WORKSTREAM 2 - EFFICIENCY AND EFFECTIVENESS OF HIGHER EDUCATION INSTITUTIONS[1]

Executive Summary

The Tripartite Advisory Group (TAG) comprising the Scottish Further and Higher Education Council (SFC), Scottish Government and Universities Scotland set out the need to consider "agreed output measures of effectiveness and efficiency on which higher education institutions (HEIs) could be assessed on the use of funding they receive". The scope of the report is the Scottish HEI sector as a whole rather than the individual institutions which make up that sector.

The invitation to tender required the appraisal of "How efficiently the resource inputs to the university sector are converted to outputs, including benchmarking input and output measures against national and international indicators". As such, this report considers different *indicators* relating to the *technical efficiency* of the HE system in Scotland. This term refers to the most common understanding of efficiency: producing output(s) using the fewest possible units of input(s). This essentially considers the ability of universities to produce defined outputs rather than (the more complex) consideration of the utilisation of resources reflecting the price individuals (and societies) are willing to pay for university provision.

In considering the efficiency of the HEI sector a broad definition was used when examining resource inputs, this included all of the resource inputs that HEIs use (e.g. staff, students, buildings) funded via public and 'leveraged in' private funding. The report acknowledges the importance of 'leveraged in' funding in that it generates *additional* economic contribution from public spending (a theme explored in more detail in the Strathclyde report for workstream 3).

The key findings from this report are summarised below.

Findings from international reports on efficiency and effectiveness

Analysis for the European Commission, Directorate General Economic and Financial Affairs used a number of quantitative techniques to rank countries in terms of their efficiency performance.

It was found that the UK system was relatively more efficient than other countries on teaching and research measures. However, it should be noted that this analysis concentrated only on publically funded institutions, examined only technical efficiency and came with a number of assumptions and limitations. Scottish institutions were included in the UK data and given the similarities with the English, Northern Irish and Welsh institutional structure, the analysis can be assumed to at least partially represent the Scottish sector.

[1] This report was commissioned by the Scottish Further and Higher Education Funding Council (SFC), Scottish Government and Universities Scotland on behalf of the Tripartite Advisory Group (TAG) on higher education in Scotland.

Findings from input, output and quality indicators comparing Scotland internationally and within the UK

The report compiled a number of input, output and quality indicators relating Scotland's HEIs to various comparator nations. Indicators were included to cover the teaching, research and knowledge exchange activities of HEIs.

Findings on teaching activity:

- For teaching inputs, if a large number of students per staff member is seen as desirable for efficiency, then Scotland performs well; Scotland ranks in the second quartile against international comparators.

- Teaching outputs are expressed both in relation to the spend but also to the resource (staff and student) inputs. Scotland is in the top performing quartile in terms of *recent graduates* per member of staff and in the second quartile in terms of *recent graduates* per student. Scotland is at the lower end of the second quartile in terms of graduates per US dollar spent.

- Although international quality comparisons have not been made, UK indicators suggest the graduates produced compare well.

Findings on research activity:

- In terms of the internationally comparable inputs, Scotland spent the highest proportion of GDP on Higher Education Research and Development (HERD). This suggested a large input contribution. Of the staff employed in research activities approximately a third have salaries funded from external sources. This demonstrates the 'levered in' research funding attracted by HEIs.

- In terms of the output measures, efficiency indicators for research are drawn from a report that makes international comparisons of Scotland's research base. Scotland sits in the first quartile for papers per researcher, citations per researcher and citations relative to HERD.

- In quality terms Scotland is in the first quartile and outperforms the UK as a whole on citation impact measures but is slightly below the UK on excellence ratings as part of the Research Assessment Exercise[2].

Findings on capital and knowledge exchange:

- Compared to other regions in the UK, Scotland has a relatively well managed estate, though some improvements could be made on environmental performance.

[2] When comparing results from the Research Assessment Exercise, it is important to bear in mind that institutions decided which staff to include in their submissions. These decisions will have been affected by the different policies of the funding councils.

