Enterprise and Learning Committee Inquiry into Science, Technology, Engineering and Mathematics (STEM) skills

Response by the Higher Education Funding Council for Wales (HEFCW)

About HEFCW

1 HEFCW is an Assembly Government Sponsored Body established in 1992 under the Further and Higher Education Act. It assumed responsibility for funding higher education (HE) in Wales on 1 September 1993. It administers funds made available by the Assembly in support of the provision of education and the undertaking of research at higher education institutions (HEIs), and the provision of prescribed HE courses at further education institutions (FEIs). It also accredits providers of initial teacher training for school teachers.

Purpose

2 This paper presents initial responses to the issues under discussion by the Committee. There has not been time to seek approval of HEFCW's Council for this paper, which must therefore be regarded as a submission from officers only.

Issues under consideration

3 We address in turn each of the areas that the Committee wishes to consider in the course of its inquiry.

3.1 The adequacy of provision of STEM skills in schools, further education colleges, higher education and work-based learning (including apprenticeships).

Flow from Schools and Further Education (FE)

3.1.1 The flow of STEM graduates and postgraduates from HEIs depends on the prior flow of STEM applicants from schools, FEIs and work-based learning routes. We believe that the key to increasing demand at degree level is further work to continue to raise demand at GSCE and A level within schools and FEIs, rather than increasing the supply of (expensive) HE provision in isolation. It is encouraging that across the UK, GCSE and A-level entries in 2010 indicate that students are returning to STEM subjects. Further maths was the UK's fastest growing A-level subject and maths, technology, biology, chemistry and physics showed among the biggest year-on-year subject rises. At GCSE level, entries for chemistry, biology and physics have doubled since 2007 although only 16% of overall entrants take triple science.

3.1.2 HEFCW actively encourages and supports HEIs to engage in activities that target the uptake of STEM subjects at a pre-HE level. Much of this work is done via widening access activities. In addition, *Science Made Simple*, for example, is a company spun out of the Department of Physics and Astronomy at Cardiff University in 2002. Its mission is to inspire a new generation of scientists by building bridges between researchers, professional and the public

and helping to embed science and engineering in popular culture. The company provides outreach services to schools, consultancy and staff training services and now engages in the region of 75,000 students a year. As another example, the University of Glamorgan hosts *Setpoint Wales*, which is part of a UK-wide network that exists to promote STEM awareness to young people including through embedding STEM activities into the National Curriculum. (Links to both these initiatives are provided at **Annex A**). HEFCW's own engagement with the National Science Academy and the HE National STEM programme (see **3.5.6** below) are also key in this respect.

HE Undergraduate (UG) provision

3.1.3 **Annex B** provides information on full person equivalent enrolments in HE for STEM subjects across the countries of the UK from 2004/05 to 2008/09. Data are provided for both full-time and part-time students, and undergraduate and postgraduate enrolments. Over the period the data indicate that in Wales there has been growth in:

- full time undergraduate enrolment numbers for biological sciences (increase of 10.9%), physical sciences (18.9%), mathematical and computer science (13.7%), engineering (1.4%) and technologies (46.6%, albeit from a low baseline). Wales leads the UK in enrolments in mathematics/computer sciences, but as Annex B shows, its relative positioning by UK country varies across other STEM subjects.
- part-time undergraduate enrolments for technologies (12.7%) and physical sciences (19.6%), but a drop in enrolments in all other subject areas. Mathematics for example saw a large drop in part-time enrolments (-37.3%).

3.1.4 Totalling the figures for all subject areas over the four year period, Wales has seen an 11.8% growth in full-time undergraduate STEM enrolments - the largest percentage growth for the UK. However, levels of growth for part-time undergraduates in Wales fell by -13.6%.

HE Postgraduate (PG) Research

3.1.5 Within Wales, HEFCW's Research Subgroup has also looked at issues relating to STEM from the point of view of the quality of the research base. The Subgroup is due to report in January 2011, but one of its emerging findings is that consideration needs to be given to the size, shape and structure of the HE research base in Wales, as there is evidence of a degree of under-representation in some key STEM areas of vital importance to the Welsh economy. This is a potential barrier to attracting new business investment in Wales, which is one of the five strategic priorities of the WAG's new *Economic Renewal Programme* (ERP). As the academic staffing complement in HEIs is largely driven by teaching, there is need for a holistic approach to tackle deficits in both Welsh HE teaching and research capacity. HEFCW's Research Subgroup is likely to identify a potential need for joint strategic investment in the four research and development (R & D) priority areas within the ERP (digital economy; low carbon economy (including climate change mitigation and adaptation); health and biosciences; advanced engineering and

manufacturing). **Annex C** provides details of HEFCW's Quality Related (QR) Funding for STEM subjects, whilst Annex A provides examples of other investment in both the ERP's four R & D priority areas and its six priority sectors for economic development.

3.2 The additional funding to support and promote STEM skills and whether the current supply of STEM skills is meeting the needs of the Welsh labour market, including international comparison with selected relevant countries and regions.

3.2.1 The flow of STEM skills at HE levels depends partly on sufficient flow at GSCE and A levels within schools and FEIs, and partly upon clear market signals to prospective students (at all levels) from employers. Simply to increase the volume of funded HE STEM provision in isolation from these other factors would be potentially wasteful of, for example, expensive laboratory facilities.

