also employed in ***distribution and transport*** (including hotels and restaurants).
- The ***primary sector*** (including utilities) and ***construction*** both employ significant numbers of STEM graduates and postgraduates, but these are small compared to the numbers in other sectors.

Figure 1 shows significant levels of growth in percentage terms in employment across a range of 'STEM intensive' sectors for STEM postgraduates over the next decade. Although, overall postgraduates only constitute 3% of overall employment, this chart shows substantial levels of future 'demand' for STEM postgraduates and highlights the structural shift in the economy towards knowledge intensive sectors which is needed to maintain Britain's competitiveness in global markets.

In terms of numbers (as opposed to percentages) significant growth is predicted in the demand for biological sciences, reflecting the significance of our pharmaceutical sector.

Figure 1: Projected changes in employment, STEM post-graduates, 2007-2017 (%)



Source: Taken from IER (2008) 'The Demand for STEM Graduates: some benchmark projections', Warwick: IER, Warwick University.

Benchmark projections for STEM 'demand'

Regarding future demand for a STEM qualified workforce, we observe the following broad trends and issues:

- The effects of 'demand' and 'supply' factors are difficult to separate, and thus should not be seen in isolation.
- ***Based on past employment trends, 'demand' for STEM graduates will grow significantly faster than the average for all subject groups, subject to the impact of the 'credit crunch' in the short term.***
- Current employment data on STEM occupations highlight the long term shift in the economy away from manufacturing towards business and other services and non-marketed services.
- The rate of growth of employment for STEM graduates is faster in manufacturing despite the fact that overall employment prospects for these sectors are less good than for all industries and services.
- The age profile of the STEM population in the workforce means there will be a significant demand for STEM qualified people to replace older workers as they retire over the next decade – 'replacement' demand is as important as 'expansion' demand.
- The falling shares of young people choosing to study STEM subjects remains of concern, despite progress with maths take-up in secondary schools, especially for industries which will increasingly rely on highly qualified STEM graduates and postgraduates.

Generally the STEM subjects are projected to see faster growth than average over the decade to 2017. Exceptions are Physical and Environmental Sciences and Engineering at 1st degree level.

Table 1 highlights the projected demand for all industries across NQF qualification categories, and demonstrates the future demand for people with 'higher-level' qualifications increasing significantly.

Table 1: Implications for Qualifications

All industries NQF category	Base year level 2007	Change 2007 - 2017	Projected level 2017	Total requirement 2007 - 2017
NQF 5	2,420,669	897,709	3,318,378	1,789,070
NQF 4	7,986,647	1,968,485	9,955,133	4,909,404
NQF 3	6,125,075	179,841	6,304,917	2,435,274
NQF 2	6,805,987	-169,232	6,636,754	2,336,932
NQF 1	5,422,300	-112,897	5,309,403	1,883,753
NQF 0	2,473,769	-814,580	1,659,188	96,334
Total	31,234,447	1,949,326	33,183,774	13,450,768
	% share	**% change**	**% share**	**% of base year level**
NQF 5	7.7	37.1	10.0	73.9
NQF 4	25.6	24.6	30.0	61.5
NQF 3	19.6	2.9	19.0	39.8
NQF 2	21.8	-2.5	20.0	34.3
NQF 1	17.4	-2.1	16.0	34.7
NQF 0	7.9	-32.9	5.0	3.9
Total	100.0	6.2	100.0	43.1

Source: Taken from IER (2008) 'The Demand for STEM Graduates: some benchmark projections', Warwick: IER, Warwick University. IER estimates based on Working Futures 2007-2017.
Notes: Total requirement includes replacement needs, including losses due to retirements.

A CIHE pilot survey

A group of HR Directors mainly from CIHE member companies helped us develop a pilot survey on the STEM questions and issues they thought were important. The questions were piloted with a broadly representative sample of businesses. The results of this sample survey are set out in a fuller report which can be found on our website at www.cihe-uk.com.

