

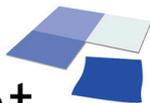
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Market forces, government agency and key disciplines:  
learning from international experience

A report to HEFCE by Curtis+Cartwright Consulting Ltd

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### **Note**

This report represents only a superficial look across 11 countries, based on desk research and discussions with contacts in the countries. Not all relevant information was available in English or accessible within the time-scale, budget and specified desk-based method for the project. In addition, the evidence collected (from policy documents and reports and from in-country respondents at Ministry level or research contexts) reflects differences of interpretation, emphasis, rhetoric and application. Hence, our statements are generalisations that need to be interpreted with care. While we have sought to verify the contents of this report with our country contacts, of necessity it may not provide a full understanding of all the cultural and other issues surrounding how key subjects are dealt with by these countries.

### **Disclaimer**

The views expressed in this report are entirely those of the study team and do not represent HEFCE's or the UK government's or the devolved administrations' views.

### **Acknowledgement**

The study team would like to thank and acknowledge all the contributors (Annex A) for their time and willing participation, and the HEFCE sponsors for their advice and guidance.

We also wish to acknowledge that if there are errors of understanding or interpretation, then responsibility for these lies with the research team rather than with those who have contributed to this study from countries outside England.

# Executive summary

## Study overview

### *Objectives (sub-section 1.3)*

- 1 The overarching objective of this evaluation was to produce:  

‘An evidence-based report presenting the findings of research into how other countries or states with similar higher education funding and student finance systems to England have identified and mitigated risks towards particular subjects or skills, and the consequences of the policy approach adopted’.
- 2 There is an immediate issue arising here. The initial broad-scoping of countries and their higher education (HE) policy and funding systems did not identify any countries that had directly or closely comparable HE funding and student finance systems to those of England (from 2012). This is perhaps unsurprising given the dynamic economic and political context that gave rise to the new (and still unfolding) English system. For this reason, we have taken a wider view of the overall and detailed objectives of the study in consultation with the Higher Education Funding Council for England (HEFCE).

### *Approach (sub-section 1.4)*

- 3 The evaluation has been carried out entirely through desk research. This includes use of academic literature and published materials (*eg* in-country websites) supplemented by correspondence and discussions with our policy and research contacts in different countries to elicit basic information and pointers to detailed resources. A list of those approached for this study is provided at Annex A.
- 4 The study examined 21 countries in a scoping phase that was used to reduce this number down in discussion with HEFCE to 11 countries for detailed investigation. The selection process is described at Annex B. The selected countries were: Australia, Brazil, Canada, Denmark, Germany, Hong Kong, Japan, the Netherlands, Poland, Scotland and the US. The HE system, the funding, priority subjects and interventions, and any available information on the success or otherwise of the interventions for each of these countries are described at Annex C.

## Key findings

- 5 The range of strategies used to support subjects and skills of strategic importance across the world is diverse. They range from initiatives to raise interest and awareness of science among youth, reduce gender gaps in science and technology education, improve funding opportunities for PhD study, and doctoral training to matching Science, Technology, Engineering and Mathematics (STEM) graduates to employment opportunities. This diversity is in part a reflection of the different political, social, economic, cultural and educational contexts (*eg* HE systems, structures and funding regimes).

### *Support for STEM or other subjects of national importance (sub-section 2.2)*

- 6 Priority subjects are found across the case study countries. However, the particular subject areas that they cover, national approaches to support these subjects and rationale for doing so, are often different from England. The rhetoric and language used can be quite different and the term ‘strategically important and vulnerable subjects’ (SIVS) is not used (or understood in the same terms):

- Many countries explicitly supported **STEM subjects** driven by the perception of a national ‘problem’ with the supply of, and/or demand for, STEM graduates. Hong Kong is an exception in the sample countries as there is both student competency in STEM and an adequate graduate supply.
- Several countries identified **vulnerable and important** subjects, although the reasons for this can be different from England. Vulnerable subjects included languages important for trade links, educational sciences and nursing; vulnerabilities can be identified at national or state level.
- Several countries have defined **national priorities** through national economic plans or strategies linked to their educational policies at all levels. These can be part of a regular planning cycle or the result of a specific review in response to changed economic or political contexts. National priorities often address other equity issues such as gender, disability or ethnicity.
- Some countries have identified **skills gaps** within particular subjects or a mismatch between graduates’ skills and employment opportunities.

### ***Interventions used (sub-section 2.3)***

- 7 The types of intervention employed for different parts of ‘the education pipeline’ present a complex picture. They vary in approach, focus (*ie* on schools, undergraduate and taught postgraduate education, research and associated post-graduate education, vocational education and training, and employment) and style.

### ***Evidence used for market-government balance (sub-section 2.4)***

- 8 The evidence used by governments for making decisions and interventions varies across the countries. It ranges from hard data and careful analysis to weaker evidence based on political assertion (see Table 2-7). Based on the limited evidence available, we suggest that the types of evidence used to determine market-government balance depend on the approach used for decision-making, the general approach that might be used for interventions, political expediency and the availability of relevant and useful evidence. We therefore consider that this is likely to mean that any differences between the types of evidence used for making decisions regarding the market-government balance between teaching, research and skills will be dominated by these cultural and contextual factors.

### ***Evidence for success or otherwise of interventions (sub-section 2.4.15)***

- 9 Most countries seek evidence of the success of their own (or others’) interventions. This includes specific evaluations of programmes or initiatives, national reviews and reports, analysis of national, international and institutional data, and audit reports, typically from Ministries of Finance or equivalent. The evidence can often be difficult to assess (internally as well as externally) because of the difficulties of long time lags between cause and effect, attribution of impact to a particular intervention, unintended consequences and the varying views of the meaning of success between countries. There appears to be a mixed picture of success or otherwise. Some interventions have been found to have had no impact. In other cases, the evidence is unclear or contradictory.

### ***Differences in funding and fee systems for England from 2012 (sub-section 2.6)***

- 10 The funding and fee system in England from 2012 is unique or rather different in a number of ways. These differences include the existence of the research evaluation system in England, but

not in all other countries in the sample, which leads to differences in the mechanisms for distributing research funding and the rationale behind the distribution; the control of access to higher education through the AAB policy, the core and margin policy and the role of the Office of Fair Access (OFFA); the approach to and purpose of the allocation of student numbers; the nature of competition between institutions in seeking to attract students; stronger ideologies of ‘competition’ and ‘contestability’ in England and the level of autonomy of the English institutions.

### ***‘Public interest’ or ‘public benefit’ reason to address market failure (sub-section 2.7)***

- 11 The terms ‘public interest’ or ‘public benefit’ are not in widespread use for policies and interventions. Instead ‘public interest’ is inferred through the use of macro-rationales identified from the case study countries for the designation of national priority subjects, themes, fields and sectors. These include: globalisation and its consequences; international competitiveness and increasing levels of competition from multiple sources; positioning and profiling of the country in particular ways; economic requirements (growth, innovation); enhancing capacity and quality (of teaching, teachers, programmes, graduates); speed of technological change and development; widening access and participation; and alignment and coordination across sectors.
- 12 The term ‘market failure’ was rarely used explicitly as a rationale for public funding subsidies and other interventions. Where it has been used, the interpretation has not always been the same. Despite this, there is abundant evidence that governments (and other stakeholders) have intervened in tertiary education and used targeted public funding in teaching and research (and at school level and with employers) in ways that accord with the OECD description of market failure.

### ***Observations (sub-section 3.3)***

- 13 The following observations provide useful overall context for HEFCE:
- The approach to priority subjects needs to be understood in the specific country’s political, social, economic, cultural and educational context; what works in one country might not work as well or at all in another and may have unintended consequences if applied literally and without analysis of context.
  - Strategies for STEM are often embedded in other policies/strategies.
  - Different countries have different approaches to oversight, management, coordination and evaluation of intervention programmes. It is not obvious what works well; the optimum approach may well depend on the country’s financial systems, political processes and accountability culture.
  - In several countries, STEM subjects are perceived as ‘too difficult’ by pupils and students, hence reducing demand for them; this cultural issue is being tackled in a variety of ways.
  - In most (but not all) of the countries, student numbers are not capped.
  - Approaches to improving the numbers of STEM-qualified individuals by encouraging immigration of international students and enabling them to stay and enter the work-force is a specific policy in countries other than England.

### ***Applicability to England (sub-section 3.4)***

- 14 The types of initiative that may be of particular interest to England include the MINT and Excellence Initiatives in Germany, Science without Borders in Brazil, Poland’s Scholarship Scheme for technical subjects, Denmark’s PhD expansion and the Netherlands’ DELTA Plan.

- 15 Beyond this, there are also interesting approaches to linking teaching and research (and HE in total) to economic development, economic growth and innovation agendas in a holistic way (eg 'Top Sectors' in the Netherlands, the KNOW project in Poland). This is similar to how SIVS has intertwined teaching and research in relation to Land Based Area Studies.
- 16 Table 3-1 provides specific suggestions of relevance to interventions being considered by HEFCE for SIVS in the post 2012 system in England.

### **Comparative education systems research**

- 17 In carrying out this work the study team has had the opportunity to examine a wide variety of resources and to discuss the objectives and data gathered with many officials and academics across the countries investigated. Moreover, given the range and variety of examples from other countries of policy initiatives that originate from similar economic and social (if not political) drivers, HEFCE would be wise to include international comparative studies in its quest for solutions to current English issues. Two clear messages arise:
- While there is academic research at the level of subject areas (eg studies of attainment in mathematics) or cross-cutting themes (eg widening participation), there appears to be little academic research into, and no clear body of knowledge about, the dynamics of a country's education and training systems and the response to interventions regarding priority subjects at the 'whole systems' level, including the interdependencies between parts of the system.<sup>1</sup>
  - There is considerable interest among academics and officials to whom we have spoken about the findings of this study and in having a forum to discuss the issues and problems (relating to priority subjects) at a whole system level so as to understand the dynamics between parts of the system and the points at which interventions are most likely to be effective (in a given culture). There may well be an opportunity to hold an international conference on this topic as a means of promoting a research agenda across countries.
- 18 If HEFCE wishes to obtain further insight into the comparison of education systems at the systems level, it is recommended that HEFCE should:
- Hold an international sector-wide event with invited speakers to discuss rationales, approaches, mechanisms and evaluation outcomes in more depth across relevant countries; it is possible that the OECD would be interested in – and might support – holding such an event.
  - Encourage the development of comparative 'whole education system' studies and publications, especially regarding the UK and other selected countries, so that the expertise and body of knowledge are available to HEFCE and others (eg EU, OECD) in the future.
  - Include international comparisons in future studies of specific sectors (eg postgraduate taught and postgraduate research provision and the dynamics of this territory).

### **Conduct of future research of this kind**

- 19 Based on our experiences of the difficulties of interpretation caused by needing to understand in some detail the political, economic and social context of each country for this research, we would recommend inclusion of an in-country fieldwork stage for future research of this kind.

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<sup>1</sup> By this we mean an understanding of the education system as a whole and how it works as a system at all levels (ie primary, secondary, tertiary, continuing education and vocational training). This includes the political and economic context, how it is funded, what its inputs and outputs are, how it meets the country's educational and skills training need, what its strengths and weaknesses are and how the system might need changing, or how it is planning to change..

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## List of abbreviations<sup>2</sup>

AGB	Association of Governing Boards (US)
AoE	Area of Excellence
ATOP	Access to Opportunities Programme (Ontario)
AUCC	Association of Universities and Colleges of Canada (Canada)
BRIC	Brazil, Russia, India and China
CAPES	Coordenação de aperfeiçoamento de pessoal de nível superior (Brazilian Federal Agency for the Support and Evaluation of Graduate Education)
CCL	Canadian Council on Learning (Canada)
CGS	Commonwealth Grant Scheme (Australia)
CNPq	Conselho Nacional de Desenvolvimento Científico e Tecnológico (Brazilian National Council for Scientific and Technological Development)
DEEWR	Department of Education, Employment and Workplace Relations (Australia)
DFG	Deutsche Forschungsgemeinschaft (German Research Association)
EU	European Union
FE	Further education
GDP	Gross Domestic Product
HE	Higher Education
HECS	Higher Education Contributions Scheme (Australia)
HEI	Higher Education Institution
HELP	Higher Education Loan Programme (Australia)
HTS	High-Tech Strategy (Germany)
HNC	Higher National Certificate (UK)
HOAK	Hoger Onderwijs Autonomie en Kwaliteit (Higher Education: autonomy and quality) (Netherlands)
HRST	Human Resources in Science and Technology (OECD)
KNOW	(National Leading Scientific Centres) (Poland)
LBAS	Language Based Area Studies (UK)
MEC	Ministry of Education (Brazil)
MEXT	Ministry of Education, Culture, Sports, Science and Technology (Japan)
MFL	Modern Foreign Languages (UK)
MINT	Mathematik, Informatik, Naturwissenschaften, Technik (STEM equivalent) (Germany)
NOW	Nederlandse Organisatie voor Wetenschappelijk Onderzoek (Netherlands Organisation for Scientific Research) (Netherlands)
OCW	Onderwijs, Cultuur en Wetenschap (the Ministry of Education, Culture and Science) (Netherlands)
OECD	Organisation for Economic Cooperation and Development

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<sup>2</sup>

Where an abbreviation is country specific the country name follows the expansion of the abbreviation.

OFFA	Office of Fair Access
PISA	Programme for International Student Assessment (OECD)
PSE	Post Secondary Education
QA	Quality Assurance
QAA	Quality Assurance Agency (UK)
QSS	Quantitative Social Science
R&D	Research and Development
RUK	Rest of the UK ( <i>ie</i> England, Wales and Northern Ireland) (Scotland)
SAC	State Accreditation Committee (Poland)
SFC	Scottish Further and Higher Education Funding Council (Scotland)
SIVS	Strategically Important and Vulnerable Subjects
SMT	Mathematics and Natural Sciences (Poland)
STEM	Science, Technology, Engineering and Mathematics
TAFE	Technical and Further Education (Australia)
UoAS	Universities of Applied Science (Netherlands)
UGC	University Grants Committee (Hong Kong)
VET	Vocational Education and Training
VTC	Vocational Training Council (Hong Kong)

# 1 Introduction

## 1.1 General

- 1.1.1 Curtis+Cartwright Consulting Limited working with Kingston University was contracted by the Higher Education Funding Council for England (HEFCE) to conduct *an evaluation into market forces, government agency and key disciplines: learning from international experience*.<sup>3, 4</sup> This document is the final report and sets out the findings of the study.

### *Terminology*

- 1.1.2 The term ‘**priority subject or theme**’ is preferred in general in this report rather than the term ‘Strategically Important and Vulnerable Subjects’ (SIVS) which has a specifically English connotation. A priority subject or theme is one which is considered to be necessary to support future economic growth (*eg* Science, Technology, Engineering and Mathematics (STEM) subjects, or a theme such as low-carbon economy) or a priority which has an important social purpose (*eg* supporting social cohesion). Where relevant in specific countries, the term ‘vulnerable subjects’ is also used.
- 1.1.3 The term ‘**country**’ is interpreted depending on context to include a federal state and/or one of its constituent states, provinces or territories of a country.

## 1.2 English policy context

### *Strategically important and vulnerable subjects in England, 2005-2011*

- 1.2.1 HEFCE’s work to mitigate the risks to the supply of graduates and skills in England was, between 2005 and 2011, conducted through the SIVS programme. This was a £350+ million programme of support that encompassed a range of interventions to raise demand, sustain provision and increase research capacity in key subjects (chiefly STEM and modern foreign languages).
- 1.2.2 The SIVS programme was originally instigated after the then Secretary of State for Education and Skills asked HEFCE in 2004 to advise on strategically important subjects and on appropriate interventions that may be necessary to support them. These subjects are also deemed to be vulnerable when there is a mismatch between supply and demand.
- 1.2.3 In general it has been the role of government with input and advice from other stakeholders such as HEFCE to define which subjects are strategically important *ie* which subjects are of particular economic and social importance or otherwise in the national interest, and HEFCE’s role to assess which subjects are vulnerable.
- 1.2.4 The list of subjects most recently designated as being SIVS was:
- STEM subjects.
  - Modern Foreign Languages (MFL).
  - Area studies and related foreign languages (also known as Language-Based Area Studies (LBAS)).

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<sup>3</sup> *An evaluation into market forces, Government agency and key disciplines: learning from international experience, HEFCE Tender, 2011.*

<sup>4</sup> *Proposal to HEFCE, an evaluation into market forces, government agency and key disciplines: learning from international experience, Curtis+Cartwright, CR518D001-1.0, 23 November 2011.*

- Quantitative Social Science (QSS).
- 1.2.5 The SIVS programme was overseen by successive Advisory Groups, first established under the chair of Sir Gareth Roberts in 2005. In 2009, the Advisory Group took on the additional responsibility of advising on graduate supply and demand, in response to a recommendation from the Sainsbury Review of Science and Innovation.<sup>5</sup>
- 1.2.6 The policy framework established and refined by successive SIVS Advisory Groups was a ‘deficit model’; once a deficit was recognised, interventions would be made to correct it. The term ‘deficit model’ also recognises that there is no overarching policy for specific areas of *the system* (eg a policy on internationalisation in response to globalisation or a policy on the contribution of the higher education (HE) sector to international trade).
- 1.2.7 At the core of the policy framework were the following key principles:
- HEFCE should be highly selective and not too interventionist because the HE system is vibrant and healthy with autonomous providers responding dynamically and competitively to changing circumstances; individual department closures do not necessarily mean that a subject is vulnerable.
  - Any interventions should be based on good evidence, support a market-led solution and not simply increase student places where demand is not present, and generally be delivered in partnership with other agencies.
- 1.2.8 Interventions undertaken through the programme included:
- Work to **raise demand and enhance teaching** such as More Maths Grads and Routes into Languages.
  - Actions to **sustain capacity** until demand-raising work took effect, including:
    - An additional £100 million to support provision of very high-cost subjects.
    - Targeted funding of places, for example, in Japanese.
    - The capability to migrate student places from a lower funding band to a higher funding band in a SIVS subject.
  - Actions to bolster **research capacity and capability**, such as supporting the creation of research Collaboration networks (eg SEPNet and Great Western Research) and providing targeted support for integrative mammalian biology.
- 1.2.9 The programme was evaluated twice: one interim evaluation<sup>6</sup> and one final evaluation.<sup>7</sup> These evaluations found that the programme was being well managed and delivering value for money, in particular by working with partner organisations to secure additional funds and disseminate and embed learning. The final evaluation also found that the programme enabled HEFCE to show leadership in this area, which itself contributed to sustaining the provision of student places. Against this, the evaluations highlighted the difficulty of attributing effects such as uptake of specific subjects to the interventions supported by the programme.

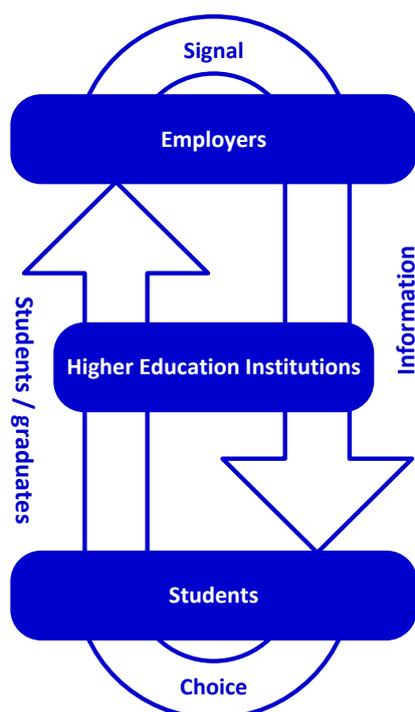
<sup>5</sup> *The race to the top: a review of the government’s science and innovation policy*, [http://webarchive.nationalarchives.gov.uk/+http://www.hm-treasury.gov.uk/d/sainsbury\\_review051007.pdf](http://webarchive.nationalarchives.gov.uk/+http://www.hm-treasury.gov.uk/d/sainsbury_review051007.pdf) [accessed 23 March 2012].

<sup>6</sup> Strategically important and vulnerable subjects: an interim evaluation of HEFCE’s programme of work, <http://www.hefce.ac.uk/pubs/rereports/year/2008/strategicallyimportantandvulnerablesubjectsaninterimevaluationofhefcesprogrammeofwork/> [accessed 23 March 2012].

<sup>7</sup> Evaluation of HEFCE’s programme of support for Strategically Important and Vulnerable Subjects [http://webarchive.nationalarchives.gov.uk/20120118171947/http://www.hefce.ac.uk/pubs/rdereports/2011/rd05\\_11/](http://webarchive.nationalarchives.gov.uk/20120118171947/http://www.hefce.ac.uk/pubs/rdereports/2011/rd05_11/) [accessed 23 March 2012].

### **Changes to the student finance system in England from 2012**

- 1.2.10 The changes to the student funding mechanism for England were set out in the June 2011 Government White Paper<sup>8</sup> and the earlier Browne Review of HE funding and student finance.<sup>9</sup> These reforms are intended to create a student-led system, in which teaching funding has been transferred from HEFCE to the student (*ie* ‘the money follows the student’). The intention is that well-informed student choice will drive innovation and excellence in HE. Student choice will be influenced and guided by comprehensive ‘Key Information Sets,’<sup>10</sup> which will communicate signals from employers about the demand for graduates through, for example, employability rates and graduate salaries. This will mean that subjects and courses that are attractive to prospective students will prosper and grow, as will the institutions that offer these courses. This cycle of information and flow of students/graduates is shown diagrammatically in Figure 1-1.



*Figure 1-1: Under the new student funding system for England, student choice will be the primary driver for excellence and innovation; student choice will be influenced by information provided by employers and HEIs*

- 1.2.11 From 2012 in England, higher education institutions (HEIs) will be funded by a mix of teaching and research grants, and student fees. Starting in the academic year 2012-13 the teaching grant is being reduced and replaced by graduate contributions in the form of repayments on subsidised loans from government. HEFCE will remain responsible for allocating the remaining teaching grant to support priorities such as covering the additional costs of subjects (*eg* medicine, science and engineering), which cannot be covered through income from graduate contributions alone.

<sup>8</sup> *Students at the heart of the system*, <http://bis.gov.uk/assets/biscore/higher-education/docs/h/11-944-higher-education-students-at-heart-of-system.pdf> [accessed 23 March 2012].

<sup>9</sup> *An independent review of Higher Education and student finance in England*, <http://webarchive.nationalarchives.gov.uk/+/hereview.independent.gov.uk/hereview/> [accessed 23 March 2012].

<sup>10</sup> *Key information sets*, <http://www.hefce.ac.uk/whatwedo/it/publicinfo/kis/> [accessed 23 March 2012]

- 1.2.12 From autumn 2012, all HEIs are able to charge up to £6,000 per year in tuition fees. Some are able to charge up to £9,000 per year. Those that do plan to charge over £6,000 need to have Access Agreements in place showing clearly that all eligible students from any background will be considered for their courses where places are available.
- 1.2.13 Prior to 2012, to contain overall costs, HEIs had allocations of student places and were fined if these allocations were exceeded. From 2012 there is some flexibility in the number of student places.<sup>8, 11</sup> HEFCE is responsible for administering a new ‘core and margin’ model whereby HEIs have a core allocation of places for students but are free to compete for students who achieve AAB at A-level or equivalent (the margin). In 2012, 65,000 student places were removed from institutions’ allocation of places to allow for this. SIVS subjects have been exempted from the adjustment to the student number control for academic year 2012-13. HEIs may be eligible for HEFCE teaching grant for high-cost subjects and highest-cost STEM subjects, and the students are able to access loans and grants. The intention is that the AAB boundary and the number of places in the margin will be extended year-by-year to encourage competition for places on the more selective courses and create the opportunity for more students to go to their first choice institution.
- 1.2.14 In addition, for academic year 2012-13, HEIs charging fees of £7,500 or less, net of fee waivers and taking out the AAB element, could bid for up to 20,000 places to support expansion by providers that combine good quality with value for money. This was intended to make it easier for further education (FE) colleges, new entrants and other non-traditional providers that can attract students, to expand to meet demand and to bring still more competition into the system.
- 1.2.15 Loans are available to cover both course and living costs for all first-time undergraduate full-time students.<sup>12</sup> Many part-time and distance-learning students are also able to access loans to cover the full tuition costs for the first time. Loans will only be repaid at a rate of nine per cent of earnings over £21,000. Repayments are based on a variable rate of interest related to income. There are no penalties for early loan repayment. In addition, grants of up to £3,250 per year are available to students from a low-income background.
- 1.2.16 A consultation paper is seeking views on the proposed arrangements for student number controls and teaching funding.<sup>13</sup>

### **Further education**

- 1.2.17 It is the government’s intention to introduce a similar system for FE from 2013/14.<sup>14</sup>

### **Research funding**

- 1.2.18 Research funding has also been reviewed as part of the government’s strategy for innovation and growth.<sup>15</sup> This includes maintaining the £4.6 billion budget for science and research programmes

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<sup>11</sup> Circular letter 26/2011, <http://www.hefce.ac.uk/pubs/year/2011/cl262011/>

<sup>12</sup> *Student finance from 2012*, <http://www.direct.gov.uk/en/EducationAndLearning/UniversityAndHigherEducation/StudentFinance/index.htm> [accessed 23 March 2012].

<sup>13</sup> *Student number controls and teaching funding – consultation on arrangements for 2013-14 and beyond*, HEFCE 2012/04, February 2012. <http://www.hefce.ac.uk/pubs/year/2012/201204/>

<sup>14</sup> *Skills for Sustainable Growth* (November 2010) set out the Government’s intention, <http://www.bis.gov.uk/assets/biscore/further-education-skills/docs/s/10-1274-skills-for-sustainable-growth-strategy.pdf> [accessed 23 March 2012].

<sup>15</sup> Innovation and research strategy for growth, <http://www.bis.gov.uk/assets/biscore/innovation/docs/i/11-1387-innovation-and-research-strategy-for-growth.pdf> [accessed 23 March 2012].

together with new funding for science capital projects (eg £158 million for e-infrastructure). Government strategy is to:

- Fund blue skies research as well as new discoveries and inventions.
- Improve the interface between HEIs and business.
- Deliver a better environment for commercialising research.

1.2.19 These goals are being met through:

- Branding the Technology and Innovation Centres as Catapult Centres to act as a bridge between academia and business and to support the commercialisation of new technologies.
- Increasing the level of the Small Company Research and Development (R&D) Tax Credit from 175% to 225% by April 2012.
- Prioritising investments into emerging technologies on the basis of rigorous criteria, and an independent assessment of UK capability to exploit their potential and succeed in global markets.
- Greater use of public procurement, helping government take the lead customer role and increasing investment in the Small Business Research Initiative.
- Increasing access to public data or to knowledge created as a result of publicly funded research.
- Accepting all the recommendations in the recent review of intellectual property by Professor Ian Hargreaves.
- Improving the framework for individuals, businesses and the public sector to innovate alone or in partnership.
- Encouraging and supporting collaboration, both between researchers and with business.

### **HEFCE's future role in SIVS**

1.2.20 The new funding regime provides an environment for SIVS which is likely to be increasingly political, dynamic, subject to change and which contains an increasing number and wider range of HE providers. These changes could have far-reaching and possibly unforeseen outcomes for SIVS. It is not yet clear for which subjects student choice can be relied upon, or how volatile student choice will be (large or sudden swings could put course or subject viability at risk), or how willing or able institutions will be to reshape provision to match demand. What is clear is that HEFCE (and indeed, other agencies and government departments) will continue to have a role in SIVS.<sup>16</sup>

1.2.21 Some £220 million intended for SIVS support for teaching is included in a number of funding streams for physics, chemistry, mathematics, engineering and MFL. In addition some £550 million is also provided in these areas through research funding. In a recent consultation, HEFCE has set out its revised policy framework for support of SIVS, which retains the 'deficit model'.<sup>17</sup>

1.2.22 The government, rather than specifying a group of subjects as previously, has asked HEFCE to consider which subjects should in future be considered to be SIVS. It has also introduced greater dynamism within undergraduate provision, with a view – where possible – to self-correction rather than government intervention. Based on these assumptions and on the advice received

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<sup>16</sup> The HEFCE advisory group's 2010-11 report, [http://www.hefce.ac.uk/pubs/hefce/2011/11\\_24/](http://www.hefce.ac.uk/pubs/hefce/2011/11_24/) [accessed 23 March 2012].

<sup>17</sup> Student number controls and teaching funding – consultation on arrangements for 2013-14 and beyond, HEFCE 2012/04, February 2012. <http://www.hefce.ac.uk/pubs/year/2012/201204/>

from partner organisations, HEFCE has developed a revised policy framework. The key points are set out below.

- 1.2.23 HEFCE will continue to support those subjects which have until now been identified as strategically important and vulnerable. However, given the new funding context, it will monitor the health of all subjects (rather than a specific list) in conjunction with partner organisations and will make selective, collaborative interventions to address specific risks to particular aspects of subject provision. HEFCE expects that this will extend beyond the subjects supported to date.
- 1.2.24 HEFCE proposes to continue to support existing SIVS, namely mathematics, physics, chemistry, engineering, MFL and related area studies, and QSS. Continued support for STEM is reflected in the level of funding for high-cost provision proposed together with specific allocation of an additional £23 million per year for the very highest-cost STEM subjects. HEFCE also protected mathematics, physics, chemistry, engineering and MFL from the reduction necessary to create a margin of places for re-allocation in academic year 2012-13.
- 1.2.25 HEFCE is committed to working with the subject bodies in STEM, MFL and QSS to promote demand and attainment. Any further non-recurrent interventions in these subjects would be made through discretionary investment with partner organisations to address specific concerns.
- 1.2.26 It is recognised that any subject could at some point become vulnerable. This might be due to concerns about that subject's accessibility, or about the availability of a particular sub-discipline, or of a particular academic level of provision, or other factors such as the need for work placements or years abroad. HEFCE thus considers that it should no longer focus on a discrete group of subjects although HEFCE will continue to support a portfolio of activities addressing subject vulnerability. HEFCE would instead monitor the HE system to:
- Identify risks to the continued availability of any subject and the likelihood of these risks occurring, using quantitative and qualitative evidence.
  - Consider the significance of these risks, if they were to occur, taking advice from government and Research Councils on their priorities, and bodies such as the Confederation of British Industry and the UK Commission for Employment and Skills on the labour market.
  - Determine those areas where the scale and materiality of risk suggests that HEFCE should initiate a response, normally in collaboration with other funders and stakeholders.
- 1.2.27 HEFCE considers that the new approach will be more inclusive, reflecting the new policy and risk environment. Given the constraints on its funding and powers, and the government's preference where possible for self-correction, HEFCE anticipates a highly selective approach to intervention.
- 1.2.28 HEFCE proposes to use an inclusive definition of 'subject', embracing sub-disciplines and different types and levels of provision. The Council intends to adopt the following principles:
- Activity should be founded on a strong evidence base which: embraces the progression of students from schools and colleges through to postgraduate study and employment; seeks (within reason) to forecast trends and requirements; and includes international comparisons.
  - HEFCE should look beyond the volume of activity at national level to consider issues such as the quality of outcomes and, as more students may seek local study options, location and accessibility of provision, including cross-border issues where appropriate.
  - HEFCE should involve industry, as well as other graduate employers and users of research, in the identification of, and response to, risks.
  - HEFCE should monitor the diversity of subject take-up and advise the government and the sector of any apparent barriers to access for particular groups.