- Data available for knowledge exchange output indicators are limited to the more traditional commercialisation performance on licences, patents, spinouts and disclosures. Where comparisons were made against the US institutions it was found that the top eight Scottish institutions were able to generate a greater level of commercialisation activity per US dollar spent.

Summary of Conclusions

A picture emerges where Scotland is above average in terms of teaching activity and with high levels of spend on research relative to GDP, performs in the top quartile on measures of research efficiency. This appears to be consistent with quantitative findings from a report to the EC that ranks the UK as the most efficient higher education system in technical terms. Although no one indicator can provide a definitive measure of the efficiency of the Scottish system, Scotland performs well in terms of the indicators and studies examined. These findings cannot indicate whether or not the system in Scotland is perfectly efficient or whether 'within system' changes to improve efficiency may be possible.

Introduction

The Tripartite Advisory Group (TAG) comprising the Scottish Further and Higher Education Council (SFC), Scottish Government and Universities Scotland set out the need to consider "agreed output measures of effectiveness and efficiency on which higher education institutions (HEIs) could be assessed on the use of funding they receive". This requires the appraisal of "How efficiently the resource inputs to the university sector are converted to outputs, including benchmarking input and output measures against national and international indicators".

An invitation to tender for this project was published in late 2009 alongside TAG workstream 1 on the definitions of funding for higher education. Although two bids were submitted for the work, it was not possible to find a bid that met both the selection criteria and the budget for the project. Further attempts were made to consolidate one of the bids to bring it within the budget but in the end no satisfactory conclusion was reached. As such, the TAG technical sub-committee agreed to undertake the work, utilising published material and internal resources.

The work undertaken draws on the approach taken in international reports on the effectiveness and efficiency of Higher Education systems to provide a basic set of indicators and commentary on Scotland's relative position, internationally and within the UK. The scope of the report is the Scottish HEI sector as a whole rather than the individual institutions which make up that sector. A range of published information is used to consider inputs, outputs and quality indicators.

This report is organised in 4 sections. Section 1 covers definitions of efficiency and effectiveness. Section 2 examines the approach taken in international studies on the efficiency and effectiveness of higher education systems. Section 3 presents a range of possible input, output and quality indicators to cover the teaching, research and knowledge exchange activities of HEIs. Section 4 offers a qualitatively analysis which draws together findings and considers the extent to which conclusions can be drawn with regard to the use of Scottish Government funding.

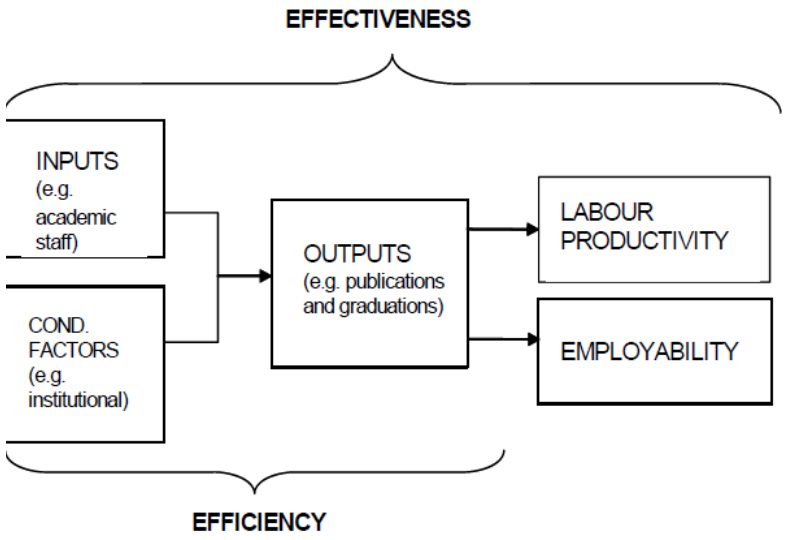
Section 1 - Definitions of efficiency and effectiveness

Several international reports acknowledge that efficiency and effectiveness are difficult to measure[3]. As such, many of the relevant studies, instead of focusing on *absolute* efficiency and effectiveness, examine *relative* efficiency across countries. There seems to be three broad responses to the difficulties in measuring efficiency. The first is to consider only the theory of efficient HE systems in terms of aiming to maximise the return to individuals and societies. The second approach draws on the theory while utilising some broad indicators that might be used to measure efficiency. The third approach is to make use of the limited data there is to quantitatively compare efficiency across countries. This paper will examine and attempt to replicate some of the efficiency indicators used in various international reports but for the Scottish sector.