Respondents covered the manufacturing, utilities, banking, consultancy and accountancy sectors. All were organisations with annual turnover of +£2 billion.

They expect a 2008 recruitment total of 1,827 STEM graduates and postgraduates, in addition to 200 experienced hires with STEM degrees. STEM graduates range from 30% to 98% of respondents' graduate intake, with the median expected to grow from 67% to 70% between 2010 and 2015.

Fifty percent indicated that they would recruit a higher proportion of their STEM graduates from the UK, and a further 35% would do so subject to conditions. The conditions included: holding sound work experience; meeting interpersonal skills standards; international awareness; cultural orientation and language skills; and work permit status. There was some need expressed to achieve a graduate intake which balanced internationally and locally educated graduates and a need to take account of their expanding global operations in future recruitment policies.

A number of factors were identified which make graduates from one institution or department more appealing than from another. Factors that were quoted included:

- Relevance of subject and modules
- Placements and industrial experience
- Specific courses offered (targeted specialisms)
- Breadth of graduates' knowledge and skills
- Interpersonal skills, not the subject studied.

"... it is important to look at the detail of what a student has studied..."

These results support the general returns from the Sector Skills Councils and other employer organisations in that they emphasise the expected growth in demand for graduates and post-graduates with STEM skills and the importance of looking at the granular detail of what a student has studied. The Cogent Sector Skills Council response accounts for about the same number of STEM graduates (1,900) as the CIHE cross-sector respondents. They see projected numbers as fairly steady at around 65% of overall graduate intake. Engineering, chemistry and then biology are their priority subjects in terms of quantity, with engineering, chemistry and then physics in terms of criticality.

The results of the pilot survey suggest that this simple questionnaire is suitable and understandable for businesses, and it provides some useful indicators of future trends.

The granularity of perspectives

The CBI and other business organisations, including Sector Skills Councils, have offered evidence on business 'demand' for STEM, and their views have emphasised the growing concern about the STEM supply chain given the needs of business in the future. Data on the imbalance between demand and supply is very difficult to determine with certainty. Detailed analysis by the Migration Advisory Committee (MAC) suggests that for STEM occupations demand and supply are currently broadly in balance, although some occupations are highlighted on the MAC's *"shortage occupation list"*. Notwithstanding these estimates from the MAC, business leaders remain concerned about the future. This is particularly so when taking into account the current high average age of people in STEM occupations, the low levels of take-up of STEM subjects by A-level students and the high numbers of international students undertaking STEM courses at postgraduate level.

Some employers want graduates who have very specific skills and experience. Some lament that there is a shortage of graduates who have these skills. This raises the issue of the role of higher education institutions (HEIs) and how far they should be developing graduates for specific jobs or developing graduates with a broad range of knowledge and a broad set of skills and competencies.

"The CIHE has stressed that the role of HEIs is to develop reflective practitioners..."

The CIHE has stressed that the role of HEIs is to develop reflective practitioners – people who can analyse, identify and solve problems, question why things are done in certain ways, be enterprising and even innovative and help transform the organisations they join. This is not to say that individuals should not have deep subject knowledge or that the curriculum should not change to reflect changing student and organisational needs. The HE system has been very adept at effecting these changes (as the growth or re-branding of courses in forensic science bears evidence). Sometimes specific courses have been jointly developed with organisations to meet an identified and growing need – the establishment of systems engineering at Loughborough University in partnership with BAE Systems would be an example of such an approach.

But it is difficult for HEIs to change their curriculum quickly even if they thought there was a definite long-term market opportunity. Neither are they in the business of reflecting short-term or very instrumentalist demands from organisations as though they were *"mere training organisations"*. So even if labour market information was entirely reliable and co-ordinated, it does not follow that HEIs will feel able to respond. But where there are clear and consistent trends, then HEIs need the internal accreditation processes backed by responsive external quality agency support to be able to effect speedy changes. Business organisations (SSCs, professional bodies or trade organisations) will want to convey these needs and trends clearly and work with selected institutions to develop and even help deliver that curriculum (especially where it involves work experience/student placements). Better articulation of need allied with closer partnerships are required at the local level.