HEFCW Funding Methodology and STEM for 2010/11

3.2.2 That said, we do recognise the need to try to ensure that the volume of HE level provision in STEM subjects is able to meet demand. We do this primarily via our teaching funding, which forms part of HEFCW's recurrent grant to HEIs. In 2010/11 we will allocate the following levels of funding against the academic subjects listed below:

SUBJECT	£
Science	62,440,653
Engineering and Technology	25,066,802
Mathematical sciences, IT and Computing	15,715,276
Pre-clinical Medicine/Dentistry	4,440,960
Clinical Medicine/Dentistry	17,919,176

3.2.3 All HEFCW funding is allocated on the basis of credits studied. The Units of Funding per credit for STEM subjects are substantially higher than for other subjects with the UG unit for 2010/11 being £45.58 for Engineering; £40.48 for Science; and £31.97 for Mathematics. This compares, for example, with a unit of funding in Social Sciences of £17.71. (Units of funding for pre-clinical and clinical medicine/dentistry included in the list above are higher again, but these subjects are not included within the definition of STEM used elsewhere in this submission). Further information is available in our Recurrent Grant Circular for 2010/11 (**W10/10HE**).

3.2.4 In 2010/11 we have further encouraged STEM provision through our *STEM Incentivisation Exercise*, which is providing an additional £250k to encourage HEIs to move provision from non-STEM to STEM subjects. The funding is designed to cover the difference between the STEM and non-STEM units of funding and has been made available via a competitive process. As well as

ensuring that new provision will fall directly into the STEM area, a further criterion for assessing the proposals received was the extent to which they supported relevant priorities in the WAG's new strategy for HE in Wales, *For our Future*. Further information about the STEM Incentivisation Exercise can be found in our Redistribution Exercise 2010/11 Circular (W10/25HE) at http://www.hefcw.ac.uk/publications/circulars/circulars_all.aspx

Postgraduate training and links with research centres

3.2.5 HEFCW is also proactively supporting the development of postgraduate skills in STEM related subjects. Our Reconfiguration and Collaboration Fund, for example, is supporting a number of research centres that have postgraduate training firmly within their aims and objectives (see again Annex A).

Labour Market Demand for STEM Graduates and Postgraduates

3.2.6 In 2010, the CBI reported the outcomes of a survey of 694 employers across the UK in *Ready to grow: business priorities for education and skills.* This report concluded that STEM subjects are 'the foundation for innovation and technological advance. Studying these subjects opens doors to rewarding jobs now, and gives young people the core knowledge and skills to adapt to the future shape of business. Demand for experienced staff remains strong'. The report also noted:

- difficulties encountered by employers in recruiting STEM staff;
- a need for Government action to increase the numbers of young people studying STEM subjects (including more promotion of maths and science in schools and protection of STEM funding in universities);
- a role for business in engaging with schools to make science and maths exciting and by providing high quality STEM work experience at all levels.

3.2.7 However, the evidence on supply and demand for graduate STEM skills is not straightforward. Within the UK, latest figures from the Higher Education Careers Services Unit (HECSU) help illustrate current difficulties in understanding concretely the nature of employer demand for STEM skills. On 1 November HECSU reported that overall graduate unemployment has reached a '17 year high' with IT graduates having the bleakest unemployment prospects at 16% of their total number and engineering graduates also facing a jobless rate of above 10%. This statement would appear to be at odds with the findings of the CBI employer survey reported above. More specifically, within Wales, we know of no specific and robust data on Welsh employer demand for STEM subjects. We therefore look forward to emerging work by the Wales Employment and Skills Board (WESB) in this respect. WESB's second annual report, *Moving Forward: Foundations for Growth*, recognises that reliable and detailed labour market information (LMI) is currently not easily available.

3.2.8 In terms of international comparisons, another CBI report in 2009, *Stronger together: businesses and universities in turbulent times* reported that 'the UK has seen a greater decline in the proportion of undergraduates studying [STEM] subjects than many of our OECD competitors' (citing *Science and Technology Indicators*, OECD 2009). However, also in 2009, the European

Commission's Directorate-General for Education and Culture, suggested that the UK is neither a 'leading' nor a 'lagging' country in relation to STEM uptake. **Annex D** provides a link to this report and some extracts that compare UK performance with other OECD countries. We are not aware of any international studies that disaggregate data for Wales from that for the rest of the UK.

3.3 The supply of education professionals able to teach STEM subjects and the impacts of ITT grants and the Graduate Teacher Programme on recruiting STEM teachers and education professionals.

Initial Teacher Training (ITT) and STEM

3.3.1 HEFCW has statutory responsibilities for initial training for school teachers. These include ensuring that HE providers continue to meet accreditation criteria in line with requirements set by the WAG and taking account of any forecast demand for newly-qualified notified teachers to the Council by the WAG in allocating funding and intake targets for ITT. In terms of STEM subjects:

- HEIs are responsible for training teachers across the range of STEM provision for other parts of the education sector, specifically schools and post-16 education.
- PGCE ITT provision is available in Wales in Mathematics, Physics, Chemistry, Information Technology, Design and Technology, and Biology
- In 2010/11, for the first time, WAG split the intake targets for Sciences with Physics and Chemistry being accorded a higher priority than Biology and General/Combined Science. HEFCW will monitor recruitment to see what effect these changes have. WAG has also indicated its wish to see Physics numbers in particular maintained as far as possible.

3.3.2 In 2009/10 PGCE recruitment to these STEM subjects met, or in some subjects, slightly exceeded the intake targets, whereas in previous years, they have often fallen short.