1.2.29 Specific interventions to address risks proposed by HEFCE include:

- Mitigating changes in student number controls to ensure that SIVS are not disadvantaged.
- Funding for higher-cost undergraduate subjects.
- Funding for certain specialist providers.
- Development of a new approach to support for postgraduate provision.
- Discretionary funding to develop partnership approaches to providing support that encourages collaboration and efficiency for small areas of provision within larger providers.
- Measures to ensure that work placements and international placements/years abroad are maintained at current levels following the fee and funding reforms.

### 1.3 Study objectives

1.3.1 The SIVS Advisory Group Report 2011<sup>18</sup> states that HEFCE will broadly assume that the HE reforms will achieve their purpose according to the government's vision, and will focus future efforts on *'identifying the minority of areas in which this may not be the case and determining any mitigating action that might be taken'*. It is prudent, therefore, to take stock of the current situation and seek to identify useful lessons from other countries' HE systems where they have similar funding environments.

1.3.2 The overarching objective of this evaluation was to produce:

'An evidence-based report presenting the findings of research into how other countries or states with similar HE funding and student finance systems to England have identified and mitigated risks towards particular subjects or skills, and the consequences of the policy approach adopted'.

1.3.3 In the initial proposal – and in the Scoping Study Report<sup>19</sup> – we signalled an immediate issue arising from the overall objective for this study, based on our initial broad-scoping of countries and their HE policy and funding systems. The issue arising is that we could not identify any countries that had directly or closely comparable HE funding and student finance systems to that of England (from 2012). This is perhaps unsurprising given the dynamic economic and political context that gave rise to the new (and still unfolding) English system. For this reason, we have taken a wider view of the overall and detailed objectives of the study in consultation with HEFCE.

1.3.4 The detailed objectives set out in the Invitation to Tender for this research were to:

- Identify countries (or states within countries) that have explicitly supported STEM subjects or other subjects of national importance and provide examples from recent history and a basket of nations (sub-section 2.2 identifies countries, states, *etc* and sub-section 2.2.16 sets out interventions used).
- Identify the evidence countries use to determine the market-government balance, and how this differs between teaching, skills and research (sub-section 2.3.2).
- Present evidence (where available) about the success or otherwise of the interventions and any unintended consequences (sub-section 2.4.15).

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<sup>18</sup> The HEFCE advisory group's 2010-11 report, [http://www.hefce.ac.uk/pubs/hefce/2011/11\\_24/](http://www.hefce.ac.uk/pubs/hefce/2011/11_24/) [accessed 23 March 2012].

<sup>19</sup> Scoping study report: an evaluation into market forces, government agency and key disciplines: learning from international experience, CC518D001-0.3, 19 December 2011.

- Explain how the funding and fee system differs from the system in England from 2012 and the applicability of any learning (sub-section 2.6).
- Highlight where the ‘public interest’ or the ‘public benefit’ has been used as a reason to address market failure, and what the rationale for public funding has been (sub-section 2.7).

## 1.4 Approach

### *Introduction*

- 1.4.1 The evaluation has been carried out entirely through desk research including discussions with our policy and research contacts in different countries to elicit basic information and pointers to detailed resources, and use of academic literature and published materials (*eg* in-country websites). A list of those approached for this work is provided at Annex A.
- 1.4.2 We divided the evaluation into two parts to balance breadth and depth of research: a rapid scoping stage followed by a detailed investigation stage. These are described below.

### *Rapid scoping stage and agreed countries*

- 1.4.3 During this stage, we examined 21 countries. The countries were: Australia, Brazil, Canada, China, Denmark, Finland, France, Germany, Hong Kong, India, Italy, Japan, South Korea, the Netherlands, New Zealand, Poland, Russia, Scotland, Singapore, Sweden, US (federal), US (state). These countries were identified on the basis that they were close in one or more ways to the overall or detailed objectives of the study, that they could provide a global perspective and that there was accessible published material of relevance to the study. Furthermore, a key criterion was that the team had prior knowledge and contacts in these countries, given the limited time and resources available for the study.
- 1.4.4 Following the initial rapid scoping stage analysis (summarised at Annex B) and discussions with HEFCE, 11 countries were selected from the original 21 for the detailed investigation phase. These were: Australia, Brazil, Canada, Denmark, Germany, Hong Kong, Japan, the Netherlands, Poland, Scotland and the US (federal and state).<sup>19</sup>

### *Detailed investigation stage*

- 1.4.5 The detailed investigation of the selected countries was undertaken through:
- Further desk research to gather additional information; this information has been collated into a set of country case studies at Annex C.
  - Identifying and structuring the answers to the detailed objectives listed at paragraph 1.3.4 through detailed analysis and team discussion.
  - Checking and verification of the findings, wherever possible, with country experts, *etc.*
  - Discussion of the findings with the HEFCE sponsor.

## 1.5 Document structure

- 1.5.1 The remainder of the report is structured as follows:
- Section 2 sets out the findings of the study against the detailed objectives of paragraph 1.3.4.

- Section 3 sets out a model for a categorisation of state-institutional relationships, makes a number of observations and discusses the applicability of the approaches and interventions identified in Section 2 to England.
- Annex A lists those who have contributed to this study.
- Annex B describes the selection of the countries for detailed study from the initial list of 21 candidate countries.
- Annex C describes the HE system, the funding, priority subjects and interventions, and any available information on the success or otherwise of the interventions in each of these countries.

## 2 Findings against study objectives

### 2.1 Introduction

#### *General*

- 2.1.1 This Section sets out the findings against the detailed objectives for the evaluation set out at paragraph 1.3.4. It also includes at sub-section 2.2.16 a list of the interventions identified during the study for the different parts of the ‘education pipeline’.
- 2.1.2 Observations on the findings and the applicability to the UK are examined in Section 3.

#### *Drivers of policy at national, regional and supra-national levels*

- 2.1.3 In all the case study countries, at federal or national levels, and in some cases at state or provincial levels, the policy drivers underlying declared national priorities relate first of all to the development of knowledge economies, second to positioning in a competitive and interconnected global environment and third to an analysis that ‘hi-tech’ societies are likely to be the future. Analyses at national level are also informed by data and information from the OECD and other international agencies, as well as European policies such as the Lisbon strategy from financial year 2000-2001 and, more recently, ‘Horizon 2020’.<sup>20</sup> More detail on drivers and policy rationales in the case study countries can be found at Annex C.

### 2.2 Support for STEM or other subjects of national importance

- 2.2.1 Having identified the case study countries according to the analysis set out in Section 1.4 above, we examined whether they have explicitly supported STEM subjects or other subjects of national importance, focusing on examples from recent history (*ie* the first objective of this study). The findings are summarised in Table 2-1 together with the rationale and, where known, the decision-making process and evidence used. Sub-section 2.2.16 sets out the interventions used by the case study countries for the different parts of the ‘education pipeline’. England is also included in Table 2-1 as a comparator.

#### *STEM subjects*

- 2.2.2 We found that many (but not all) of the case study countries explicitly supported STEM subjects. In some cases, such as Brazil, there is perceived to be a national ‘problem’ in relation to the supply of STEM graduates (or demand for STEM programmes in education due to problems in relation to teacher training or the quality of pre-HE levels). In other countries such as Hong Kong, this ‘problem’ does not exist (or perceptions are not similar) because of student competency in STEM fields and adequate graduate supply.
- 2.2.3 In other countries, such as Australia, Denmark, Germany, Poland and the US, the ‘problem’ is framed in terms of the increasing demand for STEM graduates, based on a range of factors including the needs of a knowledge-based economy and a changing labour market, and the drivers for economic competitiveness in an international context. In this case, a lack of supply is not necessarily (or at all) linked to a long-standing national deficit, but to a set of new conditions.

<sup>20</sup>

*Horizon 2020 – the EU framework programme for research and innovation,*  
[http://ec.europa.eu/research/horizon2020/index\\_en.cfm?pg=h2020](http://ec.europa.eu/research/horizon2020/index_en.cfm?pg=h2020) [accessed 26 March 2012].

- 2.2.4 In the Netherlands and US, these two agendas of supply-side issues and increasing demand come together to explain current priorities. Finally, in some countries, notably Japan, a ‘problem’ (as defined in the US) may only recently have been recognised (for example, as national league tables and trend data are analysed and absorbed).
- 2.2.5 England, through the SIVS policy, appears to reflect a ‘deficit rationale and approach’ (see paragraph 1.2.6) which tends to be reactive (seeking to plug gaps and address perceived problems as they arise) rather than a holistic or ‘value-adding’ approach which addresses all parts of the ecosystem in a large-scale and strategic way as is evident in some countries.
- 2.2.6 For these reasons – and others linked to national structures and politics, culture and history – readers should note that the information in Table 2-1 needs to be carefully interpreted based on the specific context for each country. Annex C provides more detail on each country.

### ***Vulnerable subjects***

- 2.2.7 We found that several countries identified subjects that were ‘vulnerable’ and important at national (or at state) level; however, the reasons for defining them as such were not necessarily the same in each country and the subjects were not necessarily the same as in England or as visible given no directly equivalent ‘SIVS policies’.
- 2.2.8 In several countries, minority languages were deemed to be vulnerable as well as those that were important for trade links, but were undersupplied domestically. Subjects identified in the Netherlands, for example, include Arabic, Chinese and Japanese, which are designated as ‘vulnerable’ and of national importance. Other subjects include educational sciences and nursing in Australia and the Netherlands. In some cases (such as Japan, Brazil and Australia), ‘vulnerability’ may apply at a regional level; for example, the supply of doctors or teachers for schools to particular (often remote) regions in these countries. In Japan this has produced a particular focus on medical training in certain national universities.

### ***National or state priorities***

- 2.2.9 Several countries have ‘national economic plans or strategies’ that are linked to their educational policies (with respect to schools as well as HE, vocational education and training, and to research and innovation as much as – or more than – teaching). These national strategies (*eg* Germany’s ‘High-Tech Strategy’, Denmark’s Globalisation Strategy, Poland’s National Development Programme or Japan’s Fourth Basic Science and Technology Plan) identify national priorities in terms of broad subject areas, themes, particular fields or ‘pillars’. In some cases they go further, as in the Netherlands’ ‘Human Capital Strategy’, to identify ‘Top Sectors’ or in Australia to focus on ‘frontier technologies’. Canada has priorities both at the province or territory level for teaching and at the federal level for research.

Country	Priority subjects or themes: teaching	Priority subjects or themes: research	Vulnerable subjects	Rationale	Decision-making/evidence	Other/comments
England	Sustain capacity Widen participation	Strengthen innovative capability and encourage greater investment in innovation	STEM MFL LBAS QSS	Deficit model to ensure that skills are available to UK where analysis shows there is a deficit that is not likely to be handled by the market.	Political initially with furor over possible closure of chemistry departments Minister sought advice from HEFCE on how to approach SIVS leading to establishment of advisory committee and funding Evidence includes statistics in student numbers and evaluations	Approach has been to develop the deficit model. New funding arrangements from academic year 2012-13 leading to some changes
Australia	'National priority subjects' education, nursing, science mathematics and medicine	'National research priorities' – under review	-	Meet labour market needs in terms of graduate skills. Improve international competitiveness in research	Federal government initiated review of HE to determine its future direction and how it might be reformed to meet the needs of the Australian community and economy. Evidence included submissions by key stakeholders and a national consultation process	Holistic focus on STEM at state/territory level
Brazil	STEM, health and life-sciences	Ministry of Science Technology and Innovation – 4 strategic areas	-	Development of graduate and particularly postgraduate skills to help support economic development Improve capacity in internationally recognised research	Decision-making process and detailed evidence used unknown	Strong link between teaching and research via Science Without Borders – international mobility scheme focused on developing STEM, health and life-sciences capacity and 'National Institutes of Science and Technology' (INCTs)
Canada	Computer science, high-demand engineering, health care	Use of research funding in general in improving research capacity	-	Teaching: increase enrolment in specific subject areas to overcome shortages in the labour market Research: sustain and improve economic competitiveness and growth	Largely political decisions at province level to meet shortages in particular skill areas to help improve the province's economy Evidence unknown but likely to include economic forecasts and historical data such as OECD reports	Teaching is responsibility of provinces. Research is funded at federal level.

Table 2-1: Priority subjects by country (part 1 of 3)

Country	Priority subjects or themes: teaching	Priority subjects or themes: research	Vulnerable subjects	Rationale	Decision-making/evidence	Other/comments
Denmark	Natural, technical and health sciences and IT (targeted funding at PhD level). Humanities and social sciences (increase in teaching funding to promote 'research-based' HE)	Danish Council for Strategic Research: annual themes	Minority foreign languages	Support national Globalisation and Research and Innovation Strategies which demand more highly-skilled graduates and research of international quality	Ministerial committee on 'Denmark in the global economy', (including Minister for Education) and advised by the Globalisation Council. Work carried out through themed meetings of Globalisation Council Detailed evidence unknown.	Highest focus amongst competitive research funding through research council. Based on 2006 Globalisation Strategy.
Germany	Mathematik, Informatik, Naturwissenschaften, Technik (MINT) (equivalent to STEM)	Priority technologies identified in High-Tech Strategy; also priority themes (fields of action)	English, Spanish, French, Russian, Chinese, Arab language & culture, quantitative sociology	Simulating Germany's scientific and economic potential in a targeted way; open up new prospects for German industry; find solutions to national and global challenges	High-Tech Strategy based on a shared vision by key stakeholders Evidence for latest iteration includes indicators (eg R&D) investment and evaluation of the earlier phases of the strategy. Detailed evidence unknown.	Holistic focus at all levels
Hong Kong	Charities (not government) are aiming to set up new universities focusing on literature, philosophy, theology	Areas of Excellence scheme (now in fifth round 2011-2017 – 10 areas funded in sciences and technology)	-	Stay relevant in the process of internationalisation and the rapid development of Mainland China; broaden Hong Kong's economic base by dovetailing R&D policy with four pillars and six industries identified as investment priorities	Triennial projections of sectoral need identified by government, leading to discussion between universities and government on meeting the needs Detailed evidence unknown.	In 2011, government identified education services and five other industries (medical services, environmental industries, testing & certification, innovation and technology, cultural and creative industries) as investment priorities
Japan	Medicine (in certain national universities)	8 policy-oriented research themes in subject-fields (sciences & technology)	-	Science & technology as priority investments linked to economic growth and competitiveness; ensure full employment for all who complete doctoral programmes in science & technology	Quinquennial Science & Technology Plan required by law. Evaluation of effect of previous plan used to help design next one. Detailed evidence used unknown.	Fourth Basic Science & Technology Plan contains 4 main pillars linked to growth strategy

Table 2-1: Priority subjects by country (part 2 of 3)

Country	Priority subjects or themes: teaching	Priority subjects or themes: research	Vulnerable subjects	Rationale	Decision-making/evidence	Other/comments
Netherlands	Beta-Techniek (STEM)	9 'Top Sectors' agreed nationally	Languages (Arabic, Chinese, Japanese), Theology, Education Sciences, Advanced Nursing training, some humanities	Increase numbers of graduates in Science and Engineering to support innovation; coordinate policy on science and technology in education, science and research and increase the attractiveness of employment in science and technology	Decision-making process and detailed evidence used unknown	Holistic focus at all levels & some success reported at school level in students studying sciences up to final leaving exam (>50%)
Poland	Technological subjects (environmental engineering, robotics, building engineering, computer science, mechatronics, nanotechnology and nuclear energy), Mathematics and Natural sciences (SMT)	National Programme of Scientific Research – 7 priority areas	-	Need to produce more, and better qualified graduates in technical subjects to help support national economic development. Need to improve the quality of research in SMT disciplines to become internationally competitive	Political decision to improve Poland's economic position supported by HE improvements. Detailed evidence unknown	From 2012, development of National Leading Scientific Centres (KNOW) via an open competition is to establish elite units conducting unique research projects combined with advanced interdisciplinary training.
Scotland	Employability strategy Removal of cap on STEM numbers for academic years 2007-2008 to 2009-2010	Ensure university research is better exploited for benefit of business and the economy	Potentially languages, including Gaelic	Sustain and enhance Scotland's research base and exploitation for benefit of business and the economy Better trained workforce Improve accessibility to all and improve transfer between college and universities Improve employability	Independent review made call for evidence from interested parties. Government responded with a number of consultation documents Many other evidence resources used	No overarching strategy; case-by-case funding only
US	Improved STEM quality and numbers to improve national economic competitiveness	Improved STEM quality and numbers	-	To improve national economic competitiveness and maintain US as leading economy	High-level political and science and engineering community concerns – led to initiation of a study by the National Academy of Science and National Academy of Engineering Focus groups and many other information sources	There is a close relationship on increasing STEM numbers and quality with widening participation
	Language and area studies to support the national interest	Language and area studies	-	Support the national interest	Continuing need	
	Improved teacher quality and numbers		-	Improve teaching throughout the system	-	Use of loan forgiveness

Table 2-1: Priority subjects by country (part 3 of 3)

- 2.2.10 These priorities are then linked to a range of other strategies (and mechanisms) at different levels of education and to transitions between education and employment. In addition, national priorities may be linked both to education and research agendas (eg the Netherlands, Poland, Denmark, Brazil and Germany), or predominantly to research and postgraduate education (eg Japan and Denmark). In European countries, the EU agenda also provides a guiding framework in terms of overarching goals for innovation and economic growth.<sup>21</sup> We should also note that the 'HE modernisation agenda' is an important part of the picture with a general move towards promoting greater institutional autonomy and a changing role for the state in relation to higher education (more steering, monitoring and evaluating than direct control and direction).<sup>22</sup>
- 2.2.11 It is evident that countries differ in whether their national strategies are part of a regular cycle of planning and review (as in Japan and Hong Kong) or whether they signal a new development or focused effort in the light of changing economic conditions (such as recession and a need for growth in Europe) or a response to wider globalisation agendas (or all of these). In some cases, current priorities arise from a specific review (eg Hong Kong's 2010 University Grants Committee (UGC) Review of the post-secondary education system or Australia's 2008 Bradley Review and 2010 Base Funding Review) or are associated with specific circumstances (eg the 2011 earthquake and tsunami in Japan) and these priorities are incorporated into regular planning cycles and mechanisms.
- 2.2.12 It is important to note that the rhetoric in each country is different and that the term 'SIVS' is not used (or understood in the same terms). Some countries (such as Hong Kong or Japan) do not talk in terms of 'subjects' of national importance while others (such as the Netherlands) might include all subjects/disciplines in regular reviews which lead to investment (eg in their regular 'Sector Plans'). Within such reviews, 'vulnerability' may be identified and mechanisms and resources identified to address the issue. In several countries, notably Germany and the Netherlands, while there may be declared strategic priorities and incentives to foster student demand in science and technology disciplines because of associated labour market demand (such as Poland), this is not at the expense of other subjects that may be perceived by some perhaps, to be of lesser economic importance. To quote a German respondent at federal level: 'The broad offer of the whole range of subjects at many universities is seen as a value in itself due to the experience that 'Akademische Bildung' is generating personalities able to deal with complexity and innovation'.
- 2.2.13 It is also important to recognise that national priorities address other equity issues such as increasing the number of women within science programmes and scientific employment (eg Poland, Germany), improving opportunities for disabled students or specific initiatives targeted at ethnic minorities (eg Brazil, Canada, US). These may relate to the demographic profile of the country and associated risks linked to STEM or other subjects as well as to wider economic and social goals. In addition, countries have specific initiatives in relation to postgraduate research: Brazil is trying to recruit high quality researchers in STEM and Denmark has attracted international PhD students following its expansion of PhD provision.

### **Skills shortages**

- 2.2.14 The issue of skills shortages or skills gaps includes debate about specific subjects and fields as well as types of skills, including generic graduate attributes linked to employment. For example, in Australia, the Business Council raised concerns that graduates' problem-solving skills were more suited to further study than to their use in the labour market. They also pointed to other

<sup>21</sup> *Horizon 2020 – the EU framework programme for research and innovation*, [http://ec.europa.eu/research/horizon2020/index\\_en.cfm?pg=h2020](http://ec.europa.eu/research/horizon2020/index_en.cfm?pg=h2020) [accessed 26 March 2012].

<sup>22</sup> *Governance within the European Higher Education Area: Dynamic Trends, Common Challenges, and National Particularities*, Middlehurst, R & Teixeira, P, in Curaj, A *et al.* (Eds). *European Higher Education at the Crossroads: Between the Bologna Process and National Reforms*. Bucharest, Springer. Ch 29, pp527- 550, 2012.

gaps in terms of skills lacking: in entrepreneurialism, creativity, initiative and oral business communication.<sup>23</sup> The response was to set up a Business, Industry and Tertiary Education Collaboration Council, which explores alternative approaches to strengthening graduate employability skills.

- 2.2.15 Many countries are also concerned about mismatches of skills, for example, in Germany, the MINT Pact addresses the issue of trained science and technology graduates going into other sectors of the economy; the initiative includes efforts to align graduates with relevant job opportunities.<sup>24</sup>

### Summary

- 2.2.16 Priority subjects are found across the case study countries. However, the particular subject areas that they cover, national approaches to support these subjects and rationale for doing so, are often different from England. The rhetoric and language used can be quite different and the term 'SIVS' is not used (or understood in the same terms):

- Many countries explicitly supported **STEM subjects** driven by the perception of a national 'problem' with the supply of, and/or demand for, STEM graduates. Hong Kong is an exception among the sample countries as there is both student competency in STEM and an adequate graduate supply.
- Several countries identified **vulnerable and important** subjects, although the reasons for this can be different from England. Vulnerable subjects included languages important for trade links, educational sciences and nursing; vulnerabilities can be identified at national or state level.
- Several countries have defined **national priorities** through national economic plans or strategies linked to their educational policies at all levels. These can be part of a regular planning cycle or the result of a specific review in response to changed economic or political contexts. National priorities often address other equity issues such as gender, disability or ethnicity.
- Some countries have identified **skills gaps** within particular subjects or a mismatch between graduates' skills and employment opportunities.

## 2.3 Interventions used

- 2.3.1 The findings suggest that there are differences in the ways in which countries have sought to address identified national priorities (subjects, themes, fields or sectors). In the tables below, we have sought to identify the particular approaches and mechanisms used with respect to 'the education pipeline': within schools (Table 2-2); in relation to teaching at undergraduate and taught postgraduate levels (Table 2-3); in relation to research and associated post-graduate education (Table 2-4); and in relation to vocational education and training (Table 2-5). We have also noted initiatives and involvement from employers and other stakeholders as part of 'the education-skills pipeline' (see Table 2-6).

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<sup>23</sup> *New pathways to prosperity – a national innovation framework for Australia*, Business Council of Australia, 2006 <http://www.bca.com.au/Content/101346.aspx> [accessed 26 March 2012].

<sup>24</sup> *The global picture* prepared for Universities UK by Pricewaterhouse Coopers, September 2010, <http://www.universitiesuk.ac.uk/Publications/Pages/Theglobalpicture.aspx> [accessed 25 May 2012].

Issues to be addressed	Mechanisms	Country	Comments
Declining interest in STEM subjects	1 Conduct information campaigns	Germany (1)	In Japan 10 years ago a number of 'Super Science Schools' were designated by the government (at least one is affiliated to an elite private university) In the Netherlands the business sector is also involved in 'awareness campaigns' In the Netherlands some success is reported in that a majority of pupils are now taking science options in final school-leaving exams (although not necessarily going on to universities)
	2 Hold summer schools	Japan (3)	
	3 Designate specialist science schools	Netherlands (1) Poland (1)	
	4 Appoint student ambassadors	US (1), (2), (4)	
Inadequate teacher capability and skills	5 Ensure higher level of educational attainment for teachers	Brazil (6) Japan (6); Netherlands (7), (8)	In Japan a coalition of interests across government, schools and universities has been addressing the problem of specialist teacher training
	6 Improve teacher training to increase number of teachers and quality of teachers (including specialists)	US (5), (6), (7), (8)	
	7 Bring business people into schools to teach		
	8 Groups of primary and secondary schools and some Universities of Applied Science set up specialist teacher training schemes		
Insufficient numbers of suitably qualified teachers	9 Increase number of qualified teachers	Brazil (9)	
Poor quality learning resources	10 Improve quality of learning resources	US (10)	
Poor teaching infrastructure (ie facilities)	11 Improve infrastructure for teaching	US (11)	
Groups under-represented in the education system (eg ethnic minorities and women)	12 Establish special initiatives focusing on ethnic minorities	Brazil (12) Poland (13)	
	13 Establish special initiatives focusing on women	US (12), (13)	
Poor curriculum design and content	14 Create interesting and relevant curriculum content	US (14)	
Uninspiring teaching methods	15 Deliver teaching in innovative ways (eg using new media)	US (15)	
Lack of a holistic approach	16 Establish national strategies to create a holistic approach, including all players and levels	Netherlands (16) Germany (16) Denmark (16)	Netherlands: The language is about 'alliances' between levels and sectors (ie vocational education, private companies, secondary education and universities in relation to the 'Top Sectors' strategy) While Denmark's approach is more focused on research and postgraduate students, it does cover all education levels and the business sector
High non-completion rates	17 Improve support and pastoral care available in-year and for transitions between years and levels	US (17)	

Table 2-2: Interventions at school level

Issues to be addressed	Mechanisms	Country	Comments
Too few undergraduate students ( <i>eg</i> in STEM subjects)	18 Create scholarships, bursaries	Australia (18)	Japan has played a leading role in the Asia-Pacific region in promoting university exchanges & student mobility ( <i>eg</i> SE Asia Engineering Education Development Network)
	19 Encourage international student recruitment or exchange	Brazil (19) Japan (19) Poland (18)	
	20 Remove number controls	Scotland (20) US (18), (19)	
Insufficient good quality students ( <i>eg</i> in STEM subjects)	21 Develop school pipeline (see Table 2-2)	Australia (22) Brazil (22)	Brazil's Science without Borders programme encourages inward and outward mobility of students at all levels
	22 Increasing recruitment of excellent international students	Denmark (22) Germany (22) Scotland (21) US (21)	
Lack of relevant and attractive programmes	23 Implement new titles and combinations	Denmark (26) (27) Hong Kong (3)	Japan's ministry has proposed competitive funds for innovative and distinctive teaching programmes; there is also a new initiative between ministries proposing collaboration with industry, business and HE to develop a more 'globally-capable' workforce  In the US new qualifications are being developed <i>eg</i> 'Professional Science Masters'; industry (IBM) is also involved in an MSc in 'Analytics'
	24 Encourage more marketing by universities	Japan (27) Netherlands (23), (24), (26)	
	25 Create joint degrees (including with international partners)	Poland (23), (24), (26) US (24), (26), (27)	
	26 Bring employers into curriculum design and delivery		
	27 Increase work experience		
Groups under-represented in the education system ( <i>eg</i> ethnic minorities and women)	28 Establish special initiatives for women	Australia (29) Brazil (29)	
	29 Establish special initiatives for minorities	Germany (28), (29) Poland (28) US (28), (29)	
Shortage of specialist lecturers	30 Develop specialist teacher training programmes	Japan (30), (31) Brazil (30)	
	31 Encourage affiliation of specialist 'science' schools to universities		
Too few lecturers	32 Convert humanities lecturers to science lecturers	US (32)	
Poor quality lecturers	33 Ensure higher level of educational attainment for lecturers	Brazil (33), (34), (35) US (33), (34)	
	34 Ensure better training for lecturers		
	35 Increase number of lecturers with doctorates		
Inadequate teaching infrastructure ( <i>ie</i> facilities)	36 Concentrate or share resources across universities	Netherlands (36) Scotland (36)	
	37 Invest through special initiatives	Germany (37) US (36), (37)	
High non-completion rate	38 Create pathways through credit transfer between HEIs	US (38), (39) Denmark (40)	
	39 Improve support and pastoral care available in-year and for transitions between years and levels	Netherlands (41)	
	40 Move to output-based funding		
	41 Provide financial incentives in grant or loan systems to students		
Vulnerable or priority subjects identified	42 Charities set up new specialist universities	Hong Kong (42)	
Improve employability	43 Integrate employability advisors in HEIs	Scotland (43)	