The pipeline of students

The lack of volume of STEM graduates reflects in large measure weaknesses further back in the STEM pipeline. Only 36% of students in England have an A-level. Those with A-levels in STEM subjects tend to be concentrated in certain schools (especially in the private sector). The vocational route is not yet vibrant enough and though support for the new Diplomas is healthy, there will need to be more vocal acceptance from universities and employers if more students are to take diplomas.

Maths Ranking 1995-2007: England's secondary pupils

1995: 25th place
1999: 20th place
2003: 18th place
2007: 7th place

The latest school and university data is encouraging but comes on the back of a steady long term decline in the numbers of students taking STEM subjects. Figures from UCAS show that in 2008-09 universities' acceptances of students in mathematics have risen by 8.1 per cent from 2007-08. Chemistry was up by 4.4 per cent, and physics by 3.3 per cent. These increases build on what may be an emerging trend: the figures from 2005-06 and 2007-08 show acceptances in mathematics increasing by 12.4 per cent, chemistry by 12.1 per cent and physics by 10.3 per cent. While universities' engineering acceptances fell by 0.8 per cent between 2005-06 and 2007-08, they have increased in 2008 year by 6.4 per cent. Between 2005-06 and 2007-08 mathematics A-level entries rose by 15.7 per cent, while further maths was up by 29.5 per cent. Entries for chemistry were up by 5.3 per cent and physics by 4.4 per cent, but the numbers entering IT and computing continue to fall reflecting the position at A-level.

England's pupils have been placed in the top 10 for science and maths in a global league table of achievement. The Trends in International Mathematics and Science Study[6] (Timss) is a major four-yearly comparison of standards in primary and secondary schools. The 2007 report shows that the highest score is for secondary science, where England's 14-year-olds are ranked fifth. In the three other categories, England was in seventh place. This is a significant improvement on the last round of tests in 2003.

[6] The Timss survey, run by Boston College in Massachusetts, is claimed as the largest assessment of international pupil achievement, with each country sampling 4,000 pupils in 150 schools from over 60 regions around the world. A brief article on the findings is available online at http://news.bbc.co.uk/2/hi/uk_news/education/7773081.stm

These figures are very welcome, but there remains much to be done. HEFCE's allocation of £350 million to boost STEM subjects over seven years to 2012 can only be the start of a turn around. The broad nature of the programme, involving partnerships of schools, universities, government, learned societies and the research councils has to be the right approach. But sustained effort is needed to change attitudes to STEM subjects and careers, and business must continue to play a role in this.

Employers and business organisations will have to market the attractions of STEM careers and the wide range on offer to get a clearer message to young students that studying a STEM subject opens opportunities as well as being likely to lead to a more highly paid job. Despite the popular perception, the City does not attract a large percentage of those with STEM subjects. Table 2 below from DIUS shows this, and that a considerable number of STEM graduates follow science-related careers, the exception being maths where the skills of maths graduates are more easily compatible with, and in demand by, City firms.

Table 2: Demand: Proportion Working in STEM Occupations

	Scientific Occupation	Finance (i)	Finance (ii)	Teaching	Other
Medicine and Dentistry	95	1	0	0	4
Subject Allied to Medicine	80	1	1	3	15
Biological Sciences	22	2	3	21	52
Biology	31	0	3	17	49
Sports Science	1	4	2	31	62
Psychology	23	2	5	20	50
Veterinary and Agriculture	28	2	3	8	59
Physical Sciences	30	4	4	14	48
Chemistry	36	5	1	14	44
Physics	44*	10	7	18	21
Forensic and Archaeological Science	60*	0	0	0	40
Mathematical Sciences	25	20	13	18	24
Computer Science	47	4	9	6	34
Engineering and Technology	59	3	3	3	32
Engineering	61	2	3	3	31
Technology	38*	6	4	0	52
Architecture, Building and Planning	53	0	1	0	46
STEM	49	4	4	9	34
Non-STEM	5	7	7	18	63
TOTAL	24	5	6	14	51