Subject	**2009/10**	
	Target	Intake
Mathematics	87	89
Sciences	171	171
Design and Technology	68	73
ICT	52	54

(*Source: HEFCW Higher Education Early Students Statistics (HESES) 2009/10)*

3.3.3 PGCE provision forms the bulk of the ITT intake targets. However, there is also some provision in Secondary Mathematics, Science and Design and Technology at undergraduate level. These courses, which are a combination of two and three-year courses, provide an alternative route to ITT which can contribute to the diversity of the teaching population. The courses are generally for someone who has some experience of HE but has not completed a degree. They can attract mature candidates who may have worked in industry or other

careers previously and recruitment to these UG secondary courses also strengthened in 2009/10, benefitting from targeted marketing.

Subject	**2009/10**	
	Target	Intake
Mathematics	21	21
Science	10	10
Design and Technology	33	37

(*Source: HEFCW HESES 2009/10)*

3.3.4 However, we are aware of anecdotal indications that there are not enough jobs in Wales to match this level of ITT provision, perhaps because of alleged low turnover in the teaching profession in Wales. It may be useful for the Inquiry to look for systematic evidence on this issue.

3.3.5 The ITT sector in Wales has a joint Teacher Training and Education Forum and bilingual website (http://teachertrainingcymru.org/index.htm). The website provides up to date information on teacher training opportunities in Wales. This includes profiles of students and their experiences of teacher training which includes students on STEM subject courses.

3.4 The effectiveness of education and business links between education institutions and STEM employers.

3.4.1 Within the *Economic Renewal Programme* (ERP) WAG gives clear strategic priority to 'making Wales a more attractive place to do business'. The ERP also clearly identifies the role that employer access to HE STEM expertise, together with a supply of appropriately qualified STEM staff for their businesses might play in delivering this. HEFCW is committed to supporting effective HE-employer interactions in Wales in terms of both meeting employers' STEM skills needs (including via active engagement with the sector skills councils) and contributing to their business growth, profit and productivity, etc, through knowledge exchange activities.

3.4.2 However, the relative preponderance of SMEs in the Welsh economy complicates the identification of user 'pull' or 'demand' for university expertise in Wales. With notable exceptions, such as EADS, Wales lacks major corporate research centres. This, coupled with the absence of Government research centres, puts the onus very much on Welsh HEIs not only to generate but also to exploit new knowledge. Research led by Professor Jeremy Howells of Manchester University under the auspices of UK-wide research into the Impact of HEIs on Regional Economies has shown that in comparison with other UK regions, businesses in Wales report fewer university interactions. However, where businesses in Wales do interact with universities they value those interactions more highly than do businesses in other parts of the UK. A fundamental question raised here is how can HEIs most effectively identify

what employers want - in terms of both staffing requirements and knowledge exchange activity?

3.4.3 Further research under the above initiative by Michael Kitson of Cambridge University shows that the volume of academic engagement in Wales in the commercialisation of new knowledge is above the UK average, particularly in Engineering and Materials Sciences. Further information on the research by Kitson and Howells is available at: http://ewds.strath.ac.uk/Default.aspx?alias=ewds.strath.ac.uk/impact

3.4.4 However, this is not one-way traffic. As the CBI's *Ready to grow; business priorities for education and skills* report noted, employers also have a role to play in providing quality STEM work experience opportunities for their future employees. Of interest to the Inquiry in this context might be the decline of the sandwich degree, in which a year's work placement is sandwiched between years of academic study. WESB's second annual report (see 3.2.6 above) draws attention to the demise of sandwich degrees in Wales. In England and Scotland, e-skills UK, the sector skills council (SSC) for the IT and Telecommunications sector, has secured support for a *UK Internship Programme* that places STEM students in STEM-related companies and would be keen to extend this programme to Wales.

3.5 The implementation and impact of strategic policies and government initiatives to foster STEM skills including the role of the Chief Scientific Adviser, the National Science Academy and WAG's *Skills that Work for Wales* and *For our Future* strategies and *A Science Policy for Wales*.

3.5.1 Since the publication of the *Science Policy* in 2006, HEFCW has been working actively to help ensure its delivery. Where appropriate, we expect HEIs to demonstrate strategic fit with the *Science Policy* in their corporate planning interactions with HEFCW. For example, HEIs' Innovation and Engagement (previously Third Mission) Strategies are expected to support its delivery and we also amended the criteria for bids to our Reconfiguration and Collaboration Fund in order to take the *Science Strategy* into account. The projects listed in Annex A also provide evidence of the way in which HEIs are contributing to *Science Policy* delivery.

3.5.2 *For our Future: the 21st Century Higher Education Strategy and Plan for Wales* underpins our current remit letter (2010-11) from WAG. The letter requires HEFCW to review its approach to institutional planning and create a HE system that can deliver national strategic priorities such as STEM. Our Corporate Plan (2010-11 – 2012-13), therefore, commits the Council to the delivery of *For our Future's* twin priorities of supporting economic regeneration and social justice through a stronger, better configured HE system in Wales.

3.5.3 In line with *For our Future,* our Corporate Strategy also establishes a new regional dimension to HE in Wales, where the aim is to improve HE provision on a regional basis, especially for learners who, for whatever reason, are geographically constrained, and for employers who are seeking HE support, of

whatever kind, locally. HEIs have been asked to submit regional strategies for the planning and delivery of HE by 30 November 2010 and, in the context of the identification of any new HE provision, are required to take into account current WAG priorities including STEM. Proposals due in December for the development and delivery of foundation degrees are also required to evidence the fit with strategic priorities such as STEM.