Table 2-3: Interventions at HE level – undergraduate and postgraduate teaching

Issues to be addressed	Mechanisms	Country	Comments
Too few graduate students (eg in STEM subjects)	44 Create scholarships, bursaries, fellowships	Australia (46) Brazil (44), (46)	
	45 Ensure pipeline from undergraduate level works well	Denmark (44), (46) US (44), (46)	
	46 Increase international student recruitment		
Insufficient good quality graduate students (eg in STEM subjects)	47 Establish special initiatives	Brazil (47), (48)	In Brazil this is achieved via the Science Without Borders scheme which promotes inward and outward mobility
	48 Increase recruitment of excellent international students	Denmark (47), (48) US (47, (48)	
	49 Create new 'selective' routes for talented students	Netherlands (49) Poland (49)	
Poor quality research supervisors	50 Establish better training for research supervisors	US (50)	
Insufficient volume of research	51 Target research investment	Australia (52)	
	52 Introduce or enhance research evaluations	Brazil (51), (52) Denmark (51), (52) Germany (51) Hong Kong (52) Japan (51) Netherlands (51) Poland (51), (52) US (51)	
Poor quality and relevance of research	53 Establish closer links to industry	Brazil (54), (55)	
	54 Focus on national priorities	Denmark (53) (54)	
	55 Involve private sector in research funding	Hong Kong (54), (55) Japan (53) (54) Netherlands (53) (54) Poland (53) (54)	
Lack of innovation	56 Establish closer links to industry	Denmark (56)	
	57 Involving private sector in research funding	US (56)	
Reputation of HEIs not globally strong enough	58 Use targeted funding to strengthen HEIs	Japan (58) Brazil (58) Germany (58) Hong Kong (58) Poland (58) Denmark (58)	Japan seeks to create a world-collaborative network in basic science research German 'Excellence Initiative'
Qualified graduates do not transition to work in their subject area	59 Guarantee employment for graduates with doctoral degrees in science and technology	Japan (59) Germany (60)	
	60 Establish 'matching' schemes to align science and technology graduates with employment opportunities		
High non-completion rates	61 Improve support and pastoral care available in-year and for transitions between years and levels	US (61)	
Improve employability	62 Integrate employability advisors in HEIs	Scotland (62)	

Table 2-4: Interventions at HE level – research and associated post-graduate education

Issues to be addressed	Mechanisms	Country	Comments
Inadequate numbers of students with relevant technical and vocational skills	63 Industries set up own 'private training' initiatives	Australia (64) Brazil (64)	Collectively, the steel producing industry have such an initiative in the Netherlands
	64 Incentivise technical subjects (eg scholarships, loans)	Netherlands (63) Poland (64)	
Inadequate quality of students with relevant technical and vocational skills	65 Establish better inspection regime	Netherlands (65)	
Too difficult for good students to transfer between 'vocational' and 'academic' streams	66 Establish credit and qualification pathways between 'vocational' and 'academic' education streams	Scotland (66)	Implied by currently planned reforms
Inadequate teacher capability and skills	67 Ensure higher level of educational attainment for teachers	US (67), (68)	
	68 Better training for teachers		
Lack of holistic approach	69 Establish national strategies to create a holistic approach, including all players and levels	Australia (69) Germany (69) Netherlands (69)	Vocational sector is included in wider initiatives at all educational levels
High non-completion rates	70 Improve support and pastoral care available in-year and for transitions between years and levels	US (70)	

*Table 2-5: Interventions for vocational education, further education and at sub-degree level*

Issues to be addressed	Mechanisms	Country	Comments
Volume of graduates with relevant skills and qualifications needs increasing	71 Conduct information campaigns about jobs and skills	Australia (73) Denmark (73)	
	72 Establish employer-led incentive schemes	Japan (73) Netherlands (71)	
	73 Encourage recruitment of foreign graduates	Poland (71) US (71), (72), (73 at doctoral level)	
Quality of graduates needs increasing	74 Employer makes direct investment (or joint investment with government and others)	Brazil (74) Denmark (76) Germany (74), (75)	There is concern that Japanese multi-nationals are recruiting foreign graduates (from China and elsewhere); this is prompting more English language training
	75 Employers set up private colleges	Japan (76) Netherlands (75)	
	76 Encourage recruitment of foreign graduates	US (74), (75), (76)	
Graduates with relevant qualifications need to go into relevant jobs	77 Establish career schemes	Australia (78)	Intermediaries (global consultancies & executive search firms) seek to match demand in one country or region with supply from another in relation to 'top talent'  Australia seeks to incentivise doctors to move to particular regions
	78 'Location matching'	Germany (77) US (77), (78)	

*Table 2-6: Interventions through employers, businesses and other stakeholders*

- 2.3.2 The tables and country cases at Annex C provide more detail of interventions and the ways in which coordinated interventions are being handled within countries.
- 2.3.3 Please note that we have not been able to acquire comprehensive information for all categories across all the case study countries hence the information in the tables is indicative rather than exhaustive and complete.
- 2.3.4 While it is possible to separate the interventions and mechanisms as we have done in Table 2-2 - Table 2-6, this can mask a more complex picture. For example, employers, businesses and other stakeholders are quite often involved at all levels (from schools, through undergraduate teaching to postgraduate study and research agendas) as in the case of the 'Delta Plan' initiative in the Netherlands. They may also be strongly involved in funding research or in leading aspects of the national priority strategies (as in Germany and Brazil). In addition, in some countries (like Denmark), the main focus of intervention is more towards research (targeted funding for postgraduate education and to promote research-focused teaching) than at the level of undergraduate programmes or undergraduate student funding.

## 2.4 Evidence used to determine market-government balance

- 2.4.1 This sub-section identifies the evidence countries use to determine the market-government balance and how this differs between teaching, skills and research. As well as the evidence we have also considered the decision-making process. The analysis covers:
- The meaning of market-government balance.
  - The decision-making process regarding the need for intervention and the evidence used by governments to identify priority subjects.
  - How the evidence used differs between teaching, skills and research.
- 2.4.2 Once again, it should be borne in mind that in other countries, the rhetoric and framing of debates about priority subjects will not necessarily be as in England in terms of 'market-government balance' as this reflects a particular economic, political and ideological analysis that is not necessarily shared by the case study countries.

### *Meaning of market-government balance?*

- 2.4.3 We interpret 'market-government balance' to mean the point at which government needs to intervene to mitigate risks in supporting priority subjects caused by a weakness or failure in the tertiary education market. As a back-drop to this, it is worth noting Jongbloed's analysis.<sup>25</sup> He argues that:
- Tertiary education is *not a single market*, but rather multiple and interrelated markets (a market for students – undergraduates, postgraduates, doctoral students; for research staff, teaching staff; for research grants and scholarships; a market for donations; for graduates; for company training; and continuing education *etc*).
  - There are eight kinds of 'freedoms' for providers and consumers in the HE sector that are essential ingredients for markets to operate.<sup>26</sup> Few of these conditions exist in full in the

<sup>25</sup> Marketisation in Higher Education, Clark's triangle and the Essential Ingredients of Markets, Jongbloed, B, 'Higher Education Quarterly, Vol 57, no.2, 2003.

<sup>26</sup> On the side of consumers: freedom to choose provider and product; adequate information on prices and quality; a price which influences choice; and on the side of providers: freedom of entry; freedom to specify the product; freedom to use available resources; and freedom to determine prices.

countries we have investigated, so in most cases, higher (and tertiary) education is operating as an imperfect or 'quasi-market'.

- 2.4.4 Governments adopt market-type mechanisms for various reasons and to achieve different goals. In general, these mechanisms are intended to:<sup>27</sup>
- Generate more private resources (in the light of public austerity) and/or to enhance entrepreneurial behaviour.
  - Improve the quality of teaching.
  - Enhance responsiveness to the needs of society, the labour market and students.
  - Increase productivity and efficiency.
- 2.4.5 We have found evidence of these rationales in different countries. With this analysis as a starting point, we have interpreted the question of market-government balance in two ways and have sought to address both of these.

#### ***Decision-making process and evidence used***

- 2.4.6 Table 2-1 summarises the findings for the case study countries on decision-making approaches and evidence upon which decisions and interventions are made. The evidence used ranges from hard data and careful analysis to weaker evidence based on political assertion. In addition, countries vary in their general approaches to decision-making in relation to priority subjects.
- 2.4.7 Approaches include setting up an *ad hoc* committee to address a problem and producing a report to present to government for action (*eg* England); or a larger-scale government commissioned review on a one-off (*eg* US) or periodic basis (*eg* Germany, Hong Kong, Japan) or a ministerial committee to seek views and make decisions (*eg* Denmark). There may be explicit or implicit heavy and political lobbying by relevant stakeholders (*eg* US). The choice of decision-making approaches is clearly dependant on the cultural, economic and political context.
- 2.4.8 Of course, actions and interventions will also be linked to the strength of 'evidence' (hard and soft) and by the nature and urgency of the problem to be addressed. We also observe that strong coordination and management of programmes (with built-in evaluation mechanisms) are also more likely to yield useful data and information than more *ad hoc*, sporadic and uncoordinated approaches (Germany appears to be seeking to build a coordinated approach).
- 2.4.9 A country's overall approach to its HE system is also relevant, for example, the relationship between the government (at national and/or state levels) and the institutions in terms of their levels of autonomy (whether public or private). This is likely to affect both the ways in which issues are addressed and the choice of routes and mechanisms by which they are addressed.
- 2.4.10 Of course it may also be the case that there is no direct link between evidence and policy/interventions with decisions not being based on evidence but rather on political expediency. This might arise, for example, when the government of a country wishes to 'be seen to be doing something' about STEM and sets priorities with evidence being selected to suit the policy.
- 2.4.11 Table 2-7 provides some indicative examples of the type and range of evidence used by governments that we have located through our desk research and contacts. It is likely that in most cases, multiple sources of evidence are used and that there is overlap between sources. We

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<sup>27</sup> Market type mechanisms in higher education: a comparative analysis of their occurrence and discussions on the issue in five higher education systems. Kaiser et al, CHEPS report/Higher Education Monitor Thematic report, Twente, CHEPS, 1999.

have not specifically included countries in this table as the data we have collected is not uniform across countries. Also, what is counted as ‘hard’ or ‘soft’ evidence is likely to vary within and across countries.

Type of evidence	Evidence source
<b>Hard</b>	OECD indicators
	European Commission tracking of STEM graduates
	National and international labour market data and industry sector reports
	Nationally commissioned reports and reviews
	Institutional data and performance indicators including contractual arrangements
	Reports from representative agencies and trade associations
	Feedback and evaluations from specific interventions
<b>Soft</b>	Reports or other communications from lobbying campaigns (conferences, round-tables & events)
	Political manifestos, voting behaviour and election results
	Parliamentary debates
	Informal communication between stakeholders
	Responses to calls for evidence

Table 2-7: Type and range of evidence used by governments

2.4.12 It is clear that changes of government (particularly where changes of party are involved) have resulted in a shift in direction or approach to ‘national priorities’ in different countries. It is also clear that ‘soft evidence’ – from informal contacts between key players (such as institutional leaders and ministers or civil servants) or lobbying by industry and employer groups (often in coalition with disciplinary interests in universities and research institutes) – also plays an important role in shaping national priorities. These two factors (*ie* political change and lobbying) also interact to produce new ways of perceiving and responding to ‘the problem’<sup>28</sup> (such as the STEM agenda and related interventions).

**How the evidence used differs between teaching, research and skills**

2.4.13 Based on the limited evidence available (summarised at Table 2-1), we suggest that the types of evidence used to determine market-government balance depend on the following factors:

- **Approach to decision-making:** (see paragraph 2.4.7).
- **General approach considered for intervention:** (*eg* holistic or deficit model).
- **Political expediency:** (see paragraph 2.4.10).
- **Availability of relevant and useful evidence:** in general, full and complete hard evidence is unlikely to be available (or if it is available it may not be entirely applicable as circumstances have changed); this suggests that whatever evidence is available will be used to develop a plausible and politically acceptable argument.

2.4.14 We suggest further that this is likely to mean that any differences between the types of evidence used for making decisions on the market-government balance between teaching, research and skills will be dominated by these factors.

<sup>28</sup> See for example: *No Shortage of talent: how the global market is producing the STEM skills needed for growth*, Craig, E, Thomas, R, Hou, C and Mathur, S, Research Report, Accenture Institute for High Performance, 2011., <http://www.accenture.com/us-en/Pages/insight-global-market-stem-skills-growth.aspx> [accessed 28 March 2012].

## Summary

- 2.4.15 The evidence used by governments for making decisions and interventions varies across the countries. It ranges from hard data and careful analysis to weaker evidence based on political assertion (see Table 2-7). Based on the limited evidence available, we suggest that the types of evidence used to determine market-government balance depend on the approach used for decision-making, the general approach that might be used for interventions, political expediency and the availability of relevant and useful evidence. We therefore consider that this is likely to mean that any differences between the types of evidence used for making decisions regarding the market-government balance between teaching, research and skills will be dominated by these cultural and contextual factors.

## 2.5 Evidence for success or otherwise of interventions

- 2.5.1 The following factors tend to affect the assessment of evidence of success (or otherwise) of particular interventions:

- **Long time lags:** The impact of support may only be manifested long after the support has closed. With the long ‘pipeline’ of students going through the system, and important social and cultural changes as part of the solution, it may be ten years before success can be properly judged. A mix of recent and historical interventions is likely.
- **Attribution:** Supply and demand of students/subjects can be driven by many other factors than a particular programme of support. These might include societal factors relating to perceptions of the subjects, other governmental policy decisions (especially regarding funding), similar interventions from other sector organisations and anything else that might be considered a ‘natural’ effect. Understanding causality by decoupling different drivers is always difficult, and therefore attribution is hard to specify. Attributing outcomes to particular interventions is especially difficult over longer timeframes; hence the long time-lags compound this issue.
- **Unintended consequences:** Unintended consequences are important. They might be positive or negative. An example highlighted by the interim evaluation of the SIVS programme was that of resources intended to increase demand for a strategically important and vulnerable subject being suborned into ‘poaching’ students from another SIVS rather than increasing the overall level of demand. Again, unintended consequences may become clearer over time.
- **Different meanings of success:** Finally, the very meaning of success may well differ between countries and this is integral to understanding what was achieved and how efficient, *etc* it was. For example, in England, it was agreed that individual departmental closures do not necessarily indicate the vulnerability of a subject; other countries may adopt a different perspective. Countries may have particular takes on strategic added value: for example considering that partnerships formed by a programme of support are as important as any direct increase in student/subject numbers. Part of this is also down to the perspectives of different stakeholders, for example a government seeing political and policy success, is different to an employment body seeing industry success. The meaning of ‘success’ is further blurred within a policy-making and delivery environment by the distinction between doing things that are viable at that point in time, doing what is considered the best thing to do in terms of achieving desired outcomes, and doing things that are considered value for money.

- 2.5.2 We found that most countries sought evidence of the success of their own (or others’) interventions. The type of evidence includes specific evaluations of programmes or initiatives, national reviews and reports, analysis of national, international and institutional data, and audit

reports, typically from Ministries of Finance or equivalent. We have not been able to examine this evidence in any detail (because of issues of accessibility and/or availability), given the resources and time-scale of this project. However, both from scanning particular reports and from information gathered from our contacts, the evaluations present a mixed picture.

- 2.5.3 There are few positive examples to report (*eg* there is some evidence in the Netherlands of successes at school level but causation related to specific interventions is difficult to establish). In some cases, particular interventions have been found to have had no impact (*eg* In the Netherlands, the policy of giving scholarships based on fee waivers for students to study STEM subjects, or in Australia the differential fee levels for subjects in strategic areas with lower demand). In other cases, the evidence is unclear or contradictory. For example in the US, despite the significant investment in STEM it seems that the overall goal of improving national competitiveness has not been met.<sup>29</sup> Similarly, in Poland, the growth in enrolments in technical universities is perceived to have produced lower quality outputs.
- 2.5.4 The OECD<sup>30</sup> has been a useful general resource with regard to ‘unintended consequences’. For example, a supply-driven rationing of study places by public authorities is found to meet with three types of difficulties. First, public authorities may lack the administrative information and management controls over study places that are necessary to engage in effective rationing. Alternatively, or additionally, they may lack accurate, detailed and up-to-date data about graduate labour market conditions that is needed to engage in an allocation of resources that is well-adapted to labour market conditions.
- 2.5.5 Allocation of places according to a forecast of labour market demand (as opposed to student demand) may result in a mismatch of student preferences and supply of student places that leads to serious distortions and inefficiencies. In cases where public authorities seek to lead student demand (assuming that they are better able to anticipate labour market demand than students) – they may have no better information than students about labour market conditions currently or in the future. In addition, attempting to steer enrolments towards areas of national need that contradict wage signals appears often to end in failure – *ie* an oversupply of graduates that leads them to seek employment opportunities in other countries or in other fields from which they were trained.
- 2.5.6 For example, in 1998 and 1999 the province of Ontario created a fund called the Access to Opportunities Programme (ATOP) to ‘double the pipeline’ of graduates in computer science and high-demand engineering.<sup>31</sup> This programme, which applied an innovative market test by requiring industry to match start-up costs, on one level was a tremendous success. Business response was well beyond expectations and enrolment in these subjects increased tremendously. While the demand raising aspects were successful, the overall outcome was not. These students graduated at the time of the dot.com bust and there were no jobs for them. Enrolment in computer science has not entirely recovered from this bust.
- 2.5.7 The country case-studies at Annex C provide more detailed examples and information on evaluations of success or failure and consequences (intended or unintended) where we have been able to gather it.

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<sup>29</sup> *Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5*, [http://www.nap.edu/catalog.php?record\\_id=12999](http://www.nap.edu/catalog.php?record_id=12999) [accessed 19 December 2011].

<sup>30</sup> OECD, Vol 2. *Op cit* (p217), 2008.

<sup>31</sup> *Ontario budget, 1999 speech*, <http://www.fin.gov.on.ca/en/budget/ontariobudgets/1999/99budsp.html> [accessed 23 March 2012].

## Summary

- 2.5.8 Most countries seek evidence of the success of their own (or others') interventions. This includes specific evaluations of programmes or initiatives, national reviews and reports, analysis of national, international and institutional data, and audit reports, typically from Ministries of Finance or equivalent. The evidence can often be difficult to assess (internally as well as externally) because of the difficulties of long time-lags between cause and effect, attribution of impact to a particular intervention, unintended consequences and the varying views of the meaning of success between countries. There appears to be a mixed picture of success or otherwise. Some interventions have been found to have had no impact. In other cases, the evidence is unclear or contradictory.
- 2.5.9 The country case-studies at Annex C provide more detailed examples and information on evaluations of success or failure and consequences (intended or unintended).

## 2.6 Differences in funding and fee systems in England from 2012

- 2.6.1 The funding and fee system in England from 2012 is unique or rather different in a number of ways (when compared with the sample countries, but also more generally). These are described below.
- 2.6.2 While there are more similarities between countries in research funding systems than teaching, not all countries have research evaluation systems, so the mechanisms for distributing research funding tend to be somewhat different. Many countries include some research funding within formula-based block grants for teaching for universities (*ie* in broader operational budgets). In small countries there may only be one research council. Research may also be significantly funded by foundations and industry as well as Research Councils. In most countries, there has been a move towards more competitive funding in research (or a combination of basic and competitive funding); in Europe this has been actively promoted through the European Commission's 'modernisation agenda'.
- 2.6.3 Other countries do not control access to HE in the same way that is currently occurring in England (*ie* the AAB policy, core and margin policy and the role of the Office of Fair Access (OFFA)). In several countries, access to HE is not restricted (*ie* it is open to all with relevant institutional or national examination certificates and qualifications; it may also be 'free' for students (*ie* without tuition fees). In other countries with a large private sector such as Brazil or Poland, issues of access are different – *ie* lower socio-economic groups for the most part go into the fee-paying (and less highly-regarded) demand-led private sector – and into humanities and social science subjects. There are parallels here between the UK and the US in terms of recruitment into the for-profit sector (in contrast to recruitment to the elite, non-profit private sector universities where merit-based access through scholarships is often guaranteed). In Brazil and Australia (as well as other countries), there is also a diversity dimension with affirmative action encouraging under-represented racial groups and men (Brazil) to participate in education more broadly.
- 2.6.4 The allocation of student numbers is not done in the same way or with the same purposes in other countries as is currently occurring in England. For example, in other countries, student numbers may be allocated according to formulae or negotiated on the basis of existing institutional profiles (or new ones) following agreements on institutional plans. National priorities are very often incorporated within these mechanisms.
- 2.6.5 Competition between institutions for domestic students varies significantly between countries. For example, in Brazil and Poland, competition is between public universities for STEM students, and in Japan it is between public and private. In the US, competition exists within different strata

of publicly funded and private institutions, where the ‘flag-ship’ state-funded public universities compete in recruitment with the elite private institutions, although a decline in state-funding is making such competitiveness increasingly challenging.

- 2.6.6 An interesting observation is that there is often more competition for STEM students in many countries since ‘quality students’ are in great demand. Studying in private institutions (depending on the nature of the private sector within the country *ie* elite or demand-absorbing) can be seen as an easier route for students and perhaps also a faster route to employment.
- 2.6.7 Ideologies of ‘competition’ and ‘contestability’ do not appear to be as strong – or more particularly – are not directed in the same way in other countries. In general, more competition is embedded in funding allocations for research in other countries than in relation to teaching at undergraduate level (although there are exceptions and the pattern is shifting, notably where the system has a large private element and where countries are seeking to increase levels of institutional differentiation). However, even in these contexts, it is important to differentiate between elite, non-profit private sectors (which are little different from elite publicly funded institutions since both receive large amounts of public funding for research) and demand-absorbing private for-profit providers (that nonetheless receive public funding via student grants and loans).
- 2.6.8 England’s approach to institutional autonomy appears to differ from other countries for historical reasons. England has long had a reputation for having one of the most autonomous systems in the world; however, recent policy changes are seeking at one and the same time to restrict that autonomy (through student number controls and other regulations) and to increase it through incentives for competition and by opening the market to different providers and fee-propositions. In many other countries (particularly in continental Europe), the policy trajectory appears different, *ie* towards more institutional autonomy (often within an already differentiated system) and with more caution about radical moves towards a fully-fledged ‘market’ in tertiary education at undergraduate level, particularly without a clear and appropriate regulatory framework in place. However, different countries have different starting positions in relation to this trajectory. The US, for example, in many states, is moving from a position of considerable institutional autonomy to increasing levels of control at state level because of regulatory shifts and fiscal constraints.

### **Summary**

- 2.6.9 The funding and fee system in England from 2012 is unique or rather different in a number of ways. These differences include the existence of the research evaluation system in England, but not in all other countries in the sample, which leads to differences in the mechanisms for distributing research funding and the rationale behind the distribution; the control of access to HE through the AAB policy, the core and margin policy and the role of OFFA; the approach to and purpose of the allocation of student numbers; the nature of competition between institutions in seeking to attract students; and stronger ideologies of ‘competition’ and ‘contestability’ in England and the level of autonomy of the English institutions.

## **2.7 ‘Public interest’ or ‘public benefit’ reason to address market failure**

- 2.7.1 We have used OECD terminology as a starting point in addressing this question which is the fifth objective in the terms of reference for this study. For example, the OECD argues that:
- ‘In the governance of tertiary education, the ultimate objective of educational authorities as the guardians of public interest is to ensure that public resources are efficiently spent by Tertiary Education Institutions for societal purposes. There is the expectation that

institutions are to contribute to the economic and social goals of countries. This is a mixture of many demands such as: quality of teaching and learning defined in new ways including greater relevance to learner and labour market needs; research and development feeding into business and community development; and contributing to internationalisation and international competitiveness'.<sup>32</sup>

2.7.2 Across the case study countries, a number of rationales are used in relation to the designation of national priority subjects, themes, fields and sectors. The macro-rationales that we have identified in national strategy documents reflect the OECD statement above and include:

- Globalisation and its consequences.
- International competitiveness and increasing levels of competition from multiple sources.
- Positioning and profiling of the country in particular ways.
- Economic requirements (growth, innovation).
- Enhancing capacity and quality (of teaching, teachers, programmes, graduates).
- Speed of technological change and development.
- Widening access and participation.
- Alignment and coordination across sectors.

2.7.3 We have not identified widespread use of the terms 'public interest' or 'public benefit' in relation to specific policies and interventions. Instead, we have inferred 'public interest' in relation to the macro-rationales identified by different countries. As is evident in the country case-studies (see Table 2-1 and Annex C), different countries also have specific rationales for their policies, linked to their own context.

2.7.4 The OECD was also useful in terms of guiding our understanding and investigation of 'market failure':

'Economic theory provides widely accepted underlying principles to justify governmental intervention (and public funding of) tertiary education. Concerns at two levels provide the rationale for government's involvement: efficiency concerns, often called 'market failures'; and equity concerns, mostly related to providing equal educational opportunities for all. The involvement of the government ranges from regulation through subsidisation to production of tertiary education services'.<sup>33</sup>

2.7.5 We have rarely come across explicit use of the terminology of 'market failure' as a rationale for public funding subsidies and other interventions. Where we have found this terminology, the interpretation has not always been the same. For example, in the Netherlands, there is a clear perception at policy level that students are not aware of the jobs that are available in science and technology and lack sufficient knowledge about university programmes in these areas (*ie* an information and awareness gap). In addition, programmes are reportedly seen by prospective students as too difficult to complete and jobs in these fields are seen as unattractive. These perceptions are reported in several European countries such as Denmark, Poland and the Netherlands. In the case of the Netherlands, a high-level and coordinated agenda (the Delta Plan) was set up to address these 'market failures'. A different interpretation of 'market failure' occurred in the same country in relation to serious quality failings in the private sector; in this case, government intervention was reportedly needed (*ie* to re-introduce inspections of quality) to regain public trust.

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<sup>32</sup> OECD, vol. 1, p15, 2008.

<sup>33</sup> OECD, 2008, vol. 1, p168, 2008.

- 2.7.6 Despite a lack of explicit use of the term ‘market failure’ in policy documents or in comments from our respondents, there is abundant evidence that governments (and other stakeholders) have intervened in tertiary education and used targeted public funding in teaching and research (and at school level and with employers) in ways that accord with the OECD description, above. Such interventions have included rationales related to efficiency (and market failures of different kinds) and equity – with respect to priority subjects, fields, themes and sectors. The tables in Section 2 provide examples, as do the country case-studies at Annex C.
- 2.7.7 With respect to research, in the majority of countries, there has been a strong focus on research performance and the aim of increasing the innovation effectiveness of institutions’ R&D. The OECD points to four broad actions across OECD countries:<sup>34</sup>
- Attempting to focus research efforts around explicitly chosen priority areas.
  - Changes in funding mechanisms aimed at raising research quality.
  - A stronger emphasis on research evaluation.
  - Building critical mass.
- 2.7.8 We have focused particularly on the first of these, but have also found evidence of the others in the sample countries. In several countries, building critical mass has also been part of the strategy for addressing priority areas. In others (such as Japan), the research evaluation includes a focus on the relevance of research to business and the alignment of research to national priorities. In addition, several countries have substantially increased public funding for R&D (eg Germany, Japan, Brazil and Denmark).

### **Summary**

- 2.7.9 The terms ‘public interest’ or ‘public benefit’ are not in widespread use for policies and interventions. Instead ‘public interest’ is inferred through the use of macro-rationales identified from the case study countries for the designation of national priority subjects, themes, fields and sectors. These include: globalisation and its consequences; international competitiveness and increasing levels of competition from multiple sources; positioning and profiling of the country in particular ways; economic requirements (growth, innovation); enhancing capacity and quality (of teaching, teachers, programmes, graduates); speed of technological change and development; widening access and participation; and alignment and coordination across sectors.
- 2.7.10 The term ‘market failure’ was rarely used explicitly as a rationale for public funding subsidies and other interventions. Where it has been used, the interpretation has not always been the same. Despite this, there is abundant evidence that governments (and other stakeholders) have intervened in tertiary education and used targeted public funding in teaching and research (and at school level and with employers) in ways that accord with the OECD description of market failure.

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<sup>34</sup> *Tertiary Education for the Knowledge Society*, Vol 2. Special Features: Equity, Innovation, Labour Market, Internationalisation. Santiago P, Tremblay K, Basri E and Arnal, Paris, OECD (p105), 2008).

## 3 Analysis and synthesis

### 3.1 Introduction

3.1.1 Section 2 sets out the findings of the study against the detailed study objectives listed at paragraph 1.3.4. The overall impact of the interventions in a specific country depends on the current policy and political context, the structure and history of the education sector as well as the dynamic of state-institutional relationships. In order to help with this context we have developed a simple categorisation of state-institutional relationships in sub-section 3.2. We have also documented a number of observations on such issues (sub-section 3.2) and have examined the extent of applicability of the interventions to England where feasible and appropriate (sub-section 3.3.26).

### 3.2 Categorisation of state-institutional relationships

3.2.1 As part of the study we examined the relationships between governments and their HE systems at the level of funding systems and implementation of policy, particularly in relation to national priorities, STEM and any designation of vulnerable subjects.

3.2.2 Across the case study countries, it is possible to locate different government-institution relationships on a continuum (see Figure 3-1) from 'structured control' (where the balance is tilted towards government and away from 'the market') to 'demand-led' (where the balance is tilted towards the market and away from government). There are several points along the continuum where the balance is (arguably) more even. These points include: 'negotiated arrangements' (such as performance contracts between government and institutions) and 'incentivised approaches' (initiative-funding on a competitive basis). In this model England is perceived to be moving away from 'structured control'.

3.2.3 Countries that appear (typically) to have a 'structured control' approach include: Germany, Poland and Brazil. Countries that appear to have a 'demand-led' approach include the US, Australia and Japan. Several countries use 'negotiated arrangements' (eg the Netherlands and Denmark) and incentivised approaches (eg Japan and Poland). Both Hong Kong and Japan appear to have achieved an equitable balance between 'markets' and 'government interventions' through a variety of means. The approaches of governments are also in a state of flux as several countries are in the process of granting more autonomy to their public universities and tertiary-level institutions and are also encouraging them to seek income from non-governmental sources. In addition, at the level of funding mechanisms, there is a balance between use of formulae-based approaches and competitive funding with an increasing use of the latter across countries.<sup>35</sup> The opening up of HE markets to new providers is also part of this changing dynamic.

3.2.4 In at least some, if not all, countries that operate a broadly 'demand-led' system (*ie* based on student demand), demand can also be shaped by a national policy framework that establishes different tuition prices for different study courses and that targets additional places for fields in which there are labour market shortages (eg in Australia and in Denmark at PhD level). Labour market information is also provided to prospective and enrolled students (eg Australia's new 'MyUniversity' initiative). In some countries, regulations also restrict whether institutions can close programmes that are judged to be critical to national needs without government approval.