Source: DIUS (2008), taken from presentation at STEM demand and supply workshop, 06 October, 2008. Extract from DLHE longitudinal HESA data of graduates 3 and a half years post graduation, 2006

Notes: The STEM totals reflect a weighted average of STEM graduates in STEM occupations, i.e. 49% of STEM graduates end up in STEM occupations. This also shows that only 5% of non-STEM graduates work in STEM occupations. Overall, as an average of all graduates, 24% work in STEM occupations.

Conclusions

"... Employers will have to get a clearer message to young students that studying a STEM subject opens opportunities..."

We strongly support efforts to address the 'supply' aspects of the STEM pipeline, and refer DIUS and key stakeholders to consider again the recommendations from the CIHE report on the STEM supply chain[7]. But none of us will know whether these 'supply-side' initiatives are sufficient until we all have a clearer and more agreed understanding of 'demand'. Our work and those of others can only be a start. The Sector Skills Councils and RDAs are particularly well placed to establish and articulate sectoral and local demand, but not all have yet focused on this issue especially at graduate and postgraduate level.

[7] Hugh Smith op.cit. 2007

There is also much still to be done by stakeholders in Government, education and business to ensure that the 'leakages' in the supply chain are addressed, and that all stakeholders are more involved in raising awareness among young people about career prospects in STEM occupations.

"...we need to provide ongoing and more granular insights about the demand for STEM graduates."

The IER Warwick report provides some very useful projections about demand for STEM skills in the economy, but we need a range of business stakeholders to provide ongoing and more granular insights about the demand for STEM graduates.

The CIHE will work with the CBI, UKCES, SSCs and other business organisations to provide appropriate business leadership on STEM. We look forward to supporting the new HEFCE group chaired by Peter Saraga which will consider graduate supply and demand in STEM subjects areas.

Annex A

Demand for STEM Graduates and Postgraduates – a pilot survey

SURVEY FINDINGS SUMMARY

Context
A recent meeting of HR Directors has reiterated the consensus view that UK businesses are seriously concerned about the shortage of graduates and postgraduates with STEM (science, technology, engineering and maths) skills.

Various reports from the CBI, CIHE, Sector Skills Councils and other organisations have stressed this shortage, and the UK's over-reliance on recruiting those from overseas to plug current gaps. But we have little robust information about demand for STEM graduates and post-graduates and why the pipeline of UK students needs to be increased.

This pilot survey by CIHE sought to begin to fill this gap, particularly as it related to obtaining a more in-depth and qualitative perspective on employer views.

Method
CIHE designed a short questionnaire to pilot the capturing of this information, distributing it to about 35 Council member companies and 3 Sector Skills Councils.

Responses have been consolidated and analysed, and the findings are summarised below.

Findings

Sample
Respondents covered the manufacturing, utilities, banking, consultancy and accountancy sectors. All were organisations with an annual turnover of +£2 billion. The Sector Skills Council for Chemicals and Pharmaceuticals, Nuclear, Oil and Gas, Petroleum (Cogent) also responded.

Scale and sources of STEM recruitment

- The eleven employers expect a 2008 recruitment total of 1,827 STEM graduates and postgraduates, in addition to 200 experienced hires with STEM degrees.
- STEM graduates range from 30% to 98% of respondents' graduate intake, with the median expected to grow from 67% to 70% between 2010 and 2015.
- 56% of these STEM recruits come from UK universities – this essentially concerns new graduates; employers' knowledge of the university provenance of experienced hires appears to be more limited.

- The Cogent sector anticipates an intake of 1,975 STEM graduates in 2008 – slightly more than the employer group combined. STEM subjects account for 64% of the overall intake and is expected to remain stable year on year.