3.5.4 HEFCW is also represented on the steering group for the National Science Academy, which with a budget of £2m, has recently determined to build upon and co-ordinate STEM work already underway across Wales. Ministers have appointed five 'hubs' to provide the breadth of experience and expertise required. The Wales Institute of Mathematics and Computational Sciences (WIMCS) led from Swansea University is the 'lead hub'.

3.5.5 As already indicated above, HEFCW is also engaged in Wales with WESB to ensure that the promotion of graduate employability skills is "a natural part of every student's university experience". WESB has challenged HEIs to put in place long-term and coherent systems to ensure that all their graduates have the basic employability skills expected of them by employers. HEFCW's role in this context is to help drive the employability agenda via the Learning and Teaching and Innovation and Engagement Strategies we require from HEIs. The indication we have from the sector is that this approach effectively encourages them to embed activity related to employability in their overall strategic thinking.

3.5.6 On a UK level, HEFCW works closely with HEFCE in England and jointly funds the HE National STEM Programme, which aims to encourage take-up of STEM subjects in schools and, subsequently, flow though to HE level study. WIMCS at Swansea University is the lead HEI for the Welsh spoke of this UK-wide programme, thus ensuring coherence with the development of Wales' National Science Academy (see 3.5.4 above). Further details are provided in **Annex E**.

Conclusion

4.1 The key points from this submission are:

a. The flow into STEM from schools/FEIs at GCSE and A level across the UK is now positive.

b. UG STEM numbers in Wales also are also showing signs of recovery, especially in mathematics/computer sciences.

c. Potential issues around the quality and capacity of the STEM research base in Wales are currently under exploration by HEFCW's Research Sub-group.

d. ITT targets for STEM set by WAG are being met. However, there is anecdotal evidence that the number of STEM teaching jobs in Wales does not match the supply of new teachers.

e. While there is evidence of broad expressions of employer demand and a strong sense of the value placed on STEM graduates by employers at a UK level, hard LMI for Wales is in short supply.

f. There are inconsistencies in the evidence over supply and demand for graduate STEM skills both in UK and international terms.

g. We believe that the key to increasing demand at degree level is to work to continue to raise demand at GCSE and A level within schools and FEIs, and to clarify the market signals for STEM graduates from employers, rather than to increase the supply of (expensive) funded HE provision in isolation.

4.2 We trust that the information in this submission is of help to the Committee's inquiry, and we stand ready to assist further in any way that the Committee requires.

Full person equivalent enrolments on science, technology, engineering and mathematics subjects 2004/05 to 2008/09 **ANNEX B**