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<sup>35</sup> See OECD (2008) Vol 1, *op cit*.

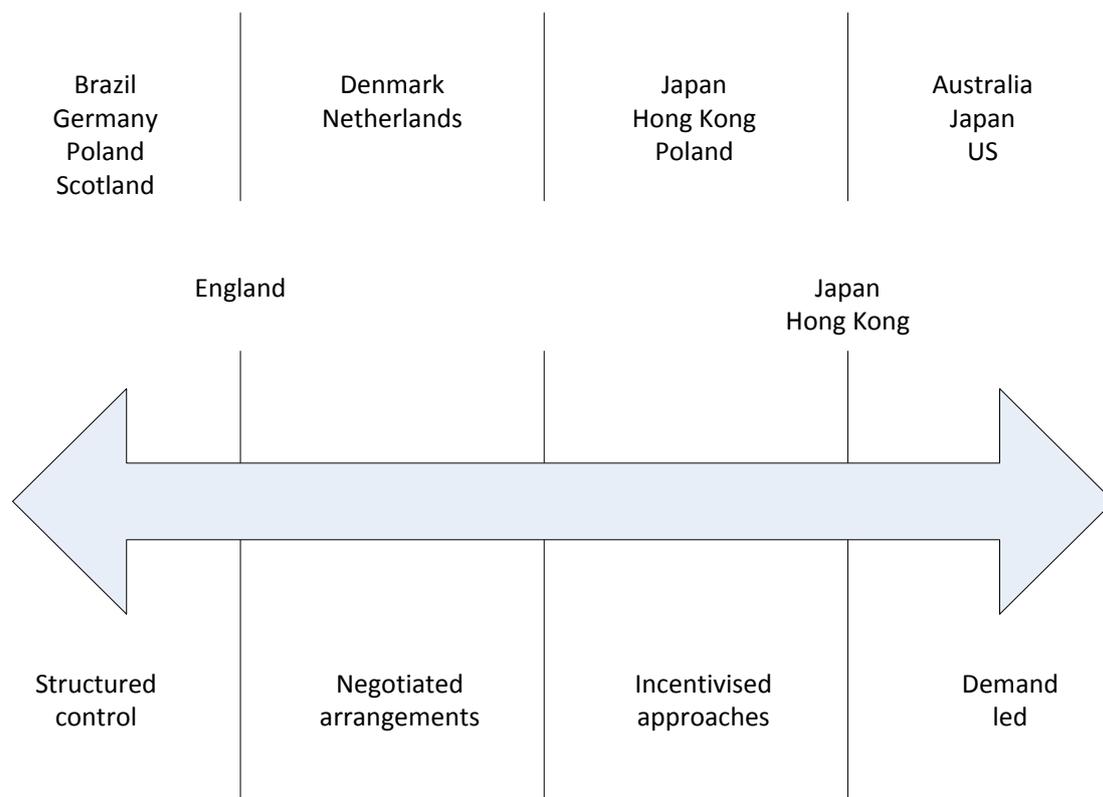


Figure 3-1: Approaches to state-institutional relationships

3.2.5 This generalised and overly simplistic picture is complicated by several factors:

- Governments may adopt different approaches to ‘the problem’ depending on perceptions of urgency and importance (*ie* level of risk) – for example, natural disasters as in Japan’s case or a concern about national competitiveness and attractiveness to multi-national businesses as in the Netherlands’ case.
- ‘The market’ is rarely a pure one in terms of education or skills since there are significant government interventions in many countries at school or broad tertiary level to influence ‘market demand’ for programmes in HE (see Table 2-2).<sup>36</sup>
- Employers, businesses and other stakeholders are involved (and increasingly involved in several countries) in both identifying national priorities and in the mechanisms and programmes used to address them (see Table 2-6).
- Even where ‘markets’ and market-demand appear to be the dominant philosophies (as in the US and Australia), the large amounts of public funding linked to student loans and grants – and associated accountability and regulatory regimes – tie institutions (public and private) to government policy and regulatory action in a variety of ways.

<sup>36</sup>

The OECD suggests that there are three main ways by which public authorities seek to shape the environment of student and institutional choice to align more closely with labour market needs and related priorities: steering through information; targeted funding for institutional provision in certain disciplines (*ie* increasing or decreasing funding); and preferential pricing and financing (to induce students into selected fields). (Tertiary Education for the Knowledge Society, Vol 2, Special Features: Equity, Innovation, Labour Market, Internationalisation. Santiago P, Tremblay K, Basri E and Arnal, Paris, OECD (p214), 2008).

### 3.3 Observations

3.3.1 During the course of the study we have made the following observations, which we believe will help set the overall context for HEFCE.

#### *Overall*

3.3.2 The approach to priority subjects for any country needs to be understood in that country's political, social, economic, cultural and educational context. It follows that what works in one country might not work as well or at all in another.

3.3.3 In some countries a holistic and strategic approach (*eg* Germany (High-Tech Strategy) and the Netherlands (Human Capital Strategy)) is being adopted in relation to STEM subjects. These approaches involve schools, FE and HE, and research together with businesses, government and other stakeholders (*eg* charities). Others (*eg* the US) have a less coordinated approach, although large amounts of research funding for STEM subjects – and in some cases a similar priority in teaching funding – is causing changes in institutional portfolios and priorities as they 'follow the funding'.

3.3.4 Some strategies for STEM are embedded in other policies/strategies (*eg* as part of its China Strategy, Denmark has allocated 13 industrial PhD projects to students with a Master's degree from a Chinese university). In other cases, a national strategic approach is announced (*eg* Spain has a national research, development and innovation plan – 2008-2011) in which various initiatives are embedded.

3.3.5 Different countries have different approaches to oversight, management, coordination and evaluation of their intervention programmes. It is not clear what approaches work well, and the optimum approach may well depend on the financial systems and accountability culture within a country.

3.3.6 Some of the arrangements have not been ideal. For example, in the US, a recent Government Accountability Office report<sup>37</sup> noted that, in 2010, 13 federal agencies invested over \$3billion in 209 programmes to increase knowledge of STEM fields and attainment of STEM degrees. The report found that there was room for improved coordination, driven by an underlying robust 5-year strategic plan, and potential for consolidation of the programmes together with reduction of administrative costs. It also found that there needed to be much better understanding of the effectiveness of these programmes, through use of reliable output measures and better uptake of evaluations and dissemination of the findings. This report also provides a useful list of the programmes and those projects that have been evaluated.

#### *Schools*

3.3.7 In some countries, the school system is already specialised at secondary level (*eg* Brazil, Poland, Netherlands) and this will affect how (and at what level) the country approaches priority subjects.

3.3.8 In several countries (*eg* UK, Netherlands, Japan, Denmark) STEM subjects are perceived as 'too difficult' by pupils and students, hence reducing demand for STEM subjects. This cultural issue is being tackled in a variety of ways.

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<sup>37</sup> *STEM education: strategic planning needed to better manage overlapping programmes across multiple agencies*, <http://gao.gov/products/GAO-12-108> [accessed 25 January 2012].

- 3.3.9 In Brazil, the focus is very much on vocational and HE levels – the school system has a number of problems such as teacher recruitment and quality. This influences the number of students able to follow STEM programmes.

#### ***Undergraduate and postgraduate teaching***

- 3.3.10 In most (but not all) of the case study countries, student numbers are not capped. (Japan does have student number controls but it appears that they are breached quite often. Australia has recently lifted student number controls.) Several countries are seeking to increase student numbers to meet national targets or international benchmarks (eg Germany, Hong Kong, Netherlands, Poland, Denmark and Brazil).
- 3.3.11 In several countries (Germany, Netherlands, Poland and Denmark), there is a concentrated effort to coordinate responses to national priorities (and perceived national problems) across government departments and between all education levels and between employers, businesses and HE.
- 3.3.12 Some mechanisms (eg scholarships for domestic students or differential fees for particular subjects as in Australia) have been tried in some countries and have not had any impact (eg Netherlands) or a perverse impact (eg Poland) so policies have either changed or are under pressure.

#### ***Research and associated postgraduate education***

- 3.3.13 Some initiatives (eg enhancing infrastructure) are relevant to undergraduate, graduate, postgraduate teaching and research.
- 3.3.14 For many countries, internationalisation is as focused on collaboration as recruitment (ie partnerships, exchanges and joint degrees). A good example is Brazil's Science without Borders programme, which is targeting 101,000 mobility scholarships in STEM fields targeted at Brazilian and overseas' students and researchers.

#### ***Vocational education, FE and sub-degree level***

- 3.3.15 In some countries (eg Hong Kong) there is a big – and growing – emphasis on vocational education (and sub-degree) sectors. For example: The statutory Vocational Training Council (VTC) was set up to provide and promote a cost-effective and comprehensive system of vocational education and training to meet the needs of the economy of Hong Kong. The operation of VTC is supported by four functional committees, 21 training boards and five general committees. The training boards offer advice on the manpower and training needs of various industries or commercial sectors and make recommendations on how these needs may be best met. The five general committees are responsible for specific training areas common to more than one sector of the economy. These areas are apprenticeship and trade testing, information technology training and development, management and supervisory training, technologist training, and vocational training for people with disabilities.
- 3.3.16 Some countries (eg the Netherlands, Brazil and Poland) have re-structured their vocational training sectors but with mixed results. For example, in the Netherlands, there appears to be unhappiness among some employer groups (eg in the steel industry) and employers have set up their own vocational training arrangements. In Brazil, although enrolment in Technical Institutes has increased, students find it difficult to progress to the university sector and, through this route, develop higher-level skills. In Poland, incentives to students and institutions to pursue

technical subjects in both universities and other HEIs has resulted in increased enrolments but also lower completion rates, and associated perceptions of poorly qualified applicants.

### ***Employers, businesses and other stakeholders***

- 3.3.17 Some countries seek to enhance the number of STEM-qualified individuals by encouraging immigration of international students and enabling them to stay and enter the work-force (eg the US encourages doctoral students and graduates in STEM subjects). Others have prohibitive immigration strategies (eg the UK at present).
- 3.3.18 There is discussion within countries as to whether to bring in international students or ensure adequate domestic supply to the labour market, or balance the two (eg Germany, Denmark and the Netherlands).
- 3.3.19 In Hong Kong, there are many private donors to education. It is unclear from the case study on what such private donations are focused (they may be linked, for example, to charities that are setting up new universities).
- 3.3.20 In Japan and Brazil, partnerships between industries and universities are growing, but are typically limited to the most prestigious universities (and these are research partnerships).
- 3.3.21 Japan has very few research-funding charities (in contrast to the UK, Germany or the US).
- 3.3.22 In most countries (eg the Netherlands, Germany and Hong Kong, in particular) employer organisations engage with government on relevant issues of HE, Vocational Education and Training (VET), and skills.
- 3.3.23 Regular labour market surveys provide relevant information to government at the national and federal/state levels (eg the Netherlands, Germany, Australia and Canada).
- 3.3.24 The relationship (and co-funding) between universities and businesses or other employers depends on the structure of the HE system (eg in the Netherlands, there is a closer link and funding between Universities of Applied Science (UoASs) and businesses than between the universities and businesses because of the academic/vocational division of roles in the HE system).
- 3.3.25 In several countries (eg the Netherlands, Germany and Brazil) the 'industry/employer' lobby is powerful and has an impact on government's strategic priorities (eg identification of 'Top Sectors' in the Netherlands).

### ***Funding systems***

- 3.3.26 There is commonality across the sample of countries in the socio-economic importance attached to ensuring a strong pipeline for STEM subjects from school through to employment, including improving infrastructure and covering both demand and supply sides of the issue. Associated investment covers improving the number and quality of graduates and the skills of the general workforce. Investment and focus on STEM is not generally in response to vulnerability, however, but to achieve growth and innovation. In other countries, vulnerability appears to focus on minority subjects rather than STEM subjects and 'vulnerability' is judged both in a local context and a macro-global context (ie medical and nursing education linked to local needs; or Islamic studies introduced because of a perceived gap in provision associated with macro-political contexts).

### ***Rationale for priority subjects***

- 3.3.27 A key rationale that is prevalent across all the case study countries is that the future economy and society will require high level – and more – scientific and technological skills both among graduates and in the general population. Countries differ in relation to their priorities within STEM subjects (*eg* in Australia, engineering predominates over other sciences, while in the US the biomedical sciences are a strong priority).
- 3.3.28 In some countries (as in England) there is a concern about a potential deficit in relation to the output of STEM graduates, especially at post-graduate taught and post-graduate research levels. Across countries, drivers include a lack of demand from students for these subjects, demographic changes and associated issues, and poor quality teaching at several levels (*eg* Brazil and Denmark). Other countries do not necessarily perceive a deficit in terms of skills' needs or demand from students, but do see a need for an output of many more graduates at HE and vocational levels in these fields (*eg* Australia, US, the Netherlands – or a combination of both as in Brazil and Poland).

## **3.4 Applicability to England**

- 3.4.1 The following paragraphs discuss the 'applicability' of the study's findings to the English post-2012 context.

### ***Funding systems***

- 3.4.2 The funding systems elsewhere are not the same as in England, so there is no exact applicability, but there are similarities with Australia, Canada and the US with evidence of 'policy borrowing' between these countries. Some common aspects of history, language, economics and culture may explain these similarities as well as current developments towards growing private investment (both corporate and individual) in HE.

### ***Initiatives and interventions relevant to England***

- 3.4.3 Countries have a variety of initiatives in place at a variety of levels (schools, vocational education and into employment) and types of intervention (*eg* scholarships, international mobility programmes, marketing campaigns, fee loan support) and also have particular initiatives aimed at under-represented groups (in relation, particularly, to gender and ethnicity).
- 3.4.4 The types of initiative that may be of particular interest to England include the MINT and Excellence initiatives in Germany, Science without Borders in Brazil, Poland's Scholarship Scheme for technical subjects, Denmark's PhD expansion and the Netherlands' DELTA Plan.
- 3.4.5 Beyond this, there are also interesting approaches to linking teaching and research (and HE in total) to economic development, economic growth and innovation agendas in a holistic way (*eg* 'Top Sectors' in the Netherlands and the KNOW project in Poland). This is similar to how SIVS has intertwined teaching and research in relation to LBAS.
- 3.4.6 Table 3-1 provides example of interventions from the case study countries considered of relevance to HEFCE's SIVS proposals identified at paragraph 1.2.29. In addition, Table 2-2 to Table 2-6 list many detailed interventions that may be of interest to HEFCE. Many have been part of the existing SIVS approach while others have not.

Proposed intervention	Country case study exemplar
Mitigating changes in student number controls to ensure that SIVS are not disadvantaged	The Netherlands' use of 'Sector Plans' that involve regular reviews at subject level
Funding for higher-cost undergraduate subjects	-
Funding for certain specialist providers	-
Development of a new approach to support for postgraduate provision	Denmark's increase in PhD provision Brazil's Science without Borders initiative Research concentration (with a focus on STEM subjects) is evident in national research priorities (as part of the pipeline of postgraduate research into employment). This includes the National Institute of Sciences and Technology in Brazil, KNOW in Poland and FORSK 2015/2020 in Denmark
Discretionary funding to develop partnership approaches to providing support that encourages collaboration and efficiency for small areas of provision within larger providers	The Netherlands' Delta plan Germany's MINT approach Collaborations across HEIs to concentrate provision are a feature in the Netherlands, Denmark and Scotland
Measures to ensure that work placements and international placements/years abroad are maintained at current levels following the fee and funding reforms	Brazil's Science without Borders initiative

Table 3-1: Initiatives of relevance to interventions proposed by HEFCE (paragraph 1.2.29)

### Small-scale versus holistic approach

- 3.4.7 An important point is the difference between a small-scale intervention (as in the case of SIVS) through HEFCE and a more holistic approach (particularly in relation to STEM subjects, but not exclusively) as in Denmark, Australia, the Netherlands and Germany. If one focuses on languages, a holistic approach is also visible where languages are seen as important for economic growth (and just as important as STEM subjects) and of importance to economic development, internationalisation agendas and 'soft power' aspects of diplomacy and trade (as in the US). Similar arguments could be made for historical and area studies.
- 3.4.8 Linked to the above is the issue of coordination in a 'whole systems' approach across education sectors (including vocational education) and with the private sector and into employment. In the Netherlands, for example, the DELTA Plan and Top Sectors Initiatives are aiming for 'alliances' between vocational education, private companies, secondary education and universities. In the US, there are some examples of this approach in individual states and where individual institutions have exercised strategic leadership. In Germany, the MINT initiative is a parallel example to the initiatives in the Netherlands.

## 3.5 Comparative education systems research

- 3.5.1 In carrying out this work the study team has had the opportunity to examine a wide variety of resources and to discuss the objectives and data gathered with many officials and academics across the countries investigated. Moreover, given the range and variety of examples from other countries of policy initiatives that originate from similar economic and social (if not political) drivers, HEFCE would be wise to include international comparative studies in its quest for solutions to current English issues. Two clear messages arise:
- While there is academic research at the level of subject areas (eg studies of attainment in mathematics) or cross-cutting themes (eg widening participation), there appears to be little academic research into, and no clear body of knowledge about, the dynamics of a country's

education and training systems and the response to interventions regarding priority subjects at the 'whole systems' level, including the interdependencies between parts of the system.<sup>38</sup>

- There is considerable interest among academics and officials to whom we have spoken about the findings of this study and in having a forum to discuss the issues and problems (relating to priority subjects) at a whole system level so as to understand the dynamics between parts of the system and the points at which interventions are most likely to be effective (in a given culture). There may well be an opportunity to hold an international conference on this topic as a means of promoting a research agenda across countries.

3.5.2 Accordingly, if HEFCE wishes to obtain further insight into the comparison of education systems at the systems level, it is recommended that HEFCE should:

- Hold an international sector-wide event with invited speakers to discuss rationales, approaches, mechanisms and evaluation outcomes in more depth across relevant countries; it is possible that the OECD would be interested in – and might support – holding such an event.
- Encourage the development of comparative 'whole education system' studies and publications, especially regarding the UK and other selected countries, so that the expertise and body of knowledge are available to HEFCE and others (*eg* EU, OECD) in the future.
- Include international comparisons in future studies of specific sectors (*eg* postgraduate taught and postgraduate research provision and the dynamics of this territory).

#### ***Conduct of future research of this kind***

3.5.3 Based on our experiences of the difficulties of interpretation caused by needing to understand in some detail the political, economic and social context of each country for this research, we would recommend inclusion of an in-country fieldwork stage for future research of this kind.

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<sup>38</sup>

By this we mean an understanding of the education system as a whole and how it works as a system at all levels (*ie* primary, secondary, tertiary, continuing education and vocational training). This includes the political and economic context, how it is funded, what its inputs and outputs are, how it meets the country's educational and skills training need, what its strengths and weaknesses are, and how the system might need changing, or how it is planning to change.

## A List of contacts

A.1 This Annex lists the individuals who have contributed input to this report. The study team would like to thank and acknowledge all the contributors for their time and willing participation.

First name	Surname	Organisation	Country
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Roger	Brown	Liverpool Hope University	Global
Angel	Calderon	RMIT	Australia
Caecile	Dahlman	Danish Agency for Universities and Internationalisation	Denmark
Peter	Eckel	Association of Governing Boards (AGB)	US
Thomas	Estermann	EUA	European Higher Education Area
John	Fielden	CHEMS	Global
Michael	Fung	University of Science and Technology, Hong Kong	Asia
Madeleine	Green	Independent	US
Lars	Haikola	Swedish National Agency for Higher Education	Sweden
Cliff	Hancock	HEFCE	Japan
Don	Heller	Michigan State University	US
Andreas	Hoeschen	Deutscher Akademischer Austausch Dienst	Germany
Mette	Holm Dalsgaard	Danish Technical University	Denmark
Janet	Ilieva	British Council (Hong Kong)	Hong Kong and Far East
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Caroline	LaChance	Association of Universities and Colleges of Canada (AUCC)	Canada
Judith	Lamie	University of Leeds	Japan
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Table A-2: List of contributors (part 1 of 2)

First name	Surname	Organisation	Country
Helena	Lim	Higher Education Academy	Wales and Northern Ireland
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*Table A-2: List of contributors (part 2 of 2)*

## B Summary of the rapid scoping phase

### B.1 Candidate countries

B.1.1 We examined 21 countries: Australia, Brazil, Canada, China, Denmark, Finland, France, Germany, Hong Kong, India, Italy, Japan, South Korea, the Netherlands, New Zealand, Poland, Russia, Scotland, Singapore, Sweden and the US. Table B-1 lists the candidate countries and their relevant key characteristics.

Country	Ratio public/private funding <sup>39</sup>	% science and engineering degrees <sup>40</sup>	% HRST Occupations <sup>40</sup>	% international/foreign students in science and engineering <sup>41</sup>
<b>Baseline</b>				
UK <sup>42</sup>	35:65	22.78	27.16	28.1
<b>Competitor countries</b>				
Australia	45:55	20.39	35.77	22.7
Canada	59:41	22.44	35.51	28.9
France	82:18	27.58	32.25	29.7*
Germany	85:15	28.05	35.99	36.9
US	37:63	14.98	32.32	35.9
<b>Other EU and OECD</b>				
Denmark	95:5	19.80	39.14	29.8
Finland	95:5	28.75	34.20	42.3
Italy	71:29	20.96	31.47	23.0*
Netherlands	73:27	14.18	37.55	7.7
Poland	70:30	16.95	26.23	9.4*
Scotland	N/A	N/A	N/A	NA
Sweden	89:11	24.64	39.55	49.9
<b>Non-EU OECD</b>				
Hong Kong	N/A	N/A	N/A	NA
Japan	33:66	24.14	14.88	16.2
New Zealand	70:30	17.31	28.59	25.2
Singapore	N/A	N/A	N/A	NA
South Korea	22:78	35.96	18.59	NA
<b>BRIC Countries</b>				
Brazil	N/A	10.95	N/A	NA
China	N/A	39.18	N/A	NA
India	N/A	N/A	N/A	NA
Russian Federation	64:36	24.77	N/A	NA
Key:		Not selected		

Table B-1: Candidate and selected countries

<sup>39</sup> Education at a glance 2011 (2008 data), OECD.

<sup>40</sup> Science, technology and industry outlook 2010, OECD. Human Resources in Science and Technology (HRST) occupations as a percentage of total employment is an indicator of the extent of innovation-related skills in the workforce. This category of workers corresponds to professionals and technicians as defined in the International Standard Classification of Occupations (ISCO-88). Science and engineering degrees as a percentage of all new degrees is an indicator of a country's potential for assimilating, developing and diffusing advanced knowledge and supplying the labour market with human resources that possess critical skills for research and development.

<sup>41</sup> Education at a glance 2011 (2009 data), OECD; please note that percentages should be treated with caution since some do not include advanced research programmes and lower level undergraduate programmes and \* indicates data on foreign vs. internationally mobile students.

<sup>42</sup> HEFCE's focus is on England, but most international organisations consider education at the UK level.

- B.1.2 These countries were identified on the basis that they were close in one or more ways to the overall or detailed objectives of the study, that they could provide a global perspective and that there was accessible published material of relevance to the study. Furthermore, a key criterion was that the team had prior knowledge and contacts in these countries, given the limited time and resources available for the study.

## B.2 Country selection

### *Key selection characteristics*

- B.2.1 The purpose of the rapid scoping stage was to identify countries that might offer insight or useful lessons for the development of policy regarding priority subjects or themes in England. In principle, the countries of most interest would have similar educational, social and economic characteristics to England. In practice, there are no countries with identical HE funding arrangements to England in the new form outlined in the White Paper, and many of the other characteristics can be dissimilar as well. Rather, the approach adopted was to identify a set of key selection characteristics that apply to England and were of relevance to the objectives of this study. The characteristics examined were as follows:
- **Economic drivers**, covering whether:
    - There is a clearly stated growth and/or innovation strategy.
    - Skills shortages are currently recognised as existing in areas or fields which are of strategic importance for the country’s economic or social development.
    - The country has a similar demography and demographic challenges (*ie* a significant increase in average age of the population) to the UK.
  - **Funding systems** used for HE, covering whether:
    - Student fees are charged for public HE.
    - Private institutions provide HE.
    - There is targeted research funding.
    - There is targeted teaching funding.
    - There is co-funding for teaching (*eg* by an employer).
  - **National internationalisation and/or globalisation policy**, covering whether:
    - There is encouragement or support for migration/mobility of skilled workers into the country or outwards.
    - There is a national level focus on strategic partnerships and collaborations (similar to the UK-India Education and Research Initiative).
    - The country has a policy on curricular reform that is directly related to internationalisation and globalisation and designed to encourage inward and outward mobility and skilled migration (*eg* programmes in foreign languages or with a strong international element).
    - There is a strong focus on developing global competencies (*eg* language skills *etc*).
  - **Economic status**, covering whether:
    - There is current economic growth and development.
    - There has been a strong impact from the current crisis on the country’s economy.
  - **Autonomy of HE institutions and the role of government in HE**, covering whether there is accreditation of institutions or whether there is a quality assurance (QA) system for HE.

- **The approach to priority subjects or themes at national and, if appropriate, state level,** covering whether:
  - There is a strong science and research base with associated policies linked to priority subjects or themes.
  - There are clear statements and policies about priority subjects or themes.
  - There is an approach to priority subjects or themes that is addressed through policies for teaching and/or students.
- **The relevant characteristics of the HE system,** covering:
  - Whether the country is perceived as a direct competitor of the UK.
  - Its geographical location – to ensure a continental spread (*eg* whether it is part of Western Europe, North America, *etc*).
  - The availability of contacts and the ease of obtaining and reading information, reports, *etc* about the country within the timescale and resources of this project.

### **Triage approach**

- B.2.2 The candidate countries were categorised in a semi-quantitative<sup>43</sup> way based on an analysis of the key characteristics to see how ‘like’ England they were. The countries were then triaged to categorise the countries as:
- **Definite countries,** where the countries selected had characteristics that were likely to provide interesting insights and lessons for the development of policy for priority subjects and themes in England.
  - **Other likely countries,** where it was not possible to say definitely that the country should be considered in the detailed stage of the study, but the study team’s judgement was that it should.
  - **Countries not directly taken forward,** where there was overlap with other countries, a lack of contacts or other issues concerning obtaining information.

### **General principles**

- B.2.3 Where necessary the following general principles were applied to the initial triage to develop a list of candidate countries for the second stage of analysis:
- The available budget would have allowed no more than 15 countries and/or themes to be considered in more detail.<sup>44</sup>
  - Countries where it was assessed to be difficult to find and access reliable information were not to be considered further unless there was a compelling reason to do so. This measure included the availability of information for the country concerned and/or whether the study team had access to the relevant language skills. Similarly, a country where there was certainty that relevant information could be obtained by the study team was preferred over a country where there was more uncertainty.
  - There was a need to cover some countries beyond Europe (*ie* at least one in the geographical areas of Australia, Asia and the Americas).
  - At least one of the BRIC Countries (*ie* Brazil, Russia, India or China) was to be considered.

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<sup>43</sup> This used a simple cluster analysis.

<sup>44</sup> As a rule of thumb the analysis of a country or a thematic area during the detailed stage of the study are considered to be roughly equal in effort.

- Countries which were 'nearer' to England in the cluster analysis were preferred with all other factors being equal.
- Countries taken forward spanned, as far as is possible within a small number of countries, the full range of characteristics between them.

B.2.4 The candidate list of countries was discussed with HEFCE, leading to the agreed countries set out at Table B-1.

## C Case studies

### C.1 Australia

#### *HE system*

- c.1.1 Australia has a funding system similar to England and a similar ratio of public to private funding sources for HE (although the funding structure is currently being reviewed). Funding allocations are more finely grained than in England as they are made at individual subject level. Australia is also a key competitor for the UK in attracting international students and skilled workers.
- c.1.2 Australia has a two-tier tertiary education system split into HE and a Technical and Further Education (TAFE) (vocational) sector. The HE sector in Australia comprises 37 public and two private universities, one Australian branch of an overseas university, three non-university self-accrediting providers and over 150 non-self-accrediting providers.<sup>45</sup> The non-self-accrediting HE providers are a very diverse group of specialised, mainly private, providers that range in size and include theological colleges and other providers that offer courses in areas such as business, information technology, natural therapies, hospitality, health, law and accounting.
- c.1.3 Most institutions are established or recognised under state or territory legislation. Under the Higher Education Support Act (2003) institutions receive different types of financial support according to their status via the Department of Education, Employment and Workplace Relations (DEEWR). The states and territories also administer and fund TAFE institutions that generally offer short courses, certificates, diplomas and advanced diplomas in a wide range of vocational subjects. Some also offer degree-level courses. A range of (mainly private) Registered Training Organisations also offer VET programs.
- c.1.4 HE policy is generally developed at Federal (Commonwealth) level via DEEWR. Despite their accreditation function, the states and territories have little practical influence in HE, and their main focus is on vocational education.

#### *HE funding system*

- c.1.5 Higher education in Australia is funded from both public and private sources. The Federal government's direct contribution to the financing of Australian HE has been falling in recent years, largely as a result of the student fee increases and the deregulation of international student and postgraduate student fees.
- c.1.6 The core educational activities of HEIs (and their wider societal role) are primarily supported via 'base' funding which is provided under the 2003 Higher Education Support Act, via the Commonwealth Grant Scheme (CGS), and supplemented by student fees. Base funding is based on the principle that it is provided 'to support universities in their fundamental role of providing teaching and learning informed by scholarship and a base capability in research, within appropriately resourced facilities'.<sup>46</sup> Teaching funding is expected to balance lifetime returns from HE to the individual student and the wider benefits to society as a whole. Societal benefit is calculated based on how much additional tax society collects from graduates and the share of this tax revenue that is attributable to a university education.

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<sup>45</sup> *Higher Education: Overview paper*, Queensland government: DEEWR, <http://www.deewr.gov.au/HigherEducation/Pages/Overview.aspx> [accessed 24 May 2012].

<sup>46</sup> *Higher Education Base Funding Review*, Final Report, DEEWR, October 2011.