1.1. Framework for considering efficiency and effectiveness

It is also worth distinguishing between the efficiency and effectiveness of the HE system. Of course, different definitions will yield different distinctions but taking one example from a recent report to the European Commission, the system is illustrated in Figure 1 below.

Figure 1: Illustration of European Commission definition of efficiency and effectiveness



Source: DG Economic and Financial Affairs, European Commission

Within this broad framework this report will consider different *indicators* relating to the *technical efficiency* of the HE system in Scotland. This term refers to the most common understanding of efficiency: producing output(s) using the fewest possible units of input(s).

[3] E.g. *"The effectiveness and efficiency of public spending" by U Mandl, A Dierx and F Ilkovitz, European Economy, Economic Papers 301, February 2008*

Technical efficiency essentially considers the ability of universities to produce defined outputs rather than (the more complex) consideration of the utilisation of resources reflecting the price individuals (and societies) are willing to pay for university provision.

By this distinction, graduate employment rates, and economic benefits in employment accruing to the graduates are considered in the broader category of effectiveness of the system. As the Strathclyde University report (TAG workstream 3) examines the economic impact of HEIs the wider benefits are not considered here.

It is important to bear in mind that in the case of HEIs both the inputs and outputs are heterogeneous making it difficult to compare utilisation of resources to produce the same things. The normal approach to overcome this problem is to use composite measures for both input and outputs. However, this would require detailed consideration of the appropriate sources of information and the relative weights for different components of the measure. The approach taken in this paper is to set out potential data sources and *initial indicators,* with the conclusions suggesting areas where the work might be developed.

1.2 Defining resource inputs within framework

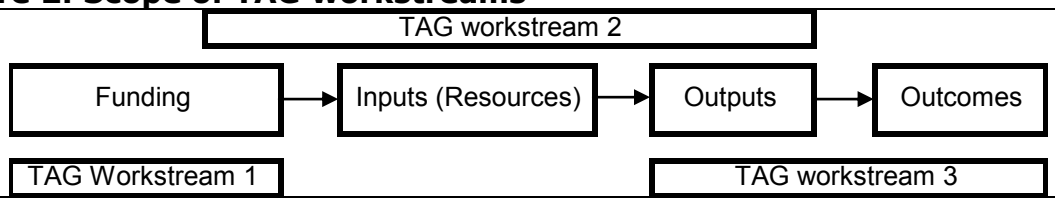
The definition of resource inputs needs some consideration. From a public sector spending point of view, the resource inputs could be considered as the various levels of public spending and investment in the HEI system and infrastructure. The HEI sector does leverage this spending to draw in further income from other public bodies and the private sector. This raises the question of whether this external funding is considered an output relating to the public spend on universities or whether it should be viewed as a resource input into the process of generating outputs (e.g. students and research).

Basic economic models of production consider how resource (or factor) inputs, including natural resources, labour and capital are converted into outputs. This would not distinguish between the source of the funding for labour or capital but instead would consider how Scottish institutions utilised all of their resource (or factor) inputs in producing outputs.

The approach taken here is to consider all funding received by Scottish HEIs alongside resource inputs but to acknowledge the distinction between Scottish Government and other public and private sources; definitions of funding are covered in detail in the Scott Moncrieff workstream 1 report.

Figure 2 shows the scope of workstream 2 in the context of the overall project. This diagram is an approximation of the scope of the various workstreams as, in places, each of the reports strays into discussion of the wider context of the HE sector. For example, there is some discussion of HEI income sources and linking of inputs to outcomes in the Strathclyde report.