Subject	Country of institution	Mode	Level	Full person equivalent enrolments					Year on year change				Total change
				2004/05	2005/06	2006/07	2007/08	2008/09	2004/05 to 2005/06	2005/06 to 2006/07	2006/07 to 2007/08	2007/08 to 2008/09	2004/05 to 2008/09
Biological Sciences	Wales	FS	UG	7,671	7,984	8,118	8,243	8,504	4.1%	1.7%	1.5%	3.2%	10.9%
		FS	PG	774	774	941	897	946	0.0%	21.6%	-4.7%	5.5%	22.2%
		PT	UG	1,263	1,498	1,325	1,001	1,139	18.6%	-11.6%	-24.4%	13.8%	-9.8%
		PT	PG	781	820	884	888	929	5.0%	7.8%	0.4%	4.7%	19.0%
		Total		**10,489**	**11,076**	**11,268**	**11,029**	**11,518**	**5.6%**	**1.7%**	**-2.1%**	**4.4%**	**9.8%**
	England	FS	UG	78,395	82,507	86,307	88,837	92,132	5.2%	4.6%	2.9%	3.7%	17.5%
		FS	PG	13,013	13,731	14,411	15,979	17,523	5.5%	5.0%	10.9%	9.7%	34.7%
		PT	UG	23,949	23,621	24,785	27,519	30,192	-1.4%	4.9%	11.0%	9.7%	26.1%
		PT	PG	13,450	13,493	13,766	13,068	14,466	0.3%	2.0%	-5.1%	10.7%	7.6%
		Total		**128,808**	**133,352**	**139,269**	**145,403**	**154,314**	**3.5%**	**4.4%**	**4.4%**	**6.1%**	**19.8%**
	Scotland	FS	UG	12,642	12,781	13,187	13,116	13,560	1.1%	3.2%	-0.5%	3.4%	7.3%
		FS	PG	1,842	1,738	1,944	1,901	2,027	-5.7%	11.9%	-2.2%	6.6%	10.0%
		PT	UG	635	863	1,057	710	672	35.9%	22.5%	-32.8%	-5.4%	5.7%
		PT	PG	1,268	1,216	1,328	1,193	1,162	-4.2%	9.2%	-10.2%	-2.6%	-8.4%
		Total		**16,387**	**16,597**	**17,516**	**16,920**	**17,419**	**1.3%**	**5.5%**	**-3.4%**	**3.0%**	**6.3%**
	Northern Ireland	FS	UG	2,153	2,321	2,315	2,091	2,048	7.8%	-0.2%	-9.7%	-2.1%	-4.9%
		FS	PG	292	250	281	224	368	-14.6%	12.4%	-20.1%	64.3%	26.0%
		PT	UG	352	392	322	243	128	11.5%	-17.9%	-24.4%	-47.4%	-63.6%
		PT	PG	262	231	769	194	178	-11.7%	232.9%	-74.8%	-8.2%	-31.9%
		Total		**3,058**	**3,194**	**3,687**	**2,752**	**2,722**	**4.4%**	**15.4%**	**-25.4%**	**-1.1%**	**-11.0%**
Physical Sciences	Wales	FS	UG	3,183	3,299	3,372	3,733	3,786	3.6%	2.2%	10.7%	1.4%	18.9%
		FS	PG	770	713	823	778	741	-7.4%	15.5%	-5.5%	-4.7%	-3.7%
		PT	UG	650	856	484	474	778	31.6%	-43.5%	-2.1%	64.2%	19.6%
		PT	PG	390	446	408	363	307	14.1%	-8.4%	-11.0%	-15.6%	-21.5%
		Total		**4,993**	**5,313**	**5,087**	**5,347**	**5,611**	**6.4%**	**-4.3%**	**5.1%**	**4.9%**	**12.4%**
	England	FS	UG	38,120	39,442	40,110	41,273	43,146	3.5%	1.7%	2.9%	4.5%	13.2%
		FS	PG	11,817	12,173	12,058	13,042	13,349	3.0%	-0.9%	8.2%	2.4%	13.0%
		PT	UG	13,633	14,722	13,065	13,987	15,347	8.0%	-11.3%	7.1%	9.7%	12.6%
		PT	PG	6,856	6,573	6,662	6,406	7,086	-4.1%	1.3%	-3.8%	10.6%	3.4%
		Total		**70,426**	**72,910**	**71,896**	**74,708**	**78,928**	**3.5%**	**-1.4%**	**3.9%**	**5.6%**	**12.1%**
	Scotland	FS	UG	5,898	6,344	6,606	7,035	7,107	7.6%	4.1%	6.5%	1.0%	20.5%
		FS	PG	1,462	1,674	1,925	1,942	2,081	14.5%	15.0%	0.9%	7.1%	42.3%
		PT	UG	230	263	400	305	290	14.5%	51.8%	-23.6%	-5.1%	25.9%
		PT	PG	745	685	904	1,194	1,041	-8.0%	31.8%	32.1%	-12.8%	39.8%
		Total		**8,335**	**8,967**	**9,834**	**10,476**	**10,518**	**7.6%**	**9.7%**	**6.5%**	**0.4%**	**26.2%**
	Northern Ireland	FS	UG	1,154	1,154	1,079	1,015	983	0.0%	-6.5%	-5.9%	-3.2%	-14.8%
		FS	PG	228	240	244	350	448	5.3%	1.7%	43.4%	28.0%	96.5%
		PT	UG	63	60	83	57	51	-5.3%	38.5%	-30.6%	-11.6%	-19.6%
		PT	PG	289	331	347	480	393	14.5%	4.7%	38.5%	-18.2%	35.8%
		Total		**1,734**	**1,785**	**1,752**	**1,902**	**1,874**	**3.0%**	**-1.8%**	**8.6%**	**-1.5%**	**8.1%**

Full person equivalent enrolments on science, technology, engineering and mathematics subjects 2004/05 to 2008/09 **ANNEX B**