UK as a source of increased STEM recruitment

Two organisations, accounting for 11% of the respondent group's intake, stated that they would not recruit a higher proportion of their STEM graduates from the UK if they were available. Reasons for this included the need to recruit in a pattern that matches the global spread of their operating assets.

On the same basis, 50% would recruit a higher proportion of their STEM graduates from the UK, and a further 35% would do so subject to conditions. The conditions included the holding of sound work experience; meeting interpersonal skills standards; international awareness, cultural orientation and language skills; work permit status. There was some need expressed to achieve a graduate intake which balanced internationally- and locally-educated graduates.

Preferred institutions for mobile STEM graduates

Preferred sources of internationally mobile STEM graduates and postgraduates are summarised by the employer respondents as follows (as % of respondent group's intake):

- UK universities: 28%
- Any university: 7%
- Specific universities: 62%
- Uncertain/No view given: 3%

Respondents giving specific institutions named the following:

- UK: 5 (Edinburgh, Heriot-Watt, Imperial College, Leeds and London School of Economics)
- Continental Europe: 7
- N. America: 6
- Asia: 19 (+ Indian Institutes of Technology)

Inclusion of Middle East and Australian HEIs was indicated as likely in future.

Factors which appeal to recruiters

A number of factors were identified which make graduates from one institution or department more appealing than from another. Factors that were quoted included:

"Factors which appeal to recruiters included placements and industrial experience".

- Relevance of subject and modules
- Placements and industrial experience
- Specific courses offered (targeted specialisms)
- Breadth of graduates' knowledge and skills
- Interpersonal skills, not the subject studied
- Meeting the academic level is a given – then meeting our competency standards
- Department's teaching and research quality
- Volume of engineering students
- Good ethnic and gender balance
- Assumed to be top quality academically – then focus on communications skills, languages, global orientation
- Profile of nationalities; HEI's rigour of admissions; preparation of student for business; AIESEC etc
- Accredited courses; 1-year placements; locality of HEI; targeted engineering disciplines

Ranking of STEM skills

STEM skills which the employer respondents sought the most were identified in terms both of quantity and of criticality.

Quantity

	Cited as highest need	*Citers' STEM intake*
Engineering	1st most cited	510
Chemistry	not cited	-
Physics	4th most cited	215
Mathematics	3rd most cited	700 (driven up by banking sector)
Technology	3rd most cited	850 (driven up by accountancy sector)

Criticality

	Cited as highest need	*Citers' STEM intake*
Engineering	1st most cited	195
Chemistry	not cited	-
Physics	not cited	-
Mathematics	2nd most cited	350 (driven up by banking sector)
Technology	not cited	-

These trends may indicate the influence that the financial services sector has on the expression of STEM graduate demand – engineering seen as most needed/critical by largest number of employers, but mathematics and technology more needed by the big-number recruiters in financial services.

The Cogent sector shows engineering and chemistry, and then biology, as being the key subject-supplies in terms of quantity. Engineering, chemistry and then biology are the highest subjects in criticality, with geology and physics in certain parts of the sector.

Other observations

"...need to challenge their assumptions that they can only be successful in certain sectors..."

- STEM application volumes are adequate; finding those with the ability to meet the required standards is getting harder.
- STEM graduates need to challenge their assumptions that they can only be successful in certain sectors – general management roles, for example, can suit them very well.
- The wide options that are open to good STEM graduates make them a competitive group from which to hire.
- The businesses surveyed indicated that they don't prescribe STEM degrees as a requirement, but they do tend to suit people to their field of work, which needs good quants skills.

Respondents

Employers	Sector Skills Councils
▪ BAE Systems ▪ BG Group ▪ Citibank ▪ Centrica ▪ HSBC ▪ KPMG ▪ McKinsey ▪ National Grid ▪ Royal Bank of Scotland ▪ Standard Chartered Bank ▪ United Utilities	▪ Cogent (the Chemicals and Pharmaceuticals, Oil and Gas, Nuclear, Petroleum and Polymer Industries.)

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