Figure 2: Scope of TAG workstreams



Source: TAG

Section 2 - International Reports on Efficiency and Effectiveness

To compare internationally, the work will draw on the efficiency literature that compares the UK to other nations. It will also, where possible, draw from reports on the UK position to consider how Scotland would fare in international comparisons of *technical efficiency*. It should be possible to draw conclusions for Scotland based on this type of evidence on two grounds (i) as part of the UK and (ii) and from similarities to the systems in England, Wales and Northern Ireland.

There is a dedicated economic literature on techniques to measure relative efficiency across institutions. This work is of a technical nature and focuses on methods such as Data Envelopment and Stochastic Frontier Analysis[4]. This type of analysis is most suitable where there are relatively homogenous institutions for comparison. For example, in England this type of work tends to band universities together by type (e.g. Russell Group with medical school). As the scope of this paper is comparisons between the Scottish sector and relevant comparators this seam of the literature has been overlooked in favour of studies published by international institutions that attempt to compare efficiency across borders.

A paper for OECD Education Ministers provides background statistics on *"Higher education: Quality, Equity and Efficiency"*. This paper groups indicators on:

- Access, Participation, Progression (e.g. educational attainment, students with disabilities)
- Expenditure on Higher Education (e.g. expenditure per student, expenditure as a proportion of GDP)
- The Returns on Higher Education (e.g. earnings premiums)
- Internationalisation of Higher Education (e.g. foreign students in HE)

Another example where international comparisons of input and output data are used to developing efficiency analysis is a paper produced for the European Commission, Directorate General Economic and Financial Affairs[5]. This presents data on the a range of indicators and a few relevant ones are shown below (for a full list see appendix 1):

- Expenditure on PGD Institutions of Higher Education as Percentage of GDP 2005
- Academic Staff per 1000 Inhabitants 2005
- Share of Students in PGD Institutions
- Students per Academic Staff 2005
- Graduates per 1000 Inhabitants 2005
- Graduates per Academic Staff 2005
- Graduates per Student 2005
- Publications 1000 Inhabitants 2005
- Articles per 1000 Inhabitants
- Articles per Academic Staff

[4] See the EC study cited below for detailed descriptions of these techniques.

[5] *"Study on the efficiency and effectiveness of public spending on tertiary education", by M St.Aubyn, A Pina, F Garcia and J Pais, European Economy Economic Papers 390, November 2009*

- Academic Staff per 1000 Inhabitants
- Average ISI Citation Index

On their own, each of these variables cannot provide an insight into the efficiency of a particular HE system. Although useful in terms of providing the context in which HE systems operate, where the inputs or outputs are standardised across the population we cannot conclude anything about efficiency. For example, if there are a large number of graduates per 1000 population, this gives an idea of one of the outputs of HEIs but it is not possible to know whether this is because a lot of inputs are devoted to HEIs or if those inputs are used very efficiently.

Furthermore by considering inputs and/or outputs standardised across the population a number of 'structural' issues are raised. For example the age profile, institutional structure and economic development of the country in question. As data on population is readily available and is shown in international comparisons of the research base, some of the indicators above are reproduced for Scotland in Annex 2 below. This is shown purely to provide some context in terms of resources devoted to Higher Education and will not elucidate thinking on efficiency.

A selection of relevant indicators from the list above are used as guidelines for generating some simple efficiency indicators for Scotland; further examples are also explored to consider how Scotland might compare on input, output and quality (see Section 3 below).

In the same report to the EC, international comparisons of efficiency are made using a number of techniques to rank the countries in terms of their efficiency performance. Results from data envelopment analysis (DEA) and stochastic frontier analysis (SFA) are shown below. Both of these methods make relative assessments of efficiency ranking countries in terms of their conversion of inputs to outputs. These techniques generate a "frontier" of what it is possible to produce and then place nations efficiency performance in relation to this. The most "efficient producers" are assumed to operate on the frontier. DEA and SFC differ in that they make different assumptions about the functional form of the frontier.