Subject	Country of institution	Mode	Level	Full person equivalent enrolments					Year on year change				Total change
				2004/05	2005/06	2006/07	2007/08	2008/09	2004/05 to 2005/06	2005/06 to 2006/07	2006/07 to 2007/08	2007/08 to 2008/09	2004/05 to 2008/09
Mathematical and Computer Sciences	Wales	FS	UG	3,506	3,374	3,560	3,557	3,987	-3.8%	5.5%	-0.1%	12.1%	13.7%
		FS	PG	600	531	635	729	843	-11.5%	19.6%	14.8%	15.6%	40.4%
		PT	UG	2,364	2,172	1,752	1,701	1,482	-8.1%	-19.3%	-3.0%	-12.9%	-37.3%
		PT	PG	527	532	505	483	407	0.9%	-5.1%	-4.4%	-15.7%	-22.9%
		Total		**6,998**	**6,609**	**6,453**	**6,469**	**6,719**	**-5.6%**	**-2.4%**	**0.3%**	**3.9%**	**-4.0%**
	England	FS	UG	79,094	73,176	67,250	65,408	66,590	-7.5%	-8.1%	-2.7%	1.8%	-15.8%
		FS	PG	16,422	15,522	15,519	16,702	18,723	-5.5%	0.0%	7.6%	12.1%	14.0%
		PT	UG	44,206	41,812	30,650	29,267	27,712	-5.4%	-26.7%	-4.5%	-5.3%	-37.3%
		PT	PG	12,973	12,746	12,059	10,833	10,686	-1.8%	-5.4%	-10.2%	-1.4%	-17.6%
		Total		**152,695**	**143,256**	**125,478**	**122,211**	**123,712**	**-6.2%**	**-12.4%**	**-2.6%**	**1.2%**	**-19.0%**
	Scotland	FS	UG	9,019	8,201	8,207	7,626	7,996	-9.1%	0.1%	-7.1%	4.9%	-11.3%
		FS	PG	2,418	2,346	2,484	2,336	2,426	-3.0%	5.9%	-6.0%	3.9%	0.3%
		PT	UG	960	2,115	2,549	1,183	1,051	120.3%	20.5%	-53.6%	-11.2%	9.5%
		PT	PG	1,597	1,560	1,387	1,158	1,050	-2.3%	-11.1%	-16.5%	-9.3%	-34.3%
		Total		**13,994**	**14,222**	**14,626**	**12,303**	**12,523**	**1.6%**	**2.8%**	**-15.9%**	**1.8%**	**-10.5%**
	Northern Ireland	FS	UG	3,092	2,958	2,791	2,495	2,398	-4.3%	-5.6%	-10.6%	-3.9%	-22.5%
		FS	PG	208	179	103	128	140	-13.7%	-42.7%	24.4%	9.4%	-32.8%
		PT	UG	480	322	234	262	118	-33.0%	-27.3%	12.0%	-54.9%	-75.4%
		PT	PG	347	315	161	177	152	-9.1%	-48.9%	9.9%	-14.4%	-56.3%
		Total		**4,126**	**3,774**	**3,289**	**3,061**	**2,807**	**-8.5%**	**-12.9%**	**-6.9%**	**-8.3%**	**-32.0%**
Engineering	Wales	FS	UG	3,829	3,875	3,923	3,821	3,883	1.2%	1.2%	-2.6%	1.6%	1.4%
		FS	PG	536	495	579	590	806	-7.6%	16.9%	1.9%	36.7%	50.4%
		PT	UG	2,512	2,314	2,348	2,500	2,399	-7.9%	1.5%	6.5%	-4.0%	-4.5%
		PT	PG	518	550	469	388	367	6.3%	-14.7%	-17.4%	-5.3%	-29.1%
		Total		**7,394**	**7,234**	**7,319**	**7,298**	**7,455**	**-2.2%**	**1.2%**	**-0.3%**	**2.2%**	**0.8%**
	England	FS	UG	52,427	52,145	52,711	54,939	57,789	-0.5%	1.1%	4.2%	5.2%	10.2%
		FS	PG	19,583	19,531	20,318	21,264	23,600	-0.3%	4.0%	4.7%	11.0%	20.5%
		PT	UG	16,600	16,596	17,555	18,035	19,294	0.0%	5.8%	2.7%	7.0%	16.2%
		PT	PG	13,878	12,875	13,474	13,534	13,966	-7.2%	4.7%	0.4%	3.2%	0.6%
		Total		**102,487**	**101,146**	**104,058**	**107,772**	**114,649**	**-1.3%**	**2.9%**	**3.6%**	**6.4%**	**11.9%**
	Scotland	FS	UG	9,307	9,071	9,267	9,122	9,565	-2.5%	2.2%	-1.6%	4.9%	2.8%
		FS	PG	1,951	2,186	2,618	2,622	3,157	12.1%	19.7%	0.2%	20.4%	61.9%
		PT	UG	1,381	1,483	1,534	1,581	1,556	7.4%	3.4%	3.1%	-1.6%	12.7%
		PT	PG	2,258	2,255	2,407	2,512	2,206	-0.1%	6.7%	4.4%	-12.2%	-2.3%
		Total		**14,897**	**14,995**	**15,825**	**15,837**	**16,484**	**0.7%**	**5.5%**	**0.1%**	**4.1%**	**10.7%**
	Northern Ireland	FS	UG	2,175	2,142	2,124	1,987	1,875	-1.5%	-0.8%	-6.5%	-5.6%	-13.8%
		FS	PG	279	287	236	251	365	2.9%	-17.8%	6.6%	45.4%	31.1%
		PT	UG	228	479	206	242	189	110.4%	-57.1%	17.8%	-22.2%	-17.3%
		PT	PG	299	283	282	201	133	-5.5%	-0.4%	-28.8%	-33.7%	-55.5%
		Total		**2,981**	**3,190**	**2,847**	**2,681**	**2,562**	**7.0%**	**-10.8%**	**-5.8%**	**-4.4%**	**-14.1%**

Full person equivalent enrolments on science, technology, engineering and mathematics subjects 2004/05 to 2008/09 **ANNEX B**