- c.1.7 CGS funds are provided directly to HEIs via a block grant. Funding allocations are based on subject groupings in funding ‘bands’ based on their historical delivery cost. The combination of fees and block grants are expected to meet the full cost of provision, although the 2011 Higher Education Base Funding Review argues, that ‘base funding for medicine, dentistry, veterinary science and agriculture should be increased by as much as 25 per cent’.<sup>47</sup> Institutions are allocated a number of student places, and universities only receive the student contribution amount for students over their funding agreement amount, or above a set premium on their funding agreement amount (10% for 2010 and 2011).
- c.1.8 The maximum amounts of student contributions are set in legislation but universities set their own fees. These are either paid by students upfront or, more commonly, through the government’s income contingent loan scheme, the Higher Education Loan Programme (HELP). Tuition fees are calculated according to the perceived direct private returns of each subject and students pay a higher fee for subjects where (limited) research demonstrates that there is a higher return on investment (*eg* commerce and law). The level of student contribution has changed over time, depending on government policy – currently the government contribution varies from 16% in law and accounting to 81% in science.
- c.1.9 A small proportion of undergraduate students (less than 5%) and over 60% of postgraduate students are required to pay the full tuition but students can apply for FEE-HELP assistance to help pay fees with higher amounts being available for medicine, dentistry and veterinary science programs. The Commonwealth Scholarships Programme helps students from equity groups (such as regional, remote and indigenous students) with educational and accommodation costs. VET FEE-HELP provides support to government-supported diploma students in all states and territories.
- c.1.10 CGS funding also includes funding for capital and research. The Base Funding Review suggests that ‘base capability in research’ comprises around 10% of public funding. Universities have autonomy in how they spend base funding and are free to determine the allocation of base funding to different purposes (*ie* cross-subsidies).
- c.1.11 Apart from the Commonwealth Scientific and Industrial Research Organisation, universities play the primary role in Australia’s research and innovation system with the bulk of pure, strategic and applied research and research training being conducted in universities. Research in HE is supported via competitive grants, sponsorships, donations and general university revenue. As in the UK, there is a dual funding system for research whereby funding is allocated via the government based on quality review (via the Department of Innovation, Industry, Science and Research) and competitively through research councils.
- c.1.12 The Federal government also provides a mix of other block and competitive grants related to excellence in teaching, business-industry collaboration, structural reform, diversity, disability support, equity support and indigenous support.

### ***HE reforms to governance and funding***

- c.1.13 The Federal government in Australia has recently announced a new policy ‘Transforming Australia’s Higher Education System’.<sup>48</sup> In 2008 there was a major review of HE (the Bradley Review) whose 2009 report<sup>49</sup> made a series of recommendations for Australian HE including

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<sup>47</sup> *ibid.*

<sup>48</sup> *Transforming Australia’s Higher Education System*, Commonwealth of Australia (2009), <http://www.deewr.gov.au/highereducation/Pages/TransformingAustraliasHESystem.aspx> [accessed 22 May 2012].

<sup>49</sup> Review of Australian Higher Education, Final Report, Australian Government, December 2008, <http://www.deewr.gov.au/highereducation/review/pages/reviewofaustralianhighereducationreport.aspx> [accessed 22 May 2012].

improving participation amongst the 25-34 age cohort (to 40% by 2025) and pathways for students between HEIs and TAFEs. There is also a strong internationalist focus on improving the international competitiveness of Australian universities in terms of research outputs and collaborations, and in maintaining the country's strong position in international student recruitment. A recent initiative is the MyUniversity website which compares universities by university and fields of study on a range of criteria including student satisfaction with teaching and generic skills development, attrition rates, employment rates, staff qualifications and student to staff ratios.<sup>50</sup>

- C.1.14 The federal government is currently restructuring its HE finance system informed by The Australian Higher Education Base Funding Review. The focus is on establishing enduring principles to underpin public investment in HE in an attempt to overcome perceptions of underfunding and knock-on impacts on quality and student satisfaction. A key issue is how interventions to address these issues should be financed, in terms of the balance between fees and government subsidies.
- C.1.15 From 2012, all student places will be deregulated in a 'demand driven system' but, unlike the UK, without a mechanism to control the overall cost. The Federal government will provide a funding contribution for every domestic student enrolled in an undergraduate course of study. Caps on domestic student numbers in undergraduate fields other than medicine will be removed and universities will make their own decisions on the number of places to offer in each funding cluster based on student demand and the needs of employers. Caps will remain in 'designated courses of study' as set in the university's funding agreement, negotiated between the institution and the government. These are undergraduate medical courses and Federal supported places in postgraduate programmes. Even before this policy is implemented there has been rapid expansion of places (30,000 in 2011) as universities have used transitional arrangements to increase enrolments before its introduction. Undergraduate student numbers have grown by 150,000 since 2007.<sup>51</sup>
- C.1.16 In research, The National Collaborative Research Infrastructure Strategy received more than A\$1 billion over the five years until 2012, half from the federal government, matched by state governments and universities. It covered facilities ranging from the Australian Synchrotron, major telescopes and ocean-going research ships, to clusters of smaller instruments such as the Australian Microanalysis and Microscopy Facility.<sup>52</sup>

### ***National priority subjects***

- C.1.17 Funding agreements with the Federal government specify that institutions can only close 'specialised and nationally significant courses' with ministerial approval. These include subjects where there are national or regional skills shortages, where the effect would be to create such a shortage, and national strategic languages. There is no list of such subjects. For the purpose of incentivising students to pursue particular programs, certain subjects are described as 'national priority courses' (eg nursing, education and science and mathematics).
- C.1.18 The Base Funding Review has identified law and humanities as vulnerable in terms of education quality and institutional investment, largely due to the fact that there are no external professional body requirements that dictate benchmark standards of course delivery, such as minimum student–staff ratios, and they are thus soft targets for cost-cutting.

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<sup>50</sup> MyUniversity website, Australian Government, <http://myuniversity.gov.au/>, [accessed 22 May 2012].

<sup>51</sup> Demand-driven system boosts student numbers, Maslen, G, 'University World News, 8 Mar 2012, <http://www.universityworldnews.com/article.php?story=20120308155637291> [accessed 22 May 2012].

<sup>52</sup> Lack of vision cited as federal research program ends, Rowbotham, J and Dayton, L, The Australian, 16 May 2012, <http://www.theaustralian.com.au/higher-education/lack-of-vision-cited-as-federal-research-program-ends/story-e6frgicx-1226356740295> [accessed 22 May 2012].

### *STEM and labour market needs*

- c.1.19 As in the UK, there is significant demand for high-level skills in the labour market and declining participation in STEM subjects from Australian nationals (a large proportion of STEM graduates are international students). Across Australia, the importance of STEM has been highlighted through initiatives including Backing Australia's Ability – Building our Future through Science and Innovation strategy from 2003, which provided extra funded student places in STEM subjects, and government funding for Islamic Studies provision. Each state also has its own strategy related to the development of STEM provision.
- c.1.20 The Australian Business Council raised concerns that graduates' problem-solving skills were more suited to further study than to their use in the labour market. They also pointed to other gaps in terms of skills lacking: in entrepreneurialism, creativity, initiative and oral business communication.<sup>53</sup> The response was to set up a Business, Industry and Tertiary Education Collaboration Council, which explores alternative approaches to strengthening graduate employability skills.
- c.1.21 In May 2012, the federal government allocated A\$54m in funding to address emerging skills shortages. This included an A\$20 million grant to establish an Australian Mathematics and Science Partnerships Programme to support innovative partnerships between universities and schools to help improve secondary students' engagement in mathematics and science, and increase the number of students pursuing such subjects at tertiary level<sup>54</sup>.

### *Differential fees and student loan support*

- c.1.22 Within the HE funding system there is provision for the Federal government to influence students' subject choice via protected places and funding support (*ie* reduced student contribution in HELP) for 'national priority courses' and by increasing student contributions (fees) for popular subjects such as law. Under the Higher Education Contributions Scheme (HECS) Reimbursement Scheme in the medical field, doctors who work in rural areas may be eligible for their HELP debts to be paid.
- c.1.23 The Federal government also provides grants to support the delivery of approved HE courses outside the university system. This is seen as an effective way to alleviate skills shortages in critical areas such as nursing or early childhood education. In 2012 the federal budget allocated over A\$60m to fund HECS-style loans for diploma students, including an extra A\$3.6m to redesign the VET FEE-HELP scheme and announced a trial of loans for certificate students in Victoria and South Australia. They include 'high-demand' courses in aged care, community services, disability work, plumbing, competitive manufacturing and training and assessment.<sup>55</sup>

### *Success or otherwise of interventions*

- c.1.24 There is some evidence that the HECS-HELP reimbursement scheme has not been particularly well taken up by students.<sup>56</sup>
- c.1.25 The 2011 Base Funding Review recommended that the Federal government should phase out the policy of protected places and funding support (*ie* reduced student contribution) for 'national priority courses' and increase student contributions for popular subjects such as law as 'there is

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<sup>53</sup> *New pathways to prosperity – a national innovation framework for Australia*, Business Council of Australia, 2006, <http://www.bca.com.au/Content/100942.aspx> [accessed 26 March 2012].

<sup>54</sup> *Boosting science, mathematics and engineering graduates*, Maslen, G, University World News, 20 May 2012, <http://www.universityworldnews.com/article.php?story=20120518090427145> [accessed 15 July 2012].

<sup>55</sup> *VET: few bumps in 'give and take' budget*, Ross, J, The Australian, 8 May 2012, <http://www.theaustralian.com.au/higher-education/vet-few-bumps-in-give-and-take-budget/story-e6frgcjx-1226350330893>

<sup>56</sup> Personal correspondence with contacts.

no evidence that public benefits differ across disciplines' and also argues that there is no evidence that student demand is altered by reducing student contributions (for priority subjects). The review argues that because of income-contingent loans, the level of student contributions has little impact on enrolments.

- c.1.26 Instead this review suggests an across the board 60:40 government to student contribution across a simplified cost-based banding of subjects. It also suggests that as low student enrolments in some courses are related to low attainment in prerequisite Year 12 subjects, some of the funds saved from removing this subsidy could be redirected towards initiatives focused on students in secondary education. It recommends more targeted measures to address skills shortages, including partnerships with employers and state governments to provide information and incentives for students to undertake courses in priority areas and seek employment in relevant industries on graduation.

## C.2 Brazil

### *HE system*

- c.2.1 The Brazilian HE sector has 5.9m students and 2,600 institutions – 260 of which are public – comprising universities (universidades), university centres (centros universitários) and faculties (faculdades). University centres and faculties are less comprehensive institutions. Public institutions are administered at federal level through the Ministry of Education (MEC), or by state or municipal (city) governments.
- c.2.2 HE is split into degree level studies and postgraduate studies. At the undergraduate level the qualifications are bacharelado (bachelor's), licenciatura (allowing graduates to work as schoolteachers) and tecnologia which are shorter (2-4 years) vocationally orientated courses geared to the labour market in health, information technology, engineering and management. Five-year degrees leading to a professional diploma lead to select state-regulated careers such as architecture, engineering, veterinary medicine, psychology and law. Around 15% of students study for tecnologia qualifications in the HE sector and the remainder study in the vocational sector in technical institutes which are federally financed and focus on the needs of local labour markets and on teacher training. Theoretically, students with tecnologia qualifications can transfer to four-year universities for further study although this is not always straightforward and technical institutes suffer from a lack of prestige.<sup>57</sup>
- c.2.3 Although absolute student numbers seem high and the Gross Enrolment Ratio rose from 10% to 34% between 2000 and 2008, participation of the relevant age cohort is still much lower than other developed nations (currently around 15%). In Brazil, all public education is legally free although the education system in Brazil suffers from significant socio-economic, regional, race and gender disparities. Many of the most affluent students in compulsory education study in the private sector, which is perceived to be of higher quality. The reverse is true in HE where places in the public universities are massively oversubscribed. There are usually 30-40 applications for each place and the number can rise to as many as 200 for the most popular courses.<sup>58</sup>
- c.2.4 Brazil has a large private HE sector that enrolls around 77% of students and employs more than 65% of all academic staff.<sup>59</sup> There is a general acceptance in Brazil of private HE because of the lack of availability of public university places. The private sector has met the demand requirements for university places, offering a mix of lower-cost, day and evening courses in rural areas. However, some private institutions are now seeking to differentiate themselves based on quality as well as cost and there are also private research universities which account for 30% of enrolments.<sup>60</sup> However, the standard of education of private HEIs is variable and the public sector remains more highly regarded. In many private sector institutions there is a problem of drop outs (around 25%) and non-completions as students struggle academically or cannot afford the fees<sup>61</sup>

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<sup>57</sup> In Brazil, Vocational Education Expands to Meet Demands of a Booming Economy, Downie, A, The Chronicle, 5 July 2011, [http://chronicle.com/article/In-Brazil-Vocational/128135/?sid=gn&utm\\_source=gn&utm\\_medium=en](http://chronicle.com/article/In-Brazil-Vocational/128135/?sid=gn&utm_source=gn&utm_medium=en) [accessed 22 May 2011].

<sup>58</sup> *Brazil: country profile*. British Council Education UK Partnership, Last updated: May 2011.

<sup>59</sup> Internationalizing Brazil's Universities, Knobel, A, 2011, <http://cshe.berkeley.edu/publications/docs/ROPS.Knobel.BrazilSciencePolicy.6.22.11.a.pdf>

<sup>60</sup> *Brazilian Higher Education System: the right to develop research*, Guerrini, D, Higher Education Development Association, 5 March 2012, <http://uv-net.uio.no/wpmu/hedda/2012/03/05/guest-blogger-brazilian-higher-education-system-the-right-to-develop-research/> [accessed 22 May 2012].

<sup>61</sup> University growth in Brazil is undermined by high dropout rates, Downie, A, The Chronicle of Higher Education, 7 July 2010, <http://chronicle.com/article/University-Growth-in-Brazil-Is/66162/> [accessed 22 May 2012].

- c.2.5 All HE institutions, private or public, are regulated by the MEC via the Department of Higher Education (Secretaria de Educação Superior). Only authorised institutions and courses are allowed to operate. The HE curriculum consists of a minimum core, consisting of subjects and practices established by the Federal Council of Education, supplemented by content defined by the institution.<sup>62</sup>
- c.2.6 The Comissão Nacional de Avaliação do Ensino Superior (the Higher Education Evaluation Commission) evaluates university courses in Brazil. It uses the National System of Higher Education Evaluation (Sistema Nacional de Avaliação do Ensino Superior). The Brazilian Federal Agency for the Support and Evaluation of Graduate Education (Coordenação de aperfeiçoamento de pessoal de nível superior (CAPES)) accredits postgraduate courses and provides university research funding. It also provides financial support to postgraduate students.

### ***HE funding system***

- c.2.7 The Brazilian government finances public education at all levels. Public HEIs do not charge tuition fees and are 100% publicly financed. Public universities are either federally funded or financed by state governments. Funding is allocated directly to institutions after negotiation. In 1986 the 10-year education plan established an academic/vocational binary line throughout the education system. The major impact of this divide in HE is that research institutions have specific funding mechanisms and enjoy significant academic and institutional autonomy.
- c.2.8 The private sector derives most of its funding from student fees which are predominantly self-financed although some private universities offer scholarships and other funding in order to promote diversity (with federal support). Most of the growth in education provision in recent years has been in the private sector and, as such, consumer expenditure on education (at all levels) almost tripled between 2000 and 2010.
- c.2.9 The National Council for Scientific and Technological Development, (Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)) linked to the Ministry of Science and Technology, is responsible for managing the federal budget for research. There are also state foundations to aid research. FAPESP (part of the government of Sao Paulo State) and FAPERJ (the Rio de Janeiro Foundation for Research) that operate in similar ways to UK Research Councils.
- c.2.10 The Brazilian Innovation Agency (Financiadora de Estudos e Projetos) is a publicly owned company subordinated to the Ministry of Science and Technology. This supports and finances innovation and scientific and technological research, both basic and applied. It funds scientific and technological research projects and graduate courses in Brazilian universities and research institutions, as well as research and development in companies.

### ***HE reforms to governance and funding***

- c.2.11 In recent years, successive Brazilian governments have used national plans to invest in, reform and develop the education sector (as a whole) to help improve the education and skills of its population. Much of the focus has been on HE, which is seen as a key vehicle for meeting labour market needs and for sustaining economic growth and development. There is a particular focus on increasing the number of graduates and developing research capacity in STEM subjects and in the medical and life sciences.
- c.2.12 Specific policies have included: increasing teacher salaries and faculty recruitment; improving staff development as postgraduate provision increases; providing a tax exemption, through a

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<sup>62</sup> Brazil: Higher Education, Nuffic. 18 October 2010, [http://www.nuffic.nl/en/files/documents/diploma-recognition/country-modules/country-module-brazil.pdf/at\\_download/file](http://www.nuffic.nl/en/files/documents/diploma-recognition/country-modules/country-module-brazil.pdf/at_download/file) [accessed 22 May 2012].

programme (PROUNI) for private institutions that offer scholarships to a certain number of low-income students; improving the gender balance; and increasing investment in state universities.

- c.2.13 A major focus has been on expanding access to HE. The government has an aim of enrolling 10 million students in HE by 2020 which will involve achieving 30% participation amongst the 25-34 age cohort and most of the additional growth required will need to be met by the private sector and an expansion in distance and e-learning.
- c.2.14 Brazil has one of the highest proportions of expenditure on each tertiary student relative to Gross Domestic Product (GDP) *per capita* (109%) in the OECD and allocates about six times more resources per student to tertiary education than to primary education.
- c.2.15 The federal and state governments have encouraged public institutions to take in more students and offer undergraduate programs in the evening. A federal government programme, REUNI, provides additional resources to public universities to expand their enrolment and new federal universities have been created in different parts of the country.
- c.2.16 Recently, the Brazilian federal government initiated a new programme entitled 'Instituto Nacional de Ciência e Tecnologia' (National Institute of Sciences and Technology) that aims to establish and consolidate networks of working groups and laboratories on an internationally competitive level, dedicated to long term research in selected scientific fields. These National Institutes are 'virtual' structures, anchored in an existing major research institute or university, but extending to research teams based in other institutions all over the country.
- c.2.17 Petrobras, a petro-chemical firm working on Brazilian oil reserves, invested R\$4.8 billion (US\$2.8 billion) in science and technology between 2007 and 2009, R\$1.2 billion (US\$700 million) of which went to Brazilian universities and research institutes. It has also created a series of 50 networks with partner universities, technical institutes and research institutes across Brazil. So far 110 universities and HEIs are participating.<sup>63</sup>
- c.2.18 The Brazilian government has also invested heavily in vocational education over the last decade in an attempt to up-skill the population to meet the demands of the labour market. The annual budget for technical institutes from 2003 to 2011 rose from \$385 million to \$3.8 billion fuelling an increase in places from 102,000 in 2002 to 401,000.<sup>64</sup> A quarter of these students pursue a bachelor's degrees or higher. In 2011 the National Programme for Access to Technical Education and Employment (Pronatec) was announced which aims to create eight million new places for professional education to high school students and workers who require professional qualifications by 2014.<sup>65</sup>

### **National priority subjects**

- c.2.19 In Brazil, strategically important subject areas are predominantly STEM and health and life sciences. In these areas government activity centres on building teaching and research capacity, improving quality in teaching and graduate outcomes, and on developing labour market skills.
- c.2.20 The Brazilian government has a strong focus on improving national Research and Development (R&D) capacity in its priority areas. National expenditure on R&D in 2007 was around 1% of GDP (\$13 billion), the highest in Latin America. Brazil's key research strengths are in the life sciences

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<sup>63</sup> *Oil giant investing millions in universities*, Hennigan, T, University World News, 20 March 2011, <http://www.universityworldnews.com/article.php?story=20110318130151658> [accessed 24 May 2012].

<sup>64</sup> *Country Briefing: Brazil*. UK HE International Unit, Updated September 2011.

<sup>65</sup> *In Brazil, Vocational Education expands to meet demands of a booming economy*, The Chronicle, 5 July 2011, [http://chronicle.com/article/In-Brazil-Vocational/128135/?sid=gn&utm\\_source=gn&utm\\_medium=en](http://chronicle.com/article/In-Brazil-Vocational/128135/?sid=gn&utm_source=gn&utm_medium=en) [accessed 22 May 2012].

(particularly in relation to natural resources). Brazil produces 2% of global scientific research, is 13th in the world rankings, including almost 19% of the world's research in tropical medicine and more than 12% in parasitology. However its output in other disciplines is relatively low.<sup>66</sup>

- c.2.21 Brazil has only half of the OECD average (13%) of its students taking science and engineering degrees. There are insufficient places in key subjects (*eg* STEM) and at postgraduate level, particularly in the public sector. This is largely a result of limited numbers of qualified students and teachers throughout the education system.<sup>67</sup> Graduate employability is low and the salary premium of a degree is high in Brazil so students have little incentive to choose disciplines that are in demand by employers.
- c.2.22 The impact of these limitations in research is that employers find it difficult to recruit well-qualified staff, particularly in the STEM disciplines. The Institute for Applied Economic Research (Instituto de Investigación Económica Aplicada) a think tank, suggests that Brazil only produces half (30,000) of the engineers it needs each year and many of those are not suitably qualified.<sup>68</sup> Brazil also needs three times as many technical institutes as it has now to meet demand as well as more courses in areas such as health and information technology.
- c.2.23 Brazil's growing oil and gas sector requires a range of skilled professionals, including welders, electricians, builders and information-technology specialists. The country is also urgently trying to build the infrastructure necessary to handle rapidly increasing living standards, and to ensure that roads, airports, stadiums and accommodations will be ready for the 2016 Olympics and the 2014 World Cup.
- c.2.24 Brazil's rapid economic growth and the discovery of new oil reserves in 2007 will bring more wealth and will increase the number of students from middle-class homes seeking a good standard of HE. The demographics of the Brazilian population, particularly in the 15-25 year age group, will cause absolute numbers to grow.

#### *Scholarships and financial support*

- c.2.25 The Brazilian government provides scholarships and financial support to help improve the number of graduates and research capacity in science subjects. These are available for students to study in Brazil and overseas. The National Board for Scientific and Technical Education provides scholarships for students to pursue science degrees and CAPES provides financial assistance, particularly for postgraduate students.

#### *International cooperation*

- c.2.26 The Brazilian government has also been actively seeking to facilitate outwards and inwards academic mobility (undergraduates, postgraduates and research fellows). Historically, Brazilian students studied abroad for full degrees, and in the 1960s and 1970s the government paid for overseas PhD programmes abroad in oil exploration, agricultural research and aircraft design, fields in which it now has a worldwide reputation.<sup>69</sup> However, recent government policy has focused on exchange programmes and short study programmes in order to gain the benefits of overseas experience, for students' own employability and to help raise standards in their home universities, without the associated risk of brain drain.

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<sup>66</sup> UK HE International Unit *op cit*.

<sup>67</sup> Study-abroad initiative needs careful study, Knobel, M, University World News, 18 December 2011, <http://www.universityworldnews.com/article.php?story=20111216171338689> [accessed 22 May 2011].

<sup>68</sup> *Studying the World*, The Economist, 17 May 2012, <http://www.economist.com/node/21550306/> [accessed 22 May 2012].

<sup>69</sup> *ibid*.

c.2.27 The relative weakness of research activities in HE establishments in Brazil means that international collaboration on research projects is well established. The Brazilian government has recently signed inter-governmental cooperation agreements with a range of countries and regions including the US, Canada, the UK, the EU, Kenya and South Africa.

*Ciência sem fronteiras (science without borders)*<sup>70</sup>

c.2.28 A recent initiative that combines the scholarship and international cooperation approaches is Science Without Borders, a large scale nationwide scholarship programme announced in 2011 led by MEC and the Ministry of Science and Technology through their respective funding agencies – CAPES and CNPq. The \$1.7 billion programme seeks to strengthen and expand the initiatives of science and technology, innovation and competitiveness through international mobility of undergraduate and graduate students and researchers.

c.2.29 Its primary objective is to place 100,000 Brazilian students (undergraduate and postgraduate) and researchers in top universities worldwide until 2015, for periods of up to one year facilitated by international partner organisations. It also hopes to attract international scholars and researchers to Brazil to work in areas of research excellence. The countries identified so far include France, Canada, Germany, Italy, the UK and the USA. 75,000 of the scholarships will be funded by the Brazilian federal government and an extra 26,000 by Brazilian corporations. The programme focuses mainly on health and life sciences and on STEM fields, with an emphasis on engineering, but also includes other fields such as the creative industries and IT and computing. There has been some criticism of the focus on STEM by Brazilian commentators, although it is generally accepted that the social sciences and humanities are well provided for through existing funding streams.

*Success or otherwise of interventions*

c.2.30 Many of the policy interventions are relatively recent so there is no evidence of impact so far. Furthermore it is widely regarded that the Brazilian education sector is suffering from the effects of significant historical under-investment meaning that the impact of any increased investment is only likely to have a serious impact in the long term.

c.2.31 Most of the funding to support strategic areas at HE level has been concentrated on science and technology subjects, which are mostly concentrated in the most prestigious public universities. As such the impact on the (growing) private sector has been limited since they tend to focus on subjects that are in demand (eg business and management).

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<sup>70</sup>

Ciência sem Fronteiras website, <http://www.cienciasemfronteiras.gov.br/web/csf-eng/faq> [accessed 24 May 2012].

## C.3 Canada

### *HE system*

- c.3.1 Canada is a key competitor for the UK in terms of the recruitment of international students and skilled workers, although it suffers from a talent drain to the US.
- c.3.2 Post Secondary Education (PSE) is provided through a mix of community colleges, public and private universities, and university colleges, with community colleges focusing on the more vocational aspects. Canadian universities educate more than 1.5 million students annually.<sup>71</sup> While community colleges generally award diplomas and certificates, and universities award degrees, there is some cross-over. There are around 160 community colleges and some 150 universities and university colleges split roughly equally between public and private. Ontario and Quebec are the largest provinces by population and are used to illustrate the remainder of this sub-section.
- c.3.3 Canada has no national system of PSE.<sup>72</sup> Some argue that this arises because of the Constitution Act of 1867<sup>73</sup> which gave individual provinces responsibility for education, including HE. Others argue that the federal government has taken a strong role in education in the past but the emerging fragmentation of Canada's economic, institutional and political structures has removed any national objectives and cohesion. As a result, markedly different systems of HE have evolved for the different provinces.
- c.3.4 The lack of a national system is reflected in the lack of a federal ministry or department of education. The federal government still has some limited powers for education matters that are in the interest of more than one of the provinces or of the nation. In particular, the federal government does have a role *inter alia* in economic and social growth and development, equality of opportunity, employment, preparing young people for the labour force, labour mobility within Canada, adult training, vocational training and research. Such matters are handled by the learning branch of Human Resources and Skills Development. It has specific responsibility for HE for aboriginal learners, for the Royal Military College of Canada, for student financial assistance and for research funding.
- c.3.5 In the absence of a federal ministry, the Association of Universities and Colleges of Canada (AUCC)<sup>71</sup> provides a forum and lobbying body for the Canadian universities. There is also no formal national accreditation system; this is met through membership of AUCC and the university's provincial government charter. Canada's leading 15 research universities receive the majority of research funding and have formed an association (U15) largely concerned with joint research programmes.
- c.3.6 Until its recent closure following withdrawal of federal funding in 2010, the Canadian Council on Learning (CCL) provided a pan-province and pan-territory view of performance and policy for the end-to-end education system.<sup>72</sup> In its valedictory report, it argued that Canada is falling behind other countries in PSE and that this 'acts as a significant drag on productivity, innovation and access to proven quality'. Furthermore, CCL sees 'incoherence in PSE' as a 'threat to Canadian innovation and productivity'. CCL concludes that the way forward is to establish a national PSE strategy with appropriate governance.

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<sup>71</sup> See <http://www.aucc.ca/canadian-universities/> [accessed 13 May 2012].

<sup>72</sup> *What is the future of learning in Canada*, Canadian Council on Learning, October 2011, <http://www.ccl-cca.ca/pdfs/CEOCorner/2010-10-11WhatistheFutureofLearninginCanada.pdf> [accessed 2 April 2012].

<sup>73</sup> This was formerly the *British North America Act*, 1867, [http://laws-lois.justice.gc.ca/eng/Const/PRINT\\_E.pdf](http://laws-lois.justice.gc.ca/eng/Const/PRINT_E.pdf) [accessed 30 April 2012].

- c.3.7 Each province or territory has its own department of education. In Ontario, this is the Ministry of Training, Colleges and Universities; in Quebec it is the ministry of Education, Recreation and Sports.

### **HE funding**

- c.3.8 In line with the governance arrangements, provincial and territorial governments provide the majority of funding to their public universities. The remainder of funding comes from student fees<sup>74</sup> and the federal government. The federal component has increased significantly over the last 10 years in both research and student support in the form of grants and loans.<sup>75</sup> The balance between the various funding sources is different in each province or territory. Some provinces (eg Quebec) charge higher fees for overseas students and for students from another province or territory. There has recently been student unrest in Quebec following a plan to increase student fees by C\$325 per year for five years.
- c.3.9 Research is largely funded at the federal level through a number of research councils. These are the Natural Sciences and Engineering Research Council, the Canadian Institutes of Health Research, the Social Sciences and Humanities Research Council of Canada. In addition, the Canada Research Chairs organisation funds research staff and the Canada Foundation for Innovation supports the funding of scientific research infrastructure.
- c.3.10 Many institutions have some form of endowment and this can be significant. For example in 2011, the University of Toronto had an endowment of C\$1.6 billion which was the largest among the Canadian universities.<sup>76</sup>
- c.3.11 According to the AUCC, universities in Canada undertake C\$10 billion of research activities with the federal government providing C\$3 billion annually for the direct costs of research, institutional costs of research, infrastructure and salary support.<sup>77</sup>

### **Priority subjects**

- c.3.12 The lack of a federal level of education strategy and policy means that for PSE, excluding research, educational priorities and initiatives take place at the level of provinces or territories. Over the years there have been strategic initiatives by provinces to increase enrolment in specific subject areas to overcome shortages in the labour market. It is not clear, however, that these have been successful. This has largely been in particular areas such as computer science, health care, teacher education and graduate education.<sup>78</sup> Payam Pakravan notes that 'though helpful in some cases, these mechanisms do nothing to correct the underlying labour market rigidities and imperfections that are causing the problems in the first place. For one thing there is no guarantee that more spaces will be filled if market signals are not working and the wages or salaries for graduates are too low'.<sup>75</sup>

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<sup>74</sup> In 2011-12 the average student fee was C\$5,366, ranging from C\$2,519 in Quebec to C\$6,640 in Ontario (see <http://www.statcan.gc.ca/daily-quotidien/110916/t110916b1-eng.htm> [accessed 13 May 2012]).