Subject	Country of institution	Mode	Level	Full person equivalent enrolments					Year on year change				Total change
				2004/05	2005/06	2006/07	2007/08	2008/09	2004/05 to 2005/06	2005/06 to 2006/07	2006/07 to 2007/08	2007/08 to 2008/09	2004/05 to 2008/09
Technologies	Wales	FS	UG	476	515	618	659	697	8.2%	20.0%	6.6%	5.8%	46.6%
		FS	PG	88	91	131	139	153	3.4%	44.0%	6.1%	10.1%	73.9%
		PT	UG	256	316	243	272	289	23.4%	-23.3%	12.0%	6.3%	12.7%
		PT	PG	135	146	122	157	183	8.1%	-16.4%	28.3%	16.6%	35.2%
		Total		**955**	**1,068**	**1,113**	**1,226**	**1,321**	**11.9%**	**4.3%**	**10.1%**	**7.8%**	**38.4%**
	England	FS	UG	7,956	8,592	8,974	9,880	10,004	8.0%	4.4%	10.1%	1.3%	25.7%
		FS	PG	2,253	2,346	2,348	2,775	2,901	4.1%	0.1%	18.2%	4.5%	28.8%
		PT	UG	3,377	2,871	2,645	3,205	3,506	-15.0%	-7.9%	21.2%	9.4%	3.8%
		PT	PG	3,595	3,568	3,016	3,012	2,865	-0.8%	-15.5%	-0.1%	-4.9%	-20.3%
		Total		**17,181**	**17,377**	**16,983**	**18,873**	**19,277**	**1.1%**	**-2.3%**	**11.1%**	**2.1%**	**12.2%**
	Scotland	FS	UG	273	489	551	677	667	79.1%	12.6%	22.9%	-1.4%	144.5%
		FS	PG	33	37	98	139	111	12.1%	164.9%	41.3%	-20.2%	234.8%
		PT	UG	35	63	79	53	67	81.2%	26.7%	-32.6%	25.6%	94.2%
		PT	PG	46	18	24	49	45	-60.9%	33.3%	104.2%	-9.2%	-3.3%
		Total		**386**	**606**	**752**	**918**	**889**	**56.9%**	**24.0%**	**22.0%**	**-3.1%**	**130.1%**
	Northern Ireland	FS	UG	69	61	84	123	144	-11.6%	36.9%	47.4%	16.8%	108.2%
		FS	PG	26	15	11	14	45	-42.3%	-26.7%	27.3%	221.4%	73.1%
		PT	UG	4	2	7	5	8	-50.0%	250.0%	-22.6%	56.1%	111.5%
		PT	PG	120	124	92	110	138	2.9%	-25.5%	19.6%	25.5%	15.0%
		Total		**219**	**202**	**194**	**252**	**335**	**-8.0%**	**-4.0%**	**30.5%**	**32.7%**	**53.0%**
Total	Wales	FS	UG	18,664	19,047	19,591	20,012	20,857	2.0%	2.9%	2.1%	4.2%	11.8%
		FS	PG	2,768	2,604	3,109	3,132	3,489	-5.9%	19.4%	0.7%	11.4%	26.0%
		PT	UG	7,046	7,155	6,151	5,947	6,086	1.6%	-14.0%	-3.3%	2.3%	-13.6%
		PT	PG	2,351	2,494	2,388	2,277	2,192	6.1%	-4.2%	-4.6%	-3.8%	-6.8%
		Total		**30,829**	**31,299**	**31,240**	**31,368**	**32,624**	**1.5%**	**-0.2%**	**0.4%**	**4.0%**	**5.8%**
	England	FS	UG	255,992	255,862	255,351	260,337	269,660	-0.1%	-0.2%	2.0%	3.6%	5.3%
		FS	PG	63,088	63,303	64,655	69,762	76,097	0.3%	2.1%	7.9%	9.1%	20.6%
		PT	UG	101,765	99,622	88,700	92,014	96,052	-2.1%	-11.0%	3.7%	4.4%	-5.6%
		PT	PG	50,752	49,254	48,977	46,854	49,071	-3.0%	-0.6%	-4.3%	4.7%	-3.3%
		Total		**471,598**	**468,041**	**457,683**	**468,967**	**490,880**	**-0.8%**	**-2.2%**	**2.5%**	**4.7%**	**4.1%**
	Scotland	FS	UG	37,140	36,886	37,818	37,575	38,896	-0.7%	2.5%	-0.6%	3.5%	4.7%
		FS	PG	7,706	7,980	9,068	8,940	9,802	3.6%	13.6%	-1.4%	9.6%	27.2%
		PT	UG	3,240	4,787	5,618	3,834	3,635	47.7%	17.4%	-31.8%	-5.2%	12.2%
		PT	PG	5,915	5,734	6,049	6,105	5,502	-3.1%	5.5%	0.9%	-9.9%	-7.0%
		Total		**54,001**	**55,387**	**58,553**	**56,453**	**57,834**	**2.6%**	**5.7%**	**-3.6%**	**2.4%**	**7.1%**
	Northern Ireland	FS	UG	8,643	8,636	8,394	7,711	7,447	-0.1%	-2.8%	-8.1%	-3.4%	-13.8%
		FS	PG	1,032	970	874	967	1,366	-6.0%	-9.9%	10.6%	41.3%	32.3%
		PT	UG	1,127	1,255	851	811	494	11.4%	-32.2%	-4.8%	-39.1%	-56.2%
		PT	PG	1,316	1,283	1,650	1,162	993	-2.5%	28.6%	-29.6%	-14.5%	-24.5%
		Total		**12,117**	**12,144**	**11,769**	**10,649**	**10,300**	**0.2%**	**-3.1%**	**-9.5%**	**-3.3%**	**-15.0%**

Source: HESA student record 2004/05 to 2008/09

Notes
Figures for Wales include the Open University in Wales, all other Open University figures included in England figures
Numbers shown are full person equivalents (e.g. a student studying for a joint Physics and Mathematics degree is counted as half an enrolment in each; a student studying a joint Mathematics and Business Studies degree is counted as half in Mathematics
UG = Undergraduate; PG = Postgraduate; FS = full-time and sandwich; PT = part-time
Values less than 5 have been expressed as *, to prevent recalculation some values greater than 5 have been expressed as +.

Annex C

HEFCW Quality Related (QR) Funding for STEM subjects

In 2010/11, HEFCW is providing £40.4 million to support research in STEM subjects through its QR funding stream. This funding is allocated on the basis of performance in the 2008 Research Assessment Exercise (RAE), and rewards research excellence. Allocations are calculated on the basis of the RAE quality profiles and volumes of staff submitted. The allocation formula also includes a subject weighting to recognise the higher costs of undertaking research in STEM subjects. The breakdown of funding by broad STEM area is as follows:

- Clinical Medicine £ 8.6 m
- Subjects Allied to Medicine £ 6.7m
- Science and Mathematics £17.8m
- Engineering £ 7.3m

Annex D

European comparisons

A report from the European commission's Directorate General for Education and Culture (DG-EAC), **'Progress towards the Lisbon objectives in education and training - indicators and benchmarks 2009'** includes a chapter on **'Enhancing Creativity and Innovation including entrepreneurship'**. Within this chapter there is a short section on graduates in Mathematics, Science and Technology (MST) which outlines the main findings of data gathered by Eurostat or OECD. Although it does not cover engineering in the title, the subject is included in the list of number of graduates per field. This subsection covers the following, with data provided for the period 2000-07:

Evolution of the number of MST students
The number of MST students overall has increased by about 16% since 2000 (2.1%pa on average). Strong growth in Malta, Cyprus and Romania. Decline in Austria, Ireland, Belgium, Spain, Bulgaria and Sweden. In EU MST students accounted for a quarter of all students in 2007

Evolution of the number of MST graduates
Growth of over 33% in number of MST graduates for 2000-07 but with a slower increase from 2005. Portugal, Slovakia and Poland report the highest growth rate (more than 12%) with a decline in numbers by 5% or more registered in Ireland, Sweden and Lithuania. However, according to the report the significant growth in numbers is unlikely to continue, with long-term demographic decline especially in Central and Eastern Europe. A slowdown in the rate was already noticeable by 2007.

Growth in the number of MST graduates by field
Significant growth since 2000 in computing (nearly 80%) with medium level growth in engineering, manufacturing, mathematics and architecture. Slow growth in life sciences and a slight decline in physical science. There are difficulties in getting accurate information with the development of interdisciplinary studies

Growth in the number of MST graduates by type of programme
Bologna has accounted for a growth in second level degrees with a moderate increase in PhDs.

MST graduates and researchers on the labour market
5% of MST graduates were PhD graduates in EU in 2007 (30% increase from 2000) but there are insufficient employment opportunities for researchers in many Member States. This can be attributed to a lack of science jobs, MST graduates finding work in other sectors of the economy and the attractiveness of other parts of the world to continue research (especially USA). Growth in the number of researchers in the UK has averaged 1.1% from 2000-07.

The report, with charts and tables can be found on the DG EAC website. Pages 104-107 are the most relevant with some of the tables repeated in the Annex.
http://ec.europa.eu/education/lifelong-learning-policy/doc/report09/report_en.pdf

ANNEX E

HE National STEM Programme

- The National HE STEM Programme is an initiative funded by the Higher Education Funding Councils for England and Wales. Although focused around Science, Technology, Engineering and Mathematics, it primarily supports the disciplines of Chemistry, Engineering, Mathematics and Physics. These are STEM subjects that have been deemed strategically important and vulnerable, and were the subject of pilot Project undertaken in Wales and England between 2005 and 2008.

- The project is jointly funded by HEFCW and HEFCE for three years 2009/10 – 2011/12 to the sum of £21M, of which £1M is provided by HEFCW.

- The Programme has three related strands:
  - Widening access within the STEM disciplines at university level, by working with those currently within the school and FE sectors;
  - HE curriculum developments focusing upon course delivery and design, student support, to enhance student knowledge, progression and skills;
  - Encouraging those currently within the workforce and society without a prior university-level qualification to engage with further study to develop enhanced knowledge and skills.

- The Programme adopts a holistic approach by considering the progression of students from school, through university and into the workplace. It facilitates the progression of those currently within the workforce, and without a prior university level qualification, into higher education study, and at the same time encourage employers to work with universities to enhance the undergraduate curriculum and support their outreach and widening participation activities. At the heart of its activities to widen participation amongst students of school and college age is the national transfer and embedding of proven practices from four discipline based projects developed independently by the Royal Society of Chemistry (Chemistry for our Future), the Institute of Physics (Stimulating Physics), the Royal Academy of Engineering (London Engineering Project), and a consortium of mathematical bodies (More Maths Grads), into the core practice of HEIs.

- The Programme examines the current undergraduate curriculum and explores the teaching of the critical STEM skills to ensure graduates of all ages are adequately prepared for their workplace. It encourages universities to look at their teaching, learning, assessment and support mechanisms, and develop innovative practice that is then shared across the sector.

- HEIs are encouraged to engage with both employers and employees on a regional basis and develop flexible and tailored programmes of study to meet regional skills needs. The Programme supports HEIs to enter into two-way dialogue with employers regarding the provision that they offer and how they offer it. It examines successful current practice, particularly from other disciplines, to

see how this may be transferred to the STEM subjects and how such provision can be piloted, evaluated and rolled out nationally; it also encourages and supports innovation in this area exploring alternative forms of accreditation, learning and assessment.

- The University of Birmingham acts as a ‘Hub’, overseeing and initiating national activity and facilitating the flow of Programme information across the HE sector. England has been separated into five regions, with Wales making up the sixth. The Welsh regional spoke is led by the Wales Institute for Mathematics and Computational Science (a HEFCW-funded collaborative research centre) based at Swansea University. The ‘spoke’ HEI will work in partnership with the following institutions to deliver the aims of the programme - University of Glamorgan, Aberystwyth University, Bangor University, Cardiff University, Swansea University, UWIC, UW Newport, Swansea Metropolitan University, Glyndŵr University and the Open University in Wales.