<sup>75</sup> *The future is not what it used to be*, CD Howe Institute Commentary, Payam Pakravan, 227, February 2006, [http://www.cdhowe.org/pdf/commentary\\_227.pdf](http://www.cdhowe.org/pdf/commentary_227.pdf) [accessed 19 May 2012].

<sup>76</sup> *US and Canadian Institutions Listed by Fiscal Year 2011 Endowment Market Value and Percentage Change in Endowment Market Value from FY 2010 to FY 2011*, NACUBO-commonfund study for 2011, [http://www.nacubo.org/Documents/research/2011\\_NCSE\\_Public\\_Tables\\_Endowment\\_Market\\_Values\\_Final\\_January\\_17\\_2012.pdf](http://www.nacubo.org/Documents/research/2011_NCSE_Public_Tables_Endowment_Market_Values_Final_January_17_2012.pdf) [accessed 12 March 2012].

<sup>77</sup> See AUCC website: <http://www.aucc.ca/policy-issues/research-and-innovation/> [accessed 25 May 2012].

<sup>78</sup> See, for example, *Revisiting Ontario College and University Revenue Data*, Snowdon & Associates, 2009, <http://www.heqco.ca/SiteCollectionDocuments/Revenue%20Data%20Eng.pdf> [accessed 18 May 2012].

### *Computer science and high-demand engineering*

- c.3.13 One specific example was the Access to Opportunities Programme (ATOP) which had funding of C\$150 million in 1998 and C\$78 million in 1999 to 'double the pipeline' of graduates in computer science and high-demand engineering by a total of 23,000 ATOP places.<sup>79</sup> This programme, which applied an innovative market test by requiring industry to match start-up costs, was on one level a tremendous success; the response from business was well beyond government expectations with enrolment increasing tremendously during this period.<sup>80</sup>
- c.3.14 Unfortunately, the new graduates emerged from the programme at the time of the bursting of the dot.com bubble and there were no jobs available for them. The long-term effect has been that enrolment in computer science courses has not entirely recovered.<sup>81</sup>

### *Health care*

- c.3.15 Since 2001, the province of British Columbia has provided approximately C\$1.2 billion in health-related post-secondary funding to institutions throughout the province. The number of nursing spaces has more than doubled by adding over 4,450 spaces, resulting in over 20,000 credentials being awarded. The provincial government has funded more than 880 health-care assistant spaces throughout the province.<sup>82</sup> Ontario<sup>83</sup> and Saskatchewan<sup>84</sup> have similar schemes. There is some uncertainty of the success of these schemes. One particular issue appears to be that of emigration to seek better jobs outside Canada.<sup>75</sup>

### *Research*

- c.3.16 Research funding is seen in Canada as a means of improving research capacity to sustain and improve economic competitiveness and growth. Moreover research enterprises in colleges and universities were seen as catalysts for economic development.<sup>78</sup>

### *Success or otherwise of interventions*

- c.3.17 As discussed above it is not clear whether the interventions within the provinces to increase enrolment in computer science, high-demand engineering and healthcare have been entirely successful.

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<sup>79</sup> 1999 Ontario budget speech, 4 May 1999, <http://www.fin.gov.on.ca/en/budget/ontariobudgets/1999/99budsp.html> [accessed 21 April 2012].

<sup>80</sup> *Private communication from Caroline LaChance of AUCC*, 8 December 2012.

<sup>81</sup> *Why we're not working now: Canada's poor track record predicting job growth*, The Globe and Mail, 2 September 2011, <http://m.theglobeandmail.com/news/national/time-to-lead/time-to-lead-archives/gaping-holes-in-our-knowledge-of-the-labour-market/article2067135/?service=mobile> [accessed 21 April 2012].

<sup>82</sup> See for example *Budget 2001*, [http://www.fin.gov.bc.ca/archive/budget01/bgt2001\\_newsrelease.pdf](http://www.fin.gov.bc.ca/archive/budget01/bgt2001_newsrelease.pdf) [accessed 19 May 2012].

<sup>83</sup> *Education and training*, [http://www.healthforceontario.ca/WhatIsHFO/education\\_training.aspx](http://www.healthforceontario.ca/WhatIsHFO/education_training.aspx) [accessed 19 May 2012].

<sup>84</sup> *Post-Secondary Education – accessibility and affordability review, interim report by Warren McCall*, 2007, [http://www.aeei.gov.sk.ca/aar/docs/McCall\\_Interim\\_Report.pdf](http://www.aeei.gov.sk.ca/aar/docs/McCall_Interim_Report.pdf) [accessed 24 May 2012].

## C.4 Denmark

### *HE system*

- C.4.1 Following recent mergers and consolidations, Denmark has a highly stratified HE system consisting of four types of institutions<sup>85</sup>:
- Eight academies of professional HE that offer ‘short-cycle’ Academy Profession Degree Programmes, vocationally-orientated programmes in fields such as business, technology and IT combining theoretical and practical elements, and including work placements.
  - Ten university colleges and specialised colleges that offer professional practice-focused bachelor programmes in professional fields such as business, education, engineering and nursing. These programmes also include work placements and provide access to further studies in the same field.
  - Eight universities which are research-intensive institutions offering research-based study programmes up to PhD level. This sector includes specialist institutions such as the Copenhagen Business School and the IT University of Copenhagen.
  - Fourteen university-level institutions that offer programmes up to degree level in specialist subject fields (*eg* music and fine and performing arts).
- C.4.2 The Ministry of Science, Innovation and Higher Education is responsible for most HEIs and the Ministry of Culture regulates the university-level institutions in specialist areas. Accreditation is mandatory for all HE programmes and is a precondition for accessing public funding. Colleges, academies and university colleges are defined as either state-controlled or state-funded but self-governing. The majority of students are taught in the university sector, and the Danish private HE sector is very small and operates outside degree-level studies.<sup>86</sup>
- C.4.3 Government influence over HEIs is exercised via the mechanism for allocation of teaching funding (see below) and ‘dialogue-based’ tools, which comprise negotiated development contracts between the Ministry and individual universities, and accountability mechanisms (*eg* annual reports and data collection) that demonstrate how public funding is used.
- C.4.4 Development contracts cover three to four years of activity and contain two types of targets: 3-5 mandatory targets (requested by the Ministry and based on national priorities) and 3-5 self-imposed targets (based on a university’s own strategic priorities and profile). The legal framework does not require specific target areas to be included in the development contracts although these have recently become simpler, more flexible and more binding agreements related to the targets and activities that they cover. Follow-up on the university development contracts is based on universities’ annual reports.

### *HE funding system*

- C.4.5 State funding is the primary source (around 90%) of funding for the Danish universities. Some institutions are funded to undertake additional public activities such as providing a museum or undertaking research-based projects, although otherwise they are all funded in the same way.

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<sup>85</sup> Study in Denmark website, <http://studyindenmark.dk/study-in-denmark/danish-higher-education-institutions> [accessed 22 May 2012]

<sup>86</sup> *The Danish Higher Education System*, Danish Agency for Universities and Internationalisation, 2011.

- c.4.6 Since 1999 the principle of output-based funding has been applied for both teaching and research, based on a combination of core and incentive-based streams. There is no negotiation between institutions and government with regard to funding.
- c.4.7 Funding for teaching is provided by the 'taximeter' system. There are three taximeter rates for each full-time student based on subject areas (humanities and social sciences, theoretical sciences, lab-based subjects, engineering and medicine) which cover four main costs (teaching, fieldwork, joint expenses and buildings). There are different rates for full- and part-time students. Funding is only provided for students who successfully pass exams. In 2009 a completion bonus was introduced based on students completing within a defined period for bachelor's and master's programmes.
- c.4.8 There are also competitively allocated teaching funds related to teaching quality enhancement as well as evenly distributed funds designed to increase completions, shorten the time taken to complete, encourage exchanges and study abroad, and overseas recruitment.<sup>87</sup>
- c.4.9 Danish students do not pay tuition fees and through the State Educational Grant and Loan Scheme, the Danish government provides financial support to all Danes over the age of 18 enrolled in a youth or HE programme. Around 50% of students make use of these loans.
- c.4.10 There are two research funding streams, basic grants and competitive funding, the latter being provided by both government and other organisations (*eg* research foundations). Basic grants are distributed to the university sector according to historical criteria (based on a 45/20/25/10 ratio related to teaching income, external grant income, bibliometrics and PhD completions). External funding largely comes from research councils, strategic research programmes, the EU, Ministry R&D funds and private foundations. There is also public competitive research funding for researcher training, public-private partnerships, research excellence, research in strategically important areas, researcher mobility and research cooperation abroad.<sup>88</sup>

#### **HE reforms to governance and funding**

- c.4.11 Higher education in Denmark has undergone significant reforms in governance and finance since the University Act of 2003. This Act made universities 'self-governing' institutions and special administrative entities in public law and introduced a new professionalised university management and governance system. As self-governing entities, universities became able to increase their private funding without risking public funding, and the main tools for budgetary allocation became development contracts and other supplementary contracts. The law also offered greater autonomy in areas such as the approval of new academic programmes and the number of staff. However the universities were not given the right to own and manage their estates and do not have the facility to borrow from the private sector. The Act emphasizes that the universities' new management should make strategic selections of research and educational areas and give high priority to these areas.
- c.4.12 In 2007/8 there were mergers between HEIs (and research institutes) leading to the creation of large and multi-campus universities. The main aim of the mergers was to strengthen education and research, sharpen the international profile and improve the competitive edge of Danish universities. Other reforms included the introduction of a new independent QA agency (ACE) in 2008. This agency is responsible for accrediting study programmes in HE and changes to the taximeter funding system.

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<sup>87</sup> *Progress in higher education reform across Europe*, CHEPS et al (2009), Governance Reform. Volume 3: Governance fiches, 2009, [http://ec.europa.eu/education/higher-education/doc/governance/vol3\\_en.pdf](http://ec.europa.eu/education/higher-education/doc/governance/vol3_en.pdf) [accessed 22 May 2012].

<sup>88</sup> *ibid.*

- C.4.13 HE is viewed as a government responsibility in Denmark and there is a focus on ensuring that adequate funds are provided for both HE and research. Denmark decided that it should meet the requirements of the EU's Barcelona Declaration, according to which 3% of GDP (1% from public spending) should be spent on research and development (this amounted to 0.5% of gross national product, amounting to €4.8 billion).<sup>89</sup> Accordingly, state funding to the university sector has increased substantially in the last decade. However, the recent economic downturn has meant that funds have become increasingly scarce and there has been a focus on reducing costs in HE and concentrating resources (*eg* via collaborations and mergers).
- C.4.14 HE and research have been subject to long-term strategic planning, most notably by the comprehensive Globalisation Strategy from 2006 (to run to 2020).<sup>90</sup> The funding of HE was prioritised in this strategy (which also covers other sectors) and it also recommended increased research funding allocation through competition, and linking basic funding to performance (in terms of completion times and reducing dropout rates).
- C.4.15 The Danish government has placed great importance on the internationalisation of education and training to develop students able to engage with the challenges of a globalised world. The government is also seeking to make Denmark a leading entrepreneurial and knowledge-based society with internationally competitive institutions that can attract talented national and international students and researchers. As part of its China Strategy, the Danish government allocated 13 industrial PhD projects to students with a Master's degree from a Chinese university.
- C.4.16 In late 2011 the new Danish coalition government announced its policy agenda which focuses on creating a more 'open' Denmark with a better balance in national integration and immigration policy, a green policy based on sustainable energy use, stronger investment in education, secure employment and growth, and strengthened links to Europe. Proposed changes in HE include the creation of 10,000 new student places by 2020; a target of 60% of the age cohort taking 3-year HE courses; a new long-term target of 25% of young people progressing to postgraduate HE; greater autonomy for universities; better quality in research; increased internationalisation; and the strengthening of professional colleges (teacher training, physiotherapy *etc.*)<sup>91</sup>
- C.4.17 Mandatory (nationally orientated) targets in the 2012-2014 development contracts focused on: improving the quality of education; strengthening cohesion across the HE sector; shortening study completion time; and improving innovation capacity.

### **National priority subjects**

- C.4.18 Basic research and education funding have generally not been used as instruments for channelling state funding towards politically designated priority subjects in HE and/or research. Universities are largely able to use their public funding as they see fit with the exception of research council funds, which are tied to specific projects, and funds earmarked for research-based public sector services, which are tied to ministerial contracts. National strategic research programmes are prioritized and categorized in a different manner by the research councils and via other sources. An example are the FORSK 2015 and FORSK 2020 programmes in which the Danish government prioritised research that can 'be a driving force for economic growth or contribute to solutions of major societal challenges' based on a lengthy consultation exercise.<sup>92</sup>

<sup>89</sup> *Students plan autumn 'austerity' protests*, Mykelbust, J P, University World News, 29 August 2010, <http://www.universityworldnews.com/article.php?story=20100828052341241> [accessed 22 May 2012].

<sup>90</sup> *Progress, Innovation and Cohesion Strategy for Denmark in the Global Economy – Summary*, [http://www.globalisering.dk/multimedia/Pixi\\_UK\\_web\\_endelig1.pdf](http://www.globalisering.dk/multimedia/Pixi_UK_web_endelig1.pdf) [accessed 22 May 2012].

<sup>91</sup> *New premier to expand higher education*, Mykelbust, J P, University World News, 9 October 2011, <http://www.universityworldnews.com/article.php?story=20111005202326239> [accessed 22 May 2012].

<sup>92</sup> *FORSK 2015 and FORSK 2020*, Danish Agency for Science and Innovation, <http://en.fi.dk/research/research2020/background> [accessed 10 August 2012].

- c.4.19 Universities decide for themselves which study programmes they want to offer, subject to approval by the Accreditation Council, which accredits and approves all new and existing study programmes. However, the ministry can also set a maximum number of student admissions in particular subjects.
- c.4.20 The natural sciences in Denmark have experienced a steady reduction in student numbers, and some commentators suggest that this is because these subjects are ‘too difficult’. As a result, 70% of students are now studying in the humanities or the social sciences where there are not enough places to meet student demand.<sup>93</sup> There is debate in Denmark about the usefulness of labour market forecasting in shaping HE provision, but so far this has had limited impact on HE policy.
- c.4.21 There have been some recent government interventions in teaching that could be characterised as strategic priorities and are described below.

#### *PhD studies*

- c.4.22 Based on an international evaluation report in 2006,<sup>94</sup> the Danish parliament agreed to target an intake of 2,800 new PhD students by 2012, up from 1,445 in 2005, an increase of 94%. During the expansion, doctoral training would be reorganised into 53 doctorate research schools. This cost €700 million.<sup>95</sup> The basic funding provided to the universities to finance the initiative was allocated such that 90% of funding was allocated proportionately to the universities’ activities in natural, technical and health sciences and IT fields, whereas the remaining 10% of funding was allocated proportionately to the universities’ activities in the humanities and social science. The Danish government has also allocated specific funds for PhD projects with relevance for the primary school sector to be undertaken in cooperation between universities and university colleges.

#### *Undergraduate studies*

- c.4.23 In 2009 the Ministry increased the lowest taximeter rate to enable the universities to provide more and better research-based HE in the humanities and social sciences. In addition, the previous government negotiated with Danish HEIs to increase the number of places on programmes with particularly good job prospects from the autumn of 2011.<sup>96</sup> There are also some specific funding streams for smaller subjects in the universities. For example, minority languages with few students receive approximately 400,000 Kroner (US\$75,000) a year from the Danish government.<sup>97</sup>
- c.4.24 Measures have been put in place to improve business and industry’s expenditure on R&D and to improve the relationships between universities and business and industry. This includes measures to improve the number of PhDs that are funded by business and industry.<sup>98</sup>

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<sup>93</sup> Business demands drive degrees shake-up, Mykelbust, J P, University World News, 6 February 2011, <http://www.universityworldnews.com/article.php?story=20110204222502376> [accessed 22 May 2012].

<sup>94</sup> *A Public Good – PhD Education in Denmark*, Danish Ministry of Science, Technology and Innovation, 19 April 2006, <http://en.fivu.dk/files/publications/2006/a-public-good-phd-education-in-denmark/html/indhold.htm> [accessed 22 May 2012].

<sup>95</sup> *Questions raised over PhD expansion*, Mykelbust, J P, University World News, 11 September 2010, <http://www.universityworldnews.com/article.php?story=20110909190730200> [accessed 22 May 2012].

<sup>96</sup> *Business demands drive degrees shake-up*, Mykelbust, J P, University World News, 6 February 2011, <http://www.universityworldnews.com/article.php?story=20110204222502376> [accessed 22 May 2012].

<sup>97</sup> *Small languages under threat as cuts bite*, Mykelbust, J P, University World News, 14 October 2010, <http://www.universityworldnews.com/article.php?story=20101113060020542> [accessed 22 May 2011].

<sup>98</sup> CHEPS *et al*, 2009 *op cit*.

### *Success or otherwise of interventions*

- c.4.25 In terms of impact, the universities did reach the target of a PhD intake of 2,400 in 2010 and the increase did primarily take place in the politically designated areas. However, a shortfall of Danish masters students means a large proportion of these additional places went to international students who tend to leave the country after completing their doctorates. In 2010, 30% of new PhDs were from overseas – and in technological sciences 40% were international students.<sup>99</sup>
- c.4.26 The undergraduate initiatives are currently being evaluated.
- c.4.27 The FORSK 2015 research prioritisation scheme has been evaluated and the evaluation found that it gave politicians an improved basis for the prioritisation of strategic research and positively engaged sector stakeholders in developing the strategic research areas. However, the process was time intensive and may not be cost-effective if priorities change over time. Nevertheless a FORSK 2020 scheme is taking place using a slightly revised process.

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<sup>99</sup> *Questions raised over PhD expansion*, Mykelbust, J P, University World News, 11 September 2010, <http://www.universityworldnews.com/article.php?story=20110909190730200> [accessed 22 May 2012].

## C.5 Germany

c.5.1 Germany is one of the UK's key competitors and performs strongly in the recruitment of talented overseas students and workers, as well as in scientific capability. Germany has adopted a system-wide approach to skills and education. Since 2006, it has had a High-Tech Strategy supported by the federal government and the states (Länder), which includes promoting mobility amongst skilled workers and improving the quality of HE and research. This strategy is complemented by the Higher Education Pact, the Initiative for Excellence and the Joint Initiative for Research and Innovation. The total funding for these initiatives is around €18 billion.

### HE system

c.5.2 There are 409 officially recognised HEIs in Germany<sup>100</sup> of three main types: research universities (104), universities of applied science (203) and specialist colleges (51). There are also now more than 100 private universities and colleges that confer officially recognised degrees (18% of the system); the majority of these are universities of applied sciences. Most students are enrolled at public universities; only 3% of students attend private institutions.

c.5.3 University education in Germany is no longer centrally coordinated. From 2006 and the reform of federalism, the 16 Länder have their own HE laws and guidelines and are fully responsible for HEIs. While there has been a shift towards institutional autonomy during the last decade the Länder governments are still major actors in German HE policy. Other important stakeholders include the German Rectors' Conference (representing both the rectors and presidents of universities and universities of applied sciences); the German Research Foundation, a self-governing research funding organisation that promotes and funds research at universities, non-university research institutions and increasingly, at universities of applied sciences; and the German Council of Science and Humanities (an advisory body to political decision-makers that issues recommendations and statements on science (*ie* research) policy).

### HE funding system

c.5.4 Most universities and colleges in Germany are publicly funded, while some are financed by the Protestant or Catholic churches. High tuition fees tend to be charged at private institutions, but quality is comparably high at both public and private institutions, according to the German Academic Exchange (Deutscher Akademischer Austausch Dienst).<sup>101</sup> In the publicly funded sector, formula funding and contracts have become the norm and every state has introduced performance-related resource allocation systems in order to encourage third-party funding and increased output in terms of numbers of graduates, publications *etc.*<sup>102</sup> The formula for the operational grant to public universities (for example) includes input criteria (number of students and study places, staff and past costs) and output-related criteria (degrees, credits, assessments, publications, grants). Recently, more funding has been provided to increase student numbers (under the Pact for Higher Education 2020).

c.5.5 In 2005, a ban on tuition fees laid down in the 2002 HE framework act was abolished and seven Länder subsequently introduced fees. Since then, however, many have changed their political position so that by the end of 2012, only two Länder will have tuition fees of €500 per semester for all students. A number of others only charge fees for 'long-term' students. According to the

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<sup>100</sup> <http://www.daad.de/deutschland/hochschulen/00413.en.html> [accessed 2.February 2012].

<sup>101</sup> *ibid.*

<sup>102</sup> *Progress in higher education reform across Europe*, CHEPS,. Governance and Funding Reform. Vol 2: Methodology, performance data, literature survey, national system analyses and case studies. Brussels, EC, 2009.

respective Länder' HE acts, the revenue from tuition fees cannot be spent freely, but has to be invested into improving the quality of teaching and study conditions for students.<sup>103</sup>

### **HE reforms to governance and funding**

- c.5.6 Governance reforms in HE have been designed to strengthen strategic planning and institutional leadership, encourage mission differentiation, increase competition within the HE system, enhance institutions' international competitiveness and promote close links between HE, research institutes and industry. Parallel funding reforms have increased levels of targeted and competitive funding. A particular feature of HE policy since the mid-2000s has been the focus on a series of strategic initiatives (see below).
- c.5.7 The overall policy of the federal government is 'founded on the basic principles of the social market economy: it is geared to competition and markets'.<sup>104</sup> Movement towards a knowledge- and service-based society, as well as demographic change, has meant concerted efforts to expand the educational system at all levels.
- c.5.8 Both federal and state levels of government signed administrative agreements to support these initiatives which are part of a wider modernization agenda to create a 'dynamic, productive, science system'. In an Education Summit in 2008, the federal government and the Länder agreed to continue these initiatives in the context of a target for Germany to become one of the world's three best science nations by 2020. A joint funding target to increase overall spending on education and research to 10% of GDP by 2015 was also agreed (to include the Lisbon Strategy target of increasing R&D expenditure to 3% of GDP – with two thirds coming from the private sector and one-third from the public sector). These targets form the parameters of the research and innovation policies of the federal government and the Länder (and are also linked to European-level Science and Innovation policies).

### **Exzellenzinitiative: Initiative for Excellence (2006-2012)**

- c.5.9 This is an instrument for encouraging top-class university research with an amount of €1.9 billion made available between 2006 and 2011. In the first two rounds of funding, 39 research schools, 37 excellence clusters and nine future concepts at 37 HEIs in 13 Länder were selected. The positive effects go far beyond the universities which were successful in the competition. *Inter alia*, new models have been developed for cooperation between universities, research institutions and industry. A report presented in November 2008 by the Joint Commission of the Deutsche Forschungsgemeinschaft (German Research Association (DFG)) and the Science Council confirmed that the Initiative for Excellence had made a decisive contribution towards heightening the profile of the universities concerned and towards establishing research-friendly structures.<sup>105</sup>

### **Pact for Higher Education 2020 (2007-2020)**

- c.5.10 This sets out to increase the share of people entering HE to 40% of the relevant year group. The federal government provided €565 million so that the universities could admit approximately 91,000 additional students by 2010. Subsequently, the number of first year students is set to rise by a further 275,000 up to 2015 – particularly in the Mathematik, Informatik, Naturwissenschaften, Technik (MINT) (mathematics, engineering, natural sciences and technology (*ie* STEM)) subjects. The second pillar of the Pact for HE saw the introduction of a programme for funding one-off payments. Research projects which were funded by the DFG

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<sup>103</sup> *ibid.*

<sup>104</sup> *Germany: national reform programme 2011*, [http://ec.europa.eu/europe2020/pdf/nrp/nrp\\_germany\\_en.pdf](http://ec.europa.eu/europe2020/pdf/nrp/nrp_germany_en.pdf) [accessed 7 December 2012].

<sup>105</sup> *Higher Education pact*, <http://www.research-in-germany.de/research-landscape/r-d-policy-framework/60122/higher-education-pact.html> [accessed 6 December 2012].

received a 20% bonus (overhead funding totalling €700 million for the period 2007 to 2010). There was also an emphasis on top researchers: the Programme for Women Professors, for example, is intended to create around 200 new positions in the course of the next five years.

#### *Joint Initiative for Research and Innovation*

- c.5.11 This supports the large science and research organizations: the Helmholtz Association, the Max Planck Society, the Fraunhofer Society, the Leibniz Science Association and the DFG. The federal government and Länder have provided the non-university research institutions with planning certainty and have increased funding by at least 3% per year up to 2010 (in return for gains in quality, efficiency and performance in research and teaching). Their profile has been heightened; there is expanding cooperation with industry, exploration of new fields of research and support for up-and-coming young scientists and women in leading positions. The Joint Initiative for Research and Innovation has increased the number of doctoral students in all the science organizations and has prompted the founding of the Helmholtz Management Academy and the introduction of Leibniz-Humboldt professorships.<sup>106</sup>

#### *High-Tech Strategy for Germany 2020*

- c.5.12 The Federal Ministry of Education and Research published, *Ideas, Innovation and Prosperity: a High-Tech Strategy for Germany* in 2010.<sup>107</sup> The rationale for this strategy included:
- An accelerating global race for knowledge.
  - Intensifying global competition for talent, technologies and market leadership.
  - The need to open up new prospects for German industry.
  - Stimulating Germany's scientific and economic potential in a targeted way.
  - Finding solutions to global and national challenges.
- c.5.13 The High-Tech Strategy (HTS) has linked up topics and measures in various fields of innovation policy across federal ministries. The strategy has included increased funding, the improvement of general conditions for innovation, identification of 'key technologies'<sup>108</sup> and a strategy for internationalisation of science and research. This integrative approach has reportedly received a great deal of international recognition and broad support in the research community and the private sector. Following an evaluation in 2010 which pointed to positive changes in the innovation environment, an updated strategy was launched, with the continuing aim of making Germany 'the leading provider of science and technology based solutions (to global problems) in the areas of climate/energy, health/nutrition, mobility, security and communication'. Within these designated fields of action, 'forward-looking projects' were also identified with specific objectives related to scientific and technological development over a period of ten to fifteen years (part of a foresight process initiated by the Federal Ministry of Education and Research). Individual ministries also put together research, development and innovation policies in their areas of responsibility. The Industry-Science Research Alliance (which includes leading representatives from science and industry) is a forum to support the implementation of the HTS and the place where systematic evaluations of the HTS are discussed.
- c.5.14 Developing a well-qualified workforce is a further part of the HTS with measures addressed at vocational training, continuing vocational education and training, and HE. The aim is also to increase the number of young engineers working in small and medium enterprises (SMEs) (part

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<sup>106</sup> *ibid.*

<sup>107</sup> High-Tech strategy 2020 for Germany, <http://www.hightech-strategie.de/en/350.php> [accessed 12 March 2012].

<sup>108</sup> Key technologies are: biotechnology, nanotechnology, micro- and nano-electronics, optical technologies, microsystems technology, materials technology, production technology, services research, space technology, information technology and communication technology.

of the Qualification Initiative for Germany, agreed between the federal government and the Länder at the Education Summit in 2008). A well-informed public able to engage in debate about emerging technologies and research results is another part of the HTS and this has involved new platforms for dialogue with the public.

### **Priority subjects**

- c.5.15 There has been a big initiative in Germany in relation to MINT (STEM) subjects with a variety of bodies involved working at different levels – in schools, enhancing quality in HE, funding research ideas and providing support into employment. The approach is designed *inter alia* to enhance scientific and technology literacy for all and to provide early and continuing support for talented young people. At the federal level, there are action days, weeks and years (*eg* year of scientific research for health), competitions and awards, placements (Jobstarter); support and advice; internet portals and training for professionals. At Länder level, initiatives are targeted at nursery, primary and secondary schools and first year students. Funding varies from small amounts (€100-200,000 *per annum* to €9.7 million for Young Engineers – to improve research and training). Some initiatives are part-funded by industry. Activities are mainly undertaken and coordinated at Länder level, with the federal level signposting initiatives (and providing a high-level policy framework). A portal for MINT initiatives aimed at young people, students, teachers, parents and businesses is hosted by a large partnership of business partners.<sup>109</sup>
- c.5.16 The rationale for these initiatives includes analyses of demographic change (fewer young people and an ageing population), a wider need for MINT skills in other (non-MINT) professions, increasing need for research activity to design new products, a negative migration balance, lack of attractiveness of MINT (at school, HE and employment levels) a need for more ethnic minorities and women in MINT fields and a particular deficit in engineering.<sup>110</sup> Within the overall strategy, there is a ‘National Pact for Women in MINT Careers’ supported by a broad alliance of government, business, the media and scientific establishments.
- c.5.17 Our respondents also reported support for some modern languages (English, Spanish, French, Russian and Chinese as well as Arabic – with the first Islamic Institute having been established). Funding supports research and teaching in schools as well as enhancement of HE programmes at bachelor and master levels.

### **Success or otherwise of interventions**

- c.5.18 It has not been feasible to find detailed information on the success or otherwise of policy interventions in the time and funding available for this study, albeit general evaluation findings have been included above (*eg* in relation to the first stage High Tech Strategy).

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<sup>109</sup> For MINT see <http://www.mintzukunftschaften.de/index.php?id=1> [accessed 10 March 2012].  
<sup>110</sup> Report by Berlin-Brandenburgische Akademie des Wissenschaften.

## C.6 Hong Kong

### *HE system*

- c.6.1 Hong Kong has 13 degree-awarding institutions including eight institutions supported by public funds administered through the UGC. These HEIs provide around 15,000 first-year degree places for approximately 20% of the 17-20 age group. There are four self-financed institutions with degree-awarding status and 22 institutions offering accredited self-financed sub-degree programmes including the Vocational Training Council (VTC); community colleges and continuing education arms run by publicly funded universities; non-profit charities; and private providers.
- c.6.2 Hong Kong's Education Bureau is responsible for setting and overseeing the implementation of HE policy and for the organisations that allocate funding, administer A-level exams and provide accreditation. The UGC, a non-statutory advisory body appointed by the Chief Executive of Hong Kong Special Administrative Region, advises on the development and funding of HE and administers public grants to the eight HEIs. It also plays a major role in quality assurance and in promoting research. The statutory VTC was set up to provide and promote a cost-effective and comprehensive system of vocational education and training to meet the needs of the economy. 21 training boards offer advice through the VTC on the manpower and training needs of various industries or commercial sectors and make recommendations on how these needs may be best met.

### *HE policy*

- c.6.3 The government's policy objectives include<sup>111</sup> supporting the progressive increase in post-secondary education opportunities; supporting the development of the self-financing post-secondary education sector and promoting the diversification of various support schemes; assuring the quality of tertiary education and ensuring its relevance to the needs and development of the community. The British Council reports<sup>112</sup> that government policy aims to expand provision at the post-secondary level to more than 60% of the relevant age group by promoting the self-financed sector, rather than through significant growth of publicly funded provision. There is public funding for courses operating under the Vocational Training Council, however, the majority of sub-degree provision remains self-financed.
- c.6.4 Recommendations from a major review of the post-secondary sector in Hong Kong, undertaken in 2010 (following one in 2002),<sup>113</sup> included creating a more integrated post-secondary system (with the Education Bureau as the single over-arching body) and, importantly, to 'stay relevant in the process of internationalisation and the rapid development of Mainland China'. (p4). Internationalisation should become one of the central themes for UGC-funded institutions, with all institutions having strategies for internationalisation and for collaborations with mainland China. In academic development, institutions should capitalise on Hong Kong's unique position and should develop research and graduate programmes uniting Asian and Western perspectives. It was recommended that government should fund internationalisation initiatives.

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<sup>111</sup> Government policy objectives for post-secondary education are set out by the Education Bureau (revised 21 December 2010) <http://www.edb.gov.hk/index.aspx?nodeID=88&langno=1> [accessed 5 March 2012].

<sup>112</sup> *Hong Kong profile*, British Council: Education UK Partnership, last updated May 2011

<sup>113</sup> *Aspirations for the Higher Education system in Hong Kong: Report of the University Grants Committee, 2010.*

### **HE funding**

- c.6.5 The government funds most of the cost of undergraduate education in UGC-funded institutions. Tuition fees were introduced in the 1970s and today pay for about 18% of unit costs according to the British Council. Postgraduate provision has developed rapidly since 2003-04 when public funding was removed from most programmes offered by UGC-funded institutions. In these institutions, research postgraduate provision is publicly funded, whilst the majority of taught postgraduate provision is now self-financed. The 2011-12 Budget included the launch of the HK\$2.5 billion Self-financing Post-Secondary Education Fund to support the development of the self-financed sector, along with the expansion of a range of student-financing packages to include those on self-financed courses at sub-degree and undergraduate levels. The general approach to funding the HE system is noted in the 2010 UGC Review, *ie*; 'The funding regime should reinforce role differentiation and be based upon the demonstrable quality of outputs and outcomes. It should also be wholly or mostly free from the impact of government's manpower planning that may affect institutions' strategic planning and conflict with the dynamism of the providers in the entire system'.
- c.6.6 The 2010 review recommended that research funding should become more competitive. This would involve a critical review of how the Block Grant for research was allocated and a review of the Research Assessment Exercise. The review also recommended that the competitive allocation of research postgraduate places should be underpinned by a credible system to assess the quality of graduates. The review noted that private universities might participate in publicly funded research activities and this should be monitored.

### **National priorities**

- c.6.7 In 1996, the UGC advised the government that Hong Kong needed world-class institutions with distinct Areas of Excellence (AoEs) to retain its leading economic position in the development of China and the Pacific Rim. Five rounds of AoEs have been undertaken (now organised through the Research Grants Council) supporting IT and Science. The 2010 UGC Review recommended a continuing focus on institutional role differentiation according to key strengths and performance in role with respect to public funding allocations. The Review also recommended that the government's R&D policy should dovetail with the four pillars and six industries identified as investment priorities to broaden Hong Kong's economic base. These include medical services, environment industries, testing and certification, innovation and technology, education services and the cultural and creative industries.
- c.6.8 The government undertakes projections of sectoral needs, largely on a triennial basis. Once every three years the universities put up Academic Development Proposals indicating the programmes to be offered and the requested student numbers. Through the UGC, sectoral needs are negotiated with each institution, culminating in specific government-subsidized student places allocated to each university. The universities are aligned through this process, although they have the latitude to offer additional programmes/places on a self-financed basis. The key parties involved are the Education Bureau, the UGC and the Finance Department. The government is also funding collaborations between local providers and overseas partners in priority subjects such as public health, the creative arts and creative industries
- c.6.9 Our informants suggest that there is no 'SIVS-type' policy in Hong Kong because scientists and engineers are well-paid and are well-aware of career opportunities. School teachers are also well-paid. The government and its agencies are market-driven and less interested in micro-management. By contrast, many charities are thinking of building new universities designed for subjects like literature, theology and philosophy to improve 'the liberal mind' in general. The

major curriculum reform now underway in Hong Kong, involving a move from a 3-year degree to a 4-year degree, is also designed to provide a general liberal education in the first year, similar to the US model. Arguably, Hong Kong has no shortage of STEM (or STEM-related) students and graduates and is seeking to redress the balance in other directions. Hong Kong strongly (culturally) believes in the importance of balance. Hong Kong is keen that more non-Chinese Hong Kong students and graduates are truly international and there are policies to support this drive eg scholarships for non-Chinese. In general, Hong Kong HE is well-funded by government and by the many private donors (since donation to education is very popular).

#### ***Success or otherwise of interventions***

- c.6.10 It has not been feasible to identify more detailed information on the success or otherwise of policy interventions (such as the Areas of Excellence initiatives) in the time and funding available for this study.

## C.7 Japan

### *HE system*

- c.7.1 Japan ranks highly amongst OECD countries in terms of R&D and the government has a strong focus on investing in the science base to support innovation. It also has a similar public to private funding ratio to the UK. Graduate unemployment has historically been low, but recent data suggest that this is changing, particularly in science and engineering fields. OECD data also suggest that Japan ranks relatively low in terms of the availability of HRST occupations compared to the supply of skilled graduates. Therefore, recent government strategic initiatives have focused on improving graduate employability in a highly competitive jobs market through initiatives to enhance teaching in science, mathematics and technology and by promoting outward international mobility and the development of language skills.
- c.7.2 Japan has a differentiated, mass tertiary education system consisting of 773 universities, 406 junior colleges, 64 colleges of technology and 3,348 specialized training colleges.<sup>114</sup> A distinctive feature of the Japanese system is the dominance of the private sector, which includes 595 private universities. The majority of the private institutions are not-for-profit (about three are for-profit). Ten of the elite private institutions are large (with 30-40,000 students) and the remainder have small enrolments. In 2009, 73.3% of university students were enrolled in private universities and 93% and 95% respectively in private junior and specialized training colleges. The different types and categories of institution vary by mission, function, academic standards, prestige, status and funding.
- c.7.3 The Ministry of Education, Culture, Sports, Science and Technology (MEXT) oversees HE, guides policy and exercises student number controls. HE is of central importance to Japan as a 'knowledge-based society' and recent reforms have included increasing the autonomy of institutions, expanding internationalisation and extending the competitive resource-allocation system.

### *HE funding*

- c.7.4 National universities receive a block grant allocated on a formula basis from MEXT (50-60% of their revenues) while public universities are funded through local governments (prefectures). The criteria used in the funding formula include number of academic staff, number of students (undergraduate and postgraduate), cost per student, *high priority field*, regional role, equity role and quality evaluation by a review panel. Private universities also receive some public funding for teaching, allocated according to a similar formula (that does not include 'high priority field', but may include a premium for achieving regional impact).<sup>115</sup> These universities may also (exceptionally) receive funds for capital expenditure to establish and improve research facilities.
- c.7.5 MEXT also provides student support in the form of means-tested grants; these may be allocated through the Ministry or through institutions; the institutions define the associated conditions and regulations. Student tuition fees are charged in all kinds of universities; there are no restrictions on fees (from central government) for private or public institutions, but central government fixes the standard tuition fee level and the upper limit for the national universities.

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<sup>114</sup> Higher Education in Japan, Saito, Y, 2011.

<sup>115</sup> *Tertiary education in the knowledge society*. Volume 1. Special Features: Governance, Funding, Quality, Santiago, P, Tremblay, K, Basri, E, Arnal, E, OECD, Paris, 2008

- c.7.6 The majority of universities' research funding comes from government and government agencies. Competitive funding can be acquired by national, public and private universities for academic research and for specific funds such as 'the Global Center of Excellence Programme' (where the government is seeking to concentrate financial support on a small number of universities with the aim of achieving 'world-class centres of learning'). There are currently 7 national 'imperial research universities' and several private universities that have received such funding (across all fields). Amongst a plethora of different government-funded initiatives are ones focused on innovative and distinctive teaching projects, on developing a more 'globally capable work-force', and on the 'Global 30' universities that will lead the way in internationalisation.<sup>116</sup>

### *Science and technology*

- c.7.7 Science and technology are at the heart of the Japanese economy. In the latest 5-year basic science and technology plan (2011-15) – which is also linked to Japan's growth strategy – government policy envisages Japan as a state that 'cultivates science and technology as a culture' and stipulates that science and technology is a priority investment for the future. Growth targets include boosting public and private sector R&D investment to over 4% of GDP and ensuring full employment for all those who completed doctoral courses in science and technology.
- c.7.8 Japan has maintained its performance at school level over time (2000-2009). For example, in the 2009 OECD Programme for International Student Assessment (PISA) for 15-year olds, Japan is among the top-performing OECD countries in reading (ranked 5), mathematics (ranked 4) and science (ranked 2). Nonetheless, there is a perception that Japan's performance has been declining,<sup>117</sup> so that there have been several government and institutional initiatives over the last decade seeking to address the problem, including the creation of 'Super Science High Schools' (these may be affiliated to universities) and the creation of specialist teacher-training programmes (eg in mathematics). A coalition of interests across government, schools and universities has been addressing these agendas.
- c.7.9 According to the OECD, Japan has 'an unusual and highly effective system for moving students into the workforce' – including heavy employer investment in continuing education and training.

### *Internationalisation*

- c.7.10 Internationalisation has increased in importance in both education and research. The government has played a central role in internationalisation with initiatives such as government scholarship programmes, funds for tuition reductions and exemptions, subsidies for building student accommodation, relaxing immigration regulations and supporting host institutions with their international students. New policies such as the 'skilled migration approach' (promoting post-graduation employment) and lower-tiered partnering of private HEIs with recruitment agents (recruiting mainly from China) are fuelling international student recruitment. These initiatives are being strengthened because of the demand for 'global-minded graduates' at rapidly globalising Japanese companies (the government is therefore supporting universities to expand their English-taught courses and study-abroad programmes).

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<sup>116</sup> Saito (2011) op cit; and personal communication with British Council office.

<sup>117</sup> In mathematics, 6% of students in Japan reach the highest level of performance (level 6 – top level) compared with an OECD average of 3%. However, 27% of students in Shanghai-China attain this level. In Japan, 21% of students reach the PISA mathematics level 5; in Singapore and Hong Kong-China, more than 30% do, and in Chinese Taipei, Korea, Switzerland, Korea and Finland, more than 21% do). OECD. (2012). Strong Performers and Successful Reformers in Education: Lessons from PISA for Japan. Paris, OECD.

### *The cultural dimension*

- c.7.11 Japanese culture and society are important components in Japan's educational and economic success and some relevant factors noted by the OECD include: regular benchmarking of performance and associated educational reforms; a deep commitment to education at all levels at government, family and industry levels; high quality teaching and high standards of education (with a belief that all students can achieve); a balance between private and public resources; and close links between education, training and employment.

### *Priority subjects*

- c.7.12 In Japan, there are no nationally designated 'priority subjects' at undergraduate level or associated funding mechanisms similar to those currently applied in England. The specific drivers of changes in HE in Japan include the need for economic growth (and an immediate response to the natural disasters of earthquake and tsunami), an ageing and ethnically homogeneous population, a perceived need to internationalise HE and a need to maintain and develop its global position in science and technology fields in the light of global competition. Japan is seeking to maintain (and enhance) its position in science and technology as part of its overall economic strategy and it is increasing spending in the STEM area in order to do this.

### *Success or otherwise of interventions*

- c.7.13 It has not been feasible to find detailed information on the success or otherwise of policy interventions in the time and funding available for this study (not least because there are a myriad of funding schemes in operation in HE).

## C.8 Netherlands

### HE system

- c.8.1 The Netherlands has a binary system of HE with 14 government approved research universities (including the Open University) and 47 Universities of Applied Science (UoAS) (*hogescholen*). There are a few private universities, including a business school (Nyenrode Business University) and a few theological universities with small numbers of students and limited research. Three of the universities are private foundations and almost all the UoASs have the legal status of private institutions; private HE also exists at sub-degree level and for part-time or distance BA-level education. Bologna structural reforms were implemented in 2002 creating a bachelor's and master's phase of HE. Private sector institutions are not covered by the HE and Research Act; they include foreign universities and business schools to which Dutch government regulations do not apply. However, within the Act, the legislation covering HE does not differentiate between private and public HE. Three universities (Delft, Eindhoven and Twente) focus predominantly on engineering and technology.

### HE policy and system reforms

- c.8.2 During the past 20 years, state steering of the sector has changed through ambitions to strengthen institutional autonomy and the internal governance and management structures of HEIs. The Hoger Onderwijs Autonomie en Kwaliteit (Higher Education: autonomy and quality (HOAK)) philosophy<sup>118</sup> of enhanced institutional autonomy was codified in the *Higher Education and Research Act* of 1993 which introduced the principle of self-regulation for HEIs. Since then, the policy framework for the Dutch HEIs has revolved mainly around funding and quality assurance. Universities have also been encouraged to develop distinct profiles and increase 'private funding'. Government policy is focused on de-regulation (*eg* allowing some selectivity in student admissions), more competition between universities and more government oversight. More recently, government policy has been concerned with 'focus' and 'excellence' with a debate about the balance between 'focus' (specialisation) and 'mass' (maintaining a broad base of subjects).<sup>119</sup>

### HE funding

- c.8.3 The research universities receive basic funding for teaching and research from the government (Onderwijs, Cultuur en Wetenschap (the Ministry of Education, Culture and Science (OCW))). Additional research funding is made available through competitive grants, most of which are distributed by the Nederlandse Organisatie voor Wetenschappelijk Onderzoek (Netherlands Organisation for Scientific Research (NWO)) to encourage strategic and applied research of relevance to the Dutch economy (and regional and European priorities<sup>120</sup>). Additional research funds come from contract research and EU framework programmes. UoAS institutions receive base funding for teaching only and have in recent years gained access to some public research funding to underline their knowledge transfer functions. The new Ministry of Innovation and

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<sup>118</sup> *Higher Education: autonomy and quality*, White paper, HOAK, 1985.

<sup>119</sup> According to one of our respondents, government policy on 'focus' and 'mass' was evaluated in 2011 and found to have had little impact at Higher Education Institution level.

<sup>120</sup> The Netherlands pays attention to the European Innovation agenda and the EU Scoreboards on Innovation. There will be tax breaks for spend on R&D and encouragement for universities and research institutes to team up with industry and work on joint projects.

Economic Affairs now has some of the (increasing) budget for research – and funding is increasingly targeted.

- c.8.4 The research universities receive their public funding via three funding flows. The first (base funding) comes from the OCW and tuition fees paid by students. It is approximately 60% of total university revenue. The second flow consists of research council funding and represents 10%. The third flow of funds makes up the remaining 30%. In recent years the ‘first flow’ has been cut back and has instead been added to the NWO budget to support excellent individual researchers through competition-based funding.
- c.8.5 Students pay a uniform tuition fee across all institutions and programmes at BA and MA levels. Fees account for 6% of university and 18% of UoAS revenues. Universities compete on fees with the private sector with regard to ‘private training’. The fee level for university students is set by government, but universities can charge higher than the set fee. Students can dispute the fee and go to judicial review. One third of the fee comes from students to the university and two thirds from government. Student support is available for eligible students; it includes a performance element. There has been a shift from grants to loans at undergraduate level. Ten years ago there were incentives for students to study science (through government payment of tuition fees); however an evaluation of the Science Scholarship Programme showed that the scheme did not increase levels of student interest in studying science (so this scheme was abandoned).
- c.8.6 The formula-based block grant allocated directly by the OCW to universities for teaching and research is based on measures of volume, prices per student/subject and historical considerations. More recently, the universities have agreed to a system of individually negotiated performance contracts to include quality indicators. Approximately 7% of the grant will be allocated in this way. The performance contracts are focused on Higher Education Institution-set targets within institutional ‘profiles’. These are also aligned with national targets. Universities also have targets to improve in specific areas (eg the progress rate of students – particularly in science – and to reduce drop-out rates).
- c.8.7 Student numbers are monitored at a macro-level and from the 1990s onwards have been re-allocated from one institution to another if needed. Until 2012 the emphasis has been on expanding student numbers to approximately 60% of the relevant age group; however, from 2012, emphasis has been put on quality of students rather than numbers. Programme supply is closely monitored with new programmes being controlled through the Accreditation Agency (Nederlands-Vlaamse Accreditatie-organisatie (NVAO)) which advises government on the introduction of new programmes. The Minister decides on new programmes and associated allocations of student numbers. Institutions report on student enrolments (within national statistics) and OCW officials regularly visit Higher Education Institutions. The two university organisations (VSNU and HBO-RAAD) also supply data and reports to the OCW and negotiate on behalf of their members; there is also a strong private sector trade association. Annual reports from universities also provide information about graduates and their skills.

### **National priorities**

- c.8.8 The OCW responds to information from the universities about subjects that are ‘vulnerable’ because of falling student numbers or for other reasons. Subjects that have been identified in recent years include some ‘small’ languages such as Arabic, Chinese and Japanese as well as theology, educational sciences (which are fragmented across institutions and are not attracting enough students), mathematics (also an issue of declining numbers), advanced nursing training and some humanities subjects. Typically, a committee is set up to look at the issue and advise government, with a key player in the chair.

- c.8.9 In the past six years, the idea of *Sector Plans* has been developed for disciplines. Education providers look at interest in the subject, provision in the subject and the nature of supply. To date, 15 Sector Plans have been developed for universities and UoASs. Out of these have come agreements about where supply should be located (*eg* University of Amsterdam and University of Leiden are agreeing to focus and concentrate programmes). The Sector Plans are presented to the OCW and some are promising enough (including recently the Humanities' Plan) to receive funding (*eg* for re-structuring). In other cases, such as improving Dutch students' quantitative skills, the agenda rests at university rather than government level.
- c.8.10 The Dutch Education Council (an Advisory Council to government) is interested in the issue of SIVS and is looking at the HEFCE approach. There is also interest (in the regulatory environment around these subjects) in Flanders, Germany and Sweden. The main concern in the Netherlands is in relation to science and engineering; however this is not seen just as an HE issue, but also one affecting vocational education and secondary education (the supply chain to industry). The concerns around STEM subjects are associated with the Lisbon competitiveness agenda (from 2000-2001): did the Dutch economy have sufficient qualified graduates in science and engineering to support innovation, the development of the Knowledge Economy, and the ability to compete with other Western nations and emerging economies? As science and technology graduates are seen as key for R&D and innovation, this has been an issue for the multi-national companies and, through them, a concern of the government. Following discussions in 2003, the Ministry of Education and the Ministry of Economic Affairs started a 'Platform on Science and Technology' to coordinate all policies and plans on Science and Technology ('Beta-Techniek') in Education, Science and Research.
- c.8.11 In 2004, the DELTA Plan argued for a coordinated effort across education sectors, government and business. The Beta-Techniek report identified a target of 50% more graduates in 10 years time and better utilisation of talent in R&D. Subsidies were available and a national debate was started to increase awareness about science and technology opportunities and their attractiveness. The platform was evaluated in 2010 and is now part of a larger effort: the 'Top Sectors' Initiative'. The platform produces reports, hands out subsidies, organises competitions and holds media events (*eg* for pupils in primary and secondary schools) to raise awareness. As in Germany, there are a range of projects, *eg*:
- To match graduates to jobs.
  - For students to have contact with business.
  - For business people to teach in schools.
- c.8.12 There has been some success according to our respondents in secondary schools: a majority (>50%) of students are taking science options (*ie* Health and Nature or Nature and Technology) in final exams. Fewer of these students go on to universities, but the universities are working on this. For example, in Amsterdam University College (a joint venture between University of Amsterdam and Vrij Universiteit, Amsterdam) the aim is to select 50% science majors.<sup>121</sup> The universities have tried to deal with demand shortages by new course design and increased marketing and there has been some growth recently in life sciences and inter-disciplinary areas (*eg* successful new courses at the University of Amsterdam in psychology and science and 'Future Planet Studies').
- c.8.13 A more right-wing Cabinet elected in 2010 (just fallen) set the political agenda to 'competitiveness and innovation'. Following a scenario exercise undertaken by the NWO, there is now more funding and a focus on projects that have 'societal or economic benefit'. This (now

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<sup>121</sup> The college is selective at entry, unlike universities. It is aiming at excellence and the comment from a senior manager is that 'there is more of a tendency towards excellence among science majors; better students choose to do science. Also, by choosing science, students are able to keep their options open longer'.

previous) government has focused on ‘winners’ (economic sectors with promise and achievements in knowledge production and success in a Netherlands context). The new Ministry of Innovation and Economic Affairs has been driving the ‘Top Sectors’ agenda. This ministry is also interested in ‘efficiencies’ – *ie* duplication in subjects and programmes and programmes that are too small to be viable.

- c.8.14 There are nine Top Sectors (adopted by government after industry lobbying) which have had an impact on education policies since there has been government support, subsidies and special regulations. The nine sectors are: Energy (natural gas); Chemical Industry; Creative Industries; High Tech; Life Sciences and Health; Water; Logistical Services; Agriculture and Food; Horticulture. By the end of 2011, all these sectors had brought stakeholders together in alliances between industry, government regulatory authorities, education sectors and other parts of the public sector such as hospitals. ‘Innovation contracts’ have been agreed and an extensive ‘Human Capital agenda’. Relevant parties get around a table to discuss shortages of skills, how to get rid of them and how to take action in the nine areas.
- c.8.15 In Dec 2011, the ‘Human Capital Strategy’ was published (in Dutch). It covers the need for highly skilled labour, the supply of graduates (*eg* in chemistry, ICT), showing shortages in all areas. Industry, the education system and research institutes are urged to join forces to take action to increase the supply of graduates and attractiveness of employment opportunities in these sectors. The language is about ‘alliances’ between vocational education, private companies, secondary education and universities. Each of the nine panels has agreed to invest in activities over the next 5+ years. The types of activities include public-private partnerships (that will generate increased investment); innovation contracts; and university alignment of their research agendas around these themes.
- c.8.16 The new ‘Performance Contracts’ in universities will include a focus on the ‘Top Sectors’. (Some universities have decided to restructure or phase out programmes and reorient their teaching and research in the light of both the Top Sectors and the ‘Performance Contract’ agendas.) Through the portfolio reviews, universities will aim to invest in areas of strength. Private funding and government funding can be earned by universities in addition to that from education budgets. In science and technology fields, universities will collaborate rather than compete so as to keep enough student places available across the country.

#### ***Success or otherwise of interventions***

- c.8.17 It has not been feasible to find detailed information on the success or otherwise of policy interventions in the time and funding available for this study. We have anecdotal evidence of the success of some interventions (*eg* in relation to science education in schools) and are aware that the DELTA initiative has been evaluated (but the quality of the evaluation and associated outcomes have been contested).

## C.9 Poland

### HE system

- c.9.1 In 2008/09 there were 456 higher education institutions in Poland comprising 131 state and 325 private institutions. These are categorised into university-type and non-university institutions. University-type HEIs (around 70%) offer at least one doctoral programme. HEIs offer full-time, extramural, evening and external courses. The college sector is classified as tertiary education for the purpose of international comparisons, but is not recognised as HE-level in national legislation. The OECD has noted that Poland's firm-based vocational education system collapsed with the dismantling in the early 1990s of many state-owned firms that played a pivotal role in the delivery of VET.<sup>122</sup>
- c.9.2 Poland has rapidly expanded its HE system since the end of the cold war. Total HE enrolments rose from around 400,000 in academic year 1990-91 to nearly 2m in academic year 2008-09. The gross enrolment rate increased from 12.9% in the academic year 1990-91 to 52.7% in academic year 2008-09. In academic year 2008-09, 65.8% of all students were enrolled in public HEIs.<sup>123</sup>
- c.9.3 Since academic year 2007-08 the Polish HE system has been divided into three cycles: bachelor (Licencjat, Inżynier), master (Magister) and doctor (Doktor). The system applies to all fields except law, pharmacy, psychology, veterinary medicine, medicine and dentistry, which are still based on two-stage system (master and doctor).<sup>124</sup> There are academic and technical HE streams and the Inżynier degree is focused on technical subjects.
- c.9.4 Since barriers were removed in 1990 the private HE sector has grown considerably from only 3 institutions to 325, and many of these have been established in smaller cities. Most students from lower socio-economic groups study in the private sector which acts as an important demand-absorber, mostly focusing on delivering business, social sciences and some humanities programmes, which are in demand from students. There is low demand for technical subjects. Many private institutions use teaching staff from neighbouring public institutions. The vast majority of private HEIs have a low status amongst employers.<sup>125</sup>
- c.9.5 The Ministry of Science and Higher Education is responsible for HE and the Ministry of National Education and Sports oversees other levels of education. HEIs that focus on specialist areas such as the arts, health, emergency services and the armed forces are supervised by their relevant ministries.
- c.9.6 The State Accreditation Committee (SAC) undertakes quality evaluation across HE. It also reviews applications for the establishment of HEIs. Since 2001 all HEIs (public and private) have been required to develop an internal quality evaluation system and since 2007 all HEIs that receive state funds for research programmes, and those that receive a financial grant for research that

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<sup>122</sup> *Boosting prospects for the young*, University World News, 29 November 2009, <http://www.universityworldnews.com/article.php?story=20091127125329937> [accessed 22 May 2012].

<sup>123</sup> *Organisation of the education system in Poland 2009/2010*, EURYBASE, [http://eacea.ec.europa.eu/education/eurydice/documents/eurybase/eurybase\\_full\\_reports/PL\\_EN.pdf](http://eacea.ec.europa.eu/education/eurydice/documents/eurybase/eurybase_full_reports/PL_EN.pdf) [accessed 22 May 2012].

<sup>124</sup> *Study in Poland, Polish Education System*, <http://www.studyinpoland.pl/en/index.php/education-in-poland/9-polish-education-system> [accessed 22 May 2012].

<sup>125</sup> *Poland's students go private in force*, Vasangar, J, The Guardian, 6 April 2011, <http://www.guardian.co.uk/world/2011/apr/06/poland-universities-private-public> [accessed 22 May 2012].

exceeds €450,000, are obliged to undergo an external research quality audit.<sup>126</sup> The SAC is also responsible for the national HE curriculum.

### **HE funding system**

- c.9.7 In 2012 the Polish government began implementing a substantial reform of the HE system that includes changes in the financing of universities. In 2012 the budget for science and HE increased by around 9% with PLN10.2 billion earmarked for HE. The government's long-term financial plan for 2011-14 assumes a steady, annual increase of resources for science of about 8%.<sup>127</sup> However, in recent years the Polish government has committed to reducing the government share of funding for both teaching and research as a result of the economic downturn. This has led to a significant increase in contributions to institutional income from tuition fees, and has thus influenced reforms designed to professionalise institutional management to help improve efficiencies and use of scarce resources.
- c.9.8 Public HEIs are subsidised by the Polish government for the following activities: teaching full-time students; training research staff; maintaining institutional estates; financial support for students; co-funding investment projects; and improving accessibility. They also receive discretionary funds from government. The Minister decides which subsidies can be accessed by the private sector.
- c.9.9 Public funding for universities' core educational activities is distributed to universities via an operational grant according to an algorithm based on: the number of enrolled students; the number of students eligible for accommodation in student hostels and the number of hostels. The money is then held by university administration and faculties, according to a 30:70 ratio, and then allocated after agreement between Rectors and student self-government boards. Individual faculties and departments operate on one-line budgets and may carry forward savings from the current year to the next.<sup>128</sup>
- c.9.10 Students studying in the publicly funded sector don't pay fees (if studying full-time), although they do in the private sector. Part-time students pay fees, and therefore most study at the weekend. Public HEIs are also allowed to charge fees for programmes or courses taught in a foreign language. Full and part-time students receive some state financial support (public and private) described as 'non-refundable and reimbursable' – means tested scholarships for the poorest students and scholarships for the best students. All bachelor students are eligible for merit based scholarships and all students are eligible for student loans, but the latter are not popular.<sup>129</sup>
- c.9.11 Since 2004, the law has stated that the level of funding provided for research in the state budget should reach the level of expenditure defined in the Lisbon Strategy. Funding for research includes funds for implementing the national research, technology and innovation policy, funds for statutory research activities, capital projects supporting R&D activities, research projects, international cooperation in the area of research, activities supporting research, and programmes and actions defined by the minister responsible for research.
- c.9.12 Formula funding for research uses a range of indicators including: participation in international organisations; international research programmes; international conferences; efficiency measures in conducting research; number of patents; partnerships with private entities; number of PhD candidates. Many of these support Ministerial priorities.

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<sup>126</sup> *Progress in higher education reform across Europe*, CHEPS et al, Governance Reform. Volume 3, 2009, Governance fiches, [http://ec.europa.eu/education/higher-education/doc/governance/vol3\\_en.pdf](http://ec.europa.eu/education/higher-education/doc/governance/vol3_en.pdf) [accessed 22 May 2012].

<sup>127</sup> Elite research centres, more funding in 2012, Siwinska, B, University World News, 8 January 2012, <http://www.universityworldnews.com/article.php?story=20111222203800997> [accessed 22 May 2012].

<sup>128</sup> CHEPS et al, 2009, *op cit*.

<sup>129</sup> *ibid*.

c.9.13 In 2008 80% of public funding for research came from the operational grant and 20% from competitive grants from research councils. Competitive grants can also be accessed by private HEIs. However, private universities are primarily teaching institutions, and in 2009 only 8% of their income came from research.<sup>130</sup> Most public universities earn around 25% of their total operating budgets from non-governmental sources including tuition from part-time and continuing education programmes.<sup>131</sup> PricewaterhouseCoopers, a consultancy, reports that Polish HE performs relatively poorly in terms of private sector income compared to other countries.<sup>132</sup>

#### *HE reforms to governance and funding*

c.9.14 The 1990 Higher Education Law is the most important recent reform of the Polish HE system. It focused on increasing institutional autonomy, the introduction of fees for part-time students and removing the barriers of entry for private HE providers. The financial algorithm was also introduced as a basis for state funding and staff were recruited on the basis of open competition, for the first time.

c.9.15 The Polish government developed an Education Development Strategy for the period 2007-2013 as part of a National Development Programme that covers all levels of education. This was based on €4.2 billion funding from the EU which includes €1.5 billion for HE and €2.6 billion for research and science.<sup>133</sup> This included a sector-wide commitment to HE improvement and commitment to EU HE modernisation and the Bologna Process (in areas such as institutional management, HE finance, student finance, HE-industry links, pedagogy and internationalisation). The Foundation for the Development of the Education System provides funds for many of these initiatives.

c.9.16 In 2011 the HE Law was amended to support the implementation of 'Poland 2030. Development Challenges' a policy which was intended to help establish Polish universities in the top 20 in European rankings by 2030 and support a 50% increase in international students studying in Poland. The 2011 law has three main pillars of policy activity: the efficiency of HE management; the flexibility of academic careers; and educational outputs. Policy areas include: investing in high-quality educational provision; commercialising research; raising entry criteria; and improving institutional autonomy. One particularly interesting area focuses on improving employability through promoting employer engagement within degree programme, tracking graduate employment routes and creating a 'Diamond Grant' to support talented engineering students to progress directly from BSc to doctoral studies.<sup>134</sup>

c.9.17 Current HE policy also seeks to differentiate HEIs into three categories according to nature and quality of their research and teaching: elite institutions capable of competing with best universities in Europe; institutions well adapted to the socio-economic development of the region and of the country; and vocational institutions carrying out teaching activities and fulfilling local needs.<sup>135</sup>

#### *The KNOW project*

c.9.18

; KNOW). These will be granted KNOW

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<sup>130</sup> Vasangar, 2011, *op cit.*

<sup>131</sup> CHEPS *et al*, 2009, *op cit.*

<sup>132</sup> *The global picture* prepared for Universities UK by Pricewaterhouse Coopers, September 2010, <http://www.universitiesuk.ac.uk/Publications/Pages/Theglobalpicture.aspx> [accessed 25 May 2012].

<sup>133</sup> EURYBASE, *op cit.*

<sup>134</sup> *Information About the Proposed Changes in the Higher Education System in Poland*, Department of International Affairs and Recognition of Diplomas, Ministry of Science and Higher Education, 23 September 2010.

<sup>135</sup> EURYBASE, *op cit.*

status by a committee of experts on a competitive basis for a five-year period. The competition for KNOW status will be open to institutes, consortiums or research centres at universities and selection will be by open competition in eight areas: the humanities, social science, pure science, technology, medical science, environmental science, agriculture and forestry, as well as the arts.

- c.9.19 Up to six KNOWs can be created in 2012. These institutions will receive around PLN10 million (US\$3 million) a year over five years of additional funding for improving academic salaries; raising the size of scholarships and recruiting outstanding academics from abroad. Unlike similar initiatives elsewhere in Europe, the tenders will not be for a specific innovation project but will relate to a summary of research activities and prestige, judged by the number and quality of citations, patents and their implementation, and cooperation between the research centre and the business community.
- c.9.20 This fund will also provide additional support to public and non-public universities offering the best degree programmes, as judged by the State Accreditation Committee. There will also be separate funding for implementing universities' internal quality assurance systems and for implementing the National Qualification Framework (as part of compliance with the Bologna Process); financing for PhD studies at the best non-public universities; and additional scholarships for the top 30% of PhD students at both public and non-public universities. Disbursement of funds to all public universities will be based on a changed funding formula, attributing greater weight to outcomes. The National Qualification Framework is intended to free study programmes from central state control, and enable universities to develop more innovative and interdisciplinary programmes and react faster and more flexibly to the needs of the market and industry.<sup>136</sup>

### **National priority subjects**

- c.9.21 National priority subjects in Poland largely focus on technical education and are described as subjects that are strategic for economic development. The subjects are decided upon by experts but the Polish government is currently implementing a reform of the HE system which focuses on STEM fields.
- c.9.22 Between 2005 and 2025, the number of young people aged 18–24 is expected to fall by over 15% in Poland.<sup>137</sup> In response to this demographic decline, the Polish government is planning to focus on improving teaching quality and widening the educational base in response to the needs of the economy and labour market. Poland has a developing economy and is focusing its funding streams on improving graduate skills, developing quality systems and building research capability and capacity.
- c.9.23 The Polish labour market has a preference for professional subjects, which has influenced student demand (and enrolments) in those fields meaning that technical subjects are often ignored by students and the number of graduates from scientific, technical and healthcare-related faculties is considered to be too low. In recent years the Ministry has sought to modernise HE curricula and teaching in mathematical, natural sciences and technical (SMT) faculties to help meet the needs of the Polish economy. It has also sought to stimulate demand for technological, mathematic and natural sciences fields (usually called technical subjects, where enrolments are declining). The ministry 'requests' such a study course to be provided by a particular university and assigns additional resources to it. Special scholarships are then made available to attract students.<sup>138</sup>

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<sup>136</sup> Siwinska, 2012, *op cit.*

<sup>137</sup> *Ibid.*

<sup>138</sup> Universities UK (2010) *op cit.*

### *Targeted scholarships*

- c.9.24 Since 2008 the Ministry of Science and Higher Education has allocated PLN620 million for special scholarships at 57 universities and technical universities funded by the European Human Capital Operational Programme. (By 2013 the total spend will be US\$322 million) Faculties apply for the funding direct to the Ministry. Subject areas include chemistry, mathematics, physics, biotechnology, environmental engineering, robotics, civil engineering, computer science, mechatronics, nanotechnology and nuclear energy.

### *'Girls as Engineers!'*

- c.9.25 In the mid-2000s a national initiative 'Girls as engineers!' was created and has been very successful. The initiative consists of a nationwide media campaign and a series of events labelled 'for girls only' at 20 Polish technical universities.

### *Success or otherwise of interventions*

- c.9.26 It is too early to say regarding the impact of the KNOW project although some experts suggest it could have the effect of marginalising HEIs in small and medium sized towns in research since the majority of the state research funds will probably go to large and well-regarded universities.
- c.9.27 The targeted scholarships have increased applications (especially to the technical universities) but there is some evidence that the intensive promotion of applications has led to an influx of under-qualified students to engineering courses, and poor levels of achievement. Recent data suggests that only 148 out of 714 students from engineering studies, who started in 2009 as part of the pilot programme for 'requested' courses, have graduated. Experts suggest that the poor graduation rate may have resulted from the fact that the programme did not specify any admission requirements and that as universities wanted to increase student numbers so they accepted applicants with poor entry qualifications.<sup>139</sup>
- c.9.28 The 'Girls as Engineers programme is seen as successful. During the past five years the national share of women among technical university students has grown by 5% and currently amounts to 35%.<sup>140</sup>

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<sup>139</sup> Campaign fuels huge increase in students at technical universities, Siwinska, B, University World News, 18 March 2012, <http://www.universityworldnews.com/article.php?story=2012030818102350> [accessed 22 May 2012].

<sup>140</sup> *Ibid.*

## C.10 Scotland

### HE system

- c.10.1 The Scottish Further and Higher Education Funding Council (SFC) is the national strategic body that is responsible for funding teaching and learning provision, research and other activities. It was set up by an Act of the Scottish Parliament in 2005.<sup>141</sup> SFC is a Non-Departmental Public Body of the Scottish government.
- c.10.2 SFC provides impartial advice to the Scottish ministers and involves colleges and universities in the development of its policies and funding methods through participation on its committees, advisory groups and working groups.
- c.10.3 Post-16 education in Scotland is provided through a mix of 41 further and higher education colleges, 16 universities and 3 other HE institutions. The majority of colleges and universities in Scotland are state funded. Currently, the college sector tends to focus on the more vocational aspects but many colleges offer degrees as well as diplomas. The Scottish Qualifications Authority accredits vocational qualifications and approves awarding bodies in Scotland.<sup>142, 143</sup> Scottish universities are autonomous and have degree-awarding powers given through their various charters. Quality assurance and enhancement is provided by the Scottish Office of the UK QAA.<sup>144</sup>
- c.10.4 In the academic year 2011-12, there were 79,463 full-time and 235,996 part-time college students and 172,435 full-time and 81,393 part-time students in the Scottish HE sector.<sup>145</sup>
- c.10.5 A recent pre-legislative consultation paper<sup>146</sup> for legislation planned for the second half of 2012 builds on earlier papers<sup>147, 148</sup> and consultations and concerns likely reform of vocational and post-16 education. The vision is 'a post-16 education sector which plays a central role in improving people's life chances, delivering the best outcomes for learners; which supports and develops a world-class research capability; and which maximises its contribution to sustainable economic growth for Scotland'. The aim of this is to create a flexible and fair system that: 'meets the needs of learners and employers; results in positive outcomes at all stages of the learner journey; and uses public funding to deliver courses, qualifications and degrees as efficiently as possible'. This is likely to include regionalisation and merger of some colleges and greater collaboration between and possibly merger of some universities.
- c.10.6 Universities Scotland is a membership body that represents and promotes the Scottish HE sector.

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<sup>141</sup> *Further and Higher Education (Scotland) Act, 2005*,  
[http://www.legislation.gov.uk/asp/2005/6/pdfs/asp\\_20050006\\_en.pdf](http://www.legislation.gov.uk/asp/2005/6/pdfs/asp_20050006_en.pdf) [accessed 25 May 2012].

<sup>142</sup> See [http://www.sqa.org.uk/sqa/CCC\\_FirstPage.jsp](http://www.sqa.org.uk/sqa/CCC_FirstPage.jsp) [accessed 25 May 2012].

<sup>143</sup> *Overview guide to quality assurance and enhancement in Scotland's colleges and universities*,  
[http://www.sfc.ac.uk/web/FILES/Our\\_Priorities\\_Effective\\_Institutions/guide\\_quality\\_assurance\\_enhancement.pdf](http://www.sfc.ac.uk/web/FILES/Our_Priorities_Effective_Institutions/guide_quality_assurance_enhancement.pdf)  
[accessed 25 May 2012].

<sup>144</sup> See <http://www.qaa.ac.uk/Scotland/Pages/default.aspx> [accessed 25 May 2012].

<sup>145</sup> *Facts & figures: the 2012 at a glance guide to the Scottish Funding Council*,  
[http://www.sfc.ac.uk/web/FILES/ReportsandPublications/Facts\\_and\\_Figures\\_2011.pdf](http://www.sfc.ac.uk/web/FILES/ReportsandPublications/Facts_and_Figures_2011.pdf) [accessed 25 May 2012].

<sup>146</sup> *Putting learners at the centre: delivering our ambitions for post-16 education*, Scottish Government, September 2011,  
<http://www.scotland.gov.uk/Resource/Doc/357943/0120971.pdf> [accessed 25 May 2012].

<sup>147</sup> *Building a smarter future: towards a sustainable Scottish solution for the future of higher education*, December 2010,  
<http://www.scotland.gov.uk/Resource/Doc/335256/0109656.pdf> [accessed 25 May 2012].

<sup>148</sup> *Review of post-16 education and vocational training in Scotland*, August 2011,  
<http://www.scotland.gov.uk/Resource/Doc/355876/0120235.pdf> [accessed 25 May 2012].

### **HE funding**

- c.10.7 SFC funds contribute towards the costs of learning and teaching, skills development, research, innovation and other costs such as staff, buildings and equipment in Scotland's HEIs and colleges.<sup>149</sup> SFC also provides resources to enable colleges to offer bursaries to students who are enrolled on non-advanced courses (courses that are up to, but not including, Higher National Certificate (HNC) level).
- c.10.8 In the academic year 2011-12, SFC provided through formula-based funding £577.6 million for colleges and £999.2 million for the HE sector.<sup>145</sup>
- c.10.9 In the academic year 2012-13 Scottish students will not pay tuition fees for education in Scotland but will be subject to tuition fees in the other parts of the UK.<sup>150</sup> The Student Awards Agency for Scotland provides student loans and bursaries to cover tuition fees and living costs as appropriate for students studying for the HNC and above.<sup>151</sup>
- c.10.10 Whereas Scottish and EU student numbers are capped, the number of students from the rest of the UK (RUK) is uncapped except for 'controlled subjects' (*ie* medicine and dentistry, nursing and midwifery pre-registration education, initial teacher education and veterinary medicine).<sup>152, 153</sup> While the student numbers for Scottish and EU students will be similar to 2011, the total number of funded places at each university will be reduced by the likely number of students to be taken in 2012 from RUK. Scottish HEIs are permitted to charge RUK students up to £9,000 per annum. While RUK students are outside the number controls, it is anticipated that practical considerations (*eg* laboratory spaces and maintaining the student experience) are likely to limit the number of RUK students.
- c.10.11 SFC's Horizon Fund supports strategic initiatives in universities including the pooling of research activities across several universities.<sup>154</sup>

### **National priorities**

- c.10.12 Although SFC funding streams do not appear to relate directly to priority subjects these can influence activities in these fields as is discussed in the following paragraphs.

### **Economic priorities**

- c.10.13 While current educational reforms<sup>146</sup> appear to be seeking to improve the Scottish economy by increasing the concentration of research funding on research excellence, aligning research to national priorities; and ensuring university research is better exploited for the benefits of business, and the economy. The latter was first identified in an earlier paper<sup>147</sup> which also considered an increasing focus on STEM subjects as a possibility.
- c.10.14 It should also be noted that from academic year 2007-08 to academic year 2009-10, the SFC allowed universities to recruit as many students as they liked in STEM subjects in a move

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<sup>149</sup> See <http://www.sfc.ac.uk/funding/funding.aspx> [accessed 25 May 2012].

<sup>150</sup> See <http://wwwucas.ac.uk/students/studentfinance/> [accessed 25 May 2012].

<sup>151</sup> See <http://www.saas.gov.uk/> [accessed 25 May 2012].

<sup>152</sup> *Intake targets for controlled subjects in universities for academic year 2012-13*, February 2012, [http://www.sfc.ac.uk/web/FILES/Circulars\\_SFC032012/SFC\\_03\\_2012.pdf](http://www.sfc.ac.uk/web/FILES/Circulars_SFC032012/SFC_03_2012.pdf) [accessed 25 May 2012].

<sup>153</sup> *Controls on the number of undergraduate places at universities & colleges in Scotland for 2012 entry*, UCAS, [wwwucas.ac.uk/documents/sncscotland.docx](http://wwwucas.ac.uk/documents/sncscotland.docx) [accessed 25 May 2012].

<sup>154</sup> See <http://www.sfc.ac.uk/research/research.aspx> [accessed 25 May 2012].

designed to raise student numbers in areas seen as pivotal to the Scottish economy.<sup>155</sup> The decision was reversed in academic year 2010-11 because of pressure on budgets.

- c.10.15 The SFC has invested in two phases of its employability strategy for supporting college and university work to build capacity and good practice so as to enhance student employability.<sup>156</sup>

#### *Possible SIVS involvement*

- c.10.16 Investigation of available resources has not found significant evidence of SIVS policy in Scotland. However, the issue of SIVS is touched upon in a recent paper<sup>146</sup> which states the following:

‘By and large most subjects are available relatively widely in universities across Scotland. However some subjects (languages, for example) require careful monitoring to ensure that this continues to be the case. There are other subjects, such as nursing, where there is duplication of effort. In the case of languages, a distinction needs to be made between learning to speak a second language and cultural and area studies. Maintaining opportunities to learn to speak a second language is important culturally, economically and to ensure a supply of teachers for our schools. We will therefore ask the SFC and the universities to give particular attention to capacity for language learning and to this overall issue’.

- c.10.17 Scottish institutions have previously been involved in two of the SIVS area studies and associated languages programmes which include support from the SFC and the UK’s network of excellence in Islamic Studies. Scotland continues to be involved with STEMNET at the schools level.<sup>157</sup>

- c.2 The SFC is able to intervene in controlled subjects to ensure that Scotland has the right number of entrants to meet its needs in these areas (*ie* medicine and dentistry, nursing and midwifery pre-registration education, initial teacher education and veterinary medicine).

- c.10.1 As required under the Gaelic Language (Scotland) Act 2005, the SFC has created a Gaelic language plan.<sup>158</sup> This *inter alia* commits the SFC to monitoring supply of and demand for courses, in liaison with colleges and universities, and to helping colleges and universities to promote and market existing provision. The SFC’s aspiration is to increase the availability and uptake of Gaelic learning opportunities in the college sector over the period 2009-14.

- c.10.2 There has been a petition to the Scottish Parliament to urge the Scottish government to instruct the Scottish Funding Council to provide targeted funding for lesser taught languages and cultures at Scottish universities. Interestingly, this refers to HEFCE SIVS.<sup>159</sup>

#### *Success or otherwise of interventions*

- c.10.3 Given the early stage of the college and HE reforms, there is as yet no evidence available as to its success or otherwise.

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<sup>155</sup> *Universities facing fines for breaching student ‘cap’*, Denholm, A, The Herald, 22 February 2010, <http://www.heraldsotland.com/news/education/universities-facing-fines-for-breaching-student-cap-1.1008316> [accessed 25 May 2012].

<sup>156</sup> See <http://www.sfc.ac.uk/skills/LearningtoWork/LearningtoWork.aspx> [accessed 25 May 2012].

<sup>157</sup> See <http://www.stemscotland.com/index.html> [accessed 25 May 2012].

<sup>158</sup> *SFC Gaelic language plan*, December 2009, [http://www.sfc.ac.uk/web/FILES/ReportsandPublications/Gaelic\\_Language\\_Plan\\_15\\_Dec\\_2009\\_English\\_Version.pdf](http://www.sfc.ac.uk/web/FILES/ReportsandPublications/Gaelic_Language_Plan_15_Dec_2009_English_Version.pdf) [accessed 25 May 2012].

<sup>159</sup> *Petition PE1395, Targeted funding for lesser taught languages*, Jan Culik, <http://www.scottish.parliament.uk/ResearchBriefingsAndFactsheets/Petitions%20briefings%20S4/PB11-1395.pdf> [accessed 25 May 2012].

c.10.4 The SFC's employability strategy has been evaluated<sup>160, 161</sup>. This concluded that 'The strategic funding initiative to develop graduate employability has been a highly effective way of encouraging change at a sector level. It is a testament to the transformative power of relatively small sums of funding when coupled with approaches which are sensitive to an individual institution's mission, culture and values'.

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<sup>160</sup> Monitoring and evaluation of learning to work, <http://www.sfc.ac.uk/skills/LearningtoWork/Monitoring.aspx>. [accessed 25 May 2012].

<sup>161</sup> *Strategic funding to develop graduate employability, report to the SFC*, September 2011, [http://www.sfc.ac.uk/web/FILES/Our\\_Priorities\\_Skills/SQW\\_fourth\\_and\\_final\\_report\\_Sep\\_2011.pdf](http://www.sfc.ac.uk/web/FILES/Our_Priorities_Skills/SQW_fourth_and_final_report_Sep_2011.pdf) [accessed 25 May 2012].

## C.11 US

### *HE system*<sup>162</sup>

- c.11.1 The US is a key competitor for the UK in both science and innovation and the recruitment of skilled students and workers. Like the UK it produces a significant number of STEM graduates each year (both US nationals and international students), and requires high-level STEM skills for a number of occupations.
- c.11.2 In 2010, the US had 20.7 million students in HE with 14.6 million being full-time students.<sup>163</sup> There are some 4,635 institutions which are entitled to award degrees and which can receive federal student financial aid.<sup>164</sup> Of these around 1,920 are two-year colleges<sup>165</sup> awarding associate degrees and 2,915 are four-year institutions awarding bachelor and master degrees and doctorates. Many students start at a two-year college before transferring to a four-year institution to complete bachelor degrees. Some 722 four-year institutions are for undergraduates only and do not offer higher degrees. Research is largely conducted at universities and these offer both undergraduate and higher-level degrees.<sup>166</sup> Institutions are classed as private or public with the private category subdivided into for-profit or not-for-profit.
- c.11.3 The US system is strongly market-oriented. However, public HEIs are coordinated and influenced at the state level to help ensure that they meet state educational, financial and social objectives. At the federal level, the Department of Education's mission is to 'promote student achievement and preparation for global competitiveness by fostering educational excellence and ensuring equal access'. It achieves this through an overall leadership and best practice role for education and by investing in targeted areas to encourage achievement of its goals access and excellence as set out in its strategic plan.<sup>167</sup> Specific objectives are to increase college access, quality and completion by improving HE and lifelong learning opportunities for youth and adults and widening participation.
- c.11.4 US universities are accredited by a number of private educational associations that are recognised by the Council for Higher Education Accreditation.

### *HE funding*

- c.11.5 Most public and private institutions have endowments. The top 839 institutions in the US and Canada had \$417 billion in endowments in 2011 with an average of \$497 million and median of \$93m.<sup>168</sup> The largest endowment is that of Harvard University with an endowment of \$31.7 billion.

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<sup>162</sup> See [http://en.wikipedia.org/wiki/Higher\\_education\\_in\\_the\\_United\\_States](http://en.wikipedia.org/wiki/Higher_education_in_the_United_States) [accessed 12 March 2012].

<sup>163</sup> See Table 5 at <http://www.census.gov/hhes/school/data/cps/2010/tables.html> [accessed 12 March 2012] which quotes a total of 20.3 million enrolled students of whom 14.6 million are full-time at October 2010. This is slightly different from the Carnegie classification basic figure (20.7m).

<sup>164</sup> Student financial aid is available on a needs basis at these institutions to contribute to payment of tuition fees and living expenses under Title IV of the Higher Education Act 1965.

<sup>165</sup> These are often but not always community colleges.

<sup>166</sup> Caution is needed with the interpretation of 'university'; some research-oriented institutions are referred to as colleges for historical reasons (eg Dartmouth College) and some universities do little research (eg Wesleyan University).

<sup>167</sup> US Department of Education strategic plan 2011-14, <http://www2.ed.gov/about/reports/strat/index.html> [accessed 12 March 2012].

<sup>168</sup> *US and Canadian Institutions Listed by Fiscal Year 2011 Endowment Market Value and Percentage Change in Endowment Market Value from FY 2010 to FY 2011*, NACUBO-commonfund study for 2011, [http://www.nacubo.org/Documents/research/2011\\_NCSE\\_Public\\_Tables\\_Endowment\\_Market\\_Values\\_Final\\_January\\_17\\_2012.pdf](http://www.nacubo.org/Documents/research/2011_NCSE_Public_Tables_Endowment_Market_Values_Final_January_17_2012.pdf) [accessed 12 March 2012].

- c.11.6 Public institutions are funded at the state level with the exception of institutions within the US military (*eg* West Point and the Naval Postgraduate School), which are funded federally. Public institutions often charge higher fees for candidates from outside their own state on the grounds that the students and their families have contributed to the state's finances through taxes, *etc.*
- c.11.7 With few exceptions the institutions charge tuition fees. Students typically get funding for tuition fees and living expenses through student loans (federal, state and private), scholarships (both needs-based and merit-based) from their institution or the federal government (*eg* the federal Pell grant of up to \$5,550 for academic year 2011-12). This grant provides need-based grants to low-income undergraduate students to promote access to post-secondary education. In academic year 2009-10 the average undergraduate tuition fees and room and board rate charged for full-time students was \$17,464.

### **National priorities**

#### **STEM**

- c.11.8 There is concern in the US that its ability to compete in the world is falling behind that of other countries. This is reflected in the relatively low ranking in the OECD in terms of its proportion of science and engineering graduates. This issue was set out in two influential reports – ‘Rising above the gathering storm’<sup>169</sup> and ‘Rising above the gathering storm, revisited’<sup>170</sup>. The response has been to make significant investments to improve the overall US school and HE systems with particular emphasis on improving take-up and completion of generic STEM subjects, getting STEM-qualified individuals into STEM jobs and widening participation. This is coupled with investment in improving teacher quality, STEM research, innovation and manufacturing. This has been implemented through funding established by a patchwork of Acts and other initiatives.<sup>170, 171, 172, 173, 174</sup> In addition, there are specific visa measures to attract and retain non-US individuals who have achieved a doctorate in a STEM subject.<sup>178</sup>

#### **Language studies**

- c.11.9 Federal support for foreign language and international studies in HE is through Title VI of the Higher Education Act. The intention is to ensure that the US has the international expertise and language skills to meet national strategic needs.<sup>175</sup> The funding includes support for establishing and running overseas research centres, centres for international business education, fellowships and international study centres to support language studies and area studies. Areas of national need for expertise in foreign languages and world regions that are of specific interest to the US are selected by the Secretary of Education in consultation with the heads of relevant federal agencies.<sup>176</sup>

<sup>169</sup> <http://www.nap.edu/openbook.php?isbn=0309100399> [accessed 19 December 2011].

<sup>170</sup> *The Higher Education Opportunity Act*, <http://www2.ed.gov/policy/highered/leg/hea08/index.html#reports> [accessed 16 March 2012].

<sup>171</sup> *The America Competes Act*, <http://www.nsf.gov/statistics/about/BILLS-111hr5116enr.pdf> [accessed 14 March 2012].

<sup>172</sup> *Race to the top K-12*, <http://www2.ed.gov/programs/racetothetop/index.html> [accessed 19 December 2011].

<sup>173</sup> Development and funding of the Department of Education's strategic plans – see <http://www2.ed.gov/policy/gen/leg/recovery/implementation.html> [accessed 16 March 2012].

<sup>174</sup> Initiatives have been created under various agencies' broad statutory powers. For example: the National Aeronautics and Space Administration (NASA), the DoD, US Department of Agriculture (USDA), Department of Homeland Security, Department of Health.

<sup>175</sup> See <http://www2.ed.gov/about/offices/list/ope/iegps/index.html> [accessed 16 March 2012].

<sup>176</sup> Results of recent consultations can be found at: <http://www2.ed.gov/about/offices/list/ope/iegps/languageneeds.htm> [accessed 16 March 2012].

### *Loan forgiveness*

- c.11.10 Loan forgiveness programmes are used to encourage individuals who have received student loans to take up certain professions. For example, under the Stafford loan forgiveness programme, individuals who teach full time for five consecutive, complete academic years in certain elementary and secondary schools that serve low-income families and meet other qualifications may be eligible for forgiveness of up \$17,500 in principal and interest.<sup>177</sup>

### *Other priority areas*

- c.11.11 We have not found any evidence of other coherent support for specific priority subjects either at the federal or state level. We think this is because there is a strong underlying assumption that the 'market will provide' and this is considered to generally apply to the supply of high quality graduates at the right time. We also suspect the attractiveness of the US as somewhere to study and/or work has helped supply meet demand. However, the US now recognises that the increasing attractiveness of other countries and research opportunities is beginning to challenge its dominant position.<sup>178</sup>

### *Success or otherwise of interventions*

- c.11.12 The 'Rising above the gathering storm, revisited' report<sup>178</sup> assessed that '*in balance it would appear that overall the United States long-term competitiveness outlook (read jobs) has further deteriorated since the publication of the Gathering Storm report five years ago*'. This suggests that the significant investments in STEM have not had the desired effect. One report found<sup>179</sup> that as regards improving the quality of STEM undergraduate teaching and student learning notes that '*...[STEM] reforms at the classroom level have not led to the hoped for magnitude of change in student learning, retention in the major and the like...*'.
- c.11.13 A recent Government Accountability Office report<sup>180</sup> noted that in 2010, 13 federal agencies invested over \$3 billion in 209 programmes to increase knowledge of STEM fields and attainment of STEM degrees. The report found that there was room for improved coordination, driven by an underlying robust 5-year strategic plan, and potential for consolidation of the programmes together with reduction of administrative costs. It also found that there needed to be much better understanding of the effectiveness of these programmes, through use of reliable output measures and better uptake of evaluations and dissemination of the findings. This report also provides a useful list of the programmes and of those projects that have been evaluated. The latest Department of Education strategy broadly recognises these issues and is trying to improve the situation.

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<sup>177</sup> See <http://studentaid.ed.gov/PORTALSWebApp/students/english/cancelstaff.jsp> [accessed 16 March 2012].

<sup>178</sup> *Rising above the gathering storm, revisited: rapidly approaching category 5*, [http://www.nap.edu/catalog.php?record\\_id=12999](http://www.nap.edu/catalog.php?record_id=12999), [accessed 19 December 2011].

<sup>179</sup> *Linking evidence and promising practices in STEM undergraduate education – a status report for the National Academies National Research Council Board of Science Education*, James Fairweather, [http://www7.nationalacademies.org/bose/Fairweather\\_CommissionedPaper.pdf](http://www7.nationalacademies.org/bose/Fairweather_CommissionedPaper.pdf) [accessed 21 March 2012].

<sup>180</sup> *STEM education: strategic planning needed to better manage overlapping programmes across multiple agencies*, <http://gao.gov/products/GAO-12-108> [accessed 25 January 2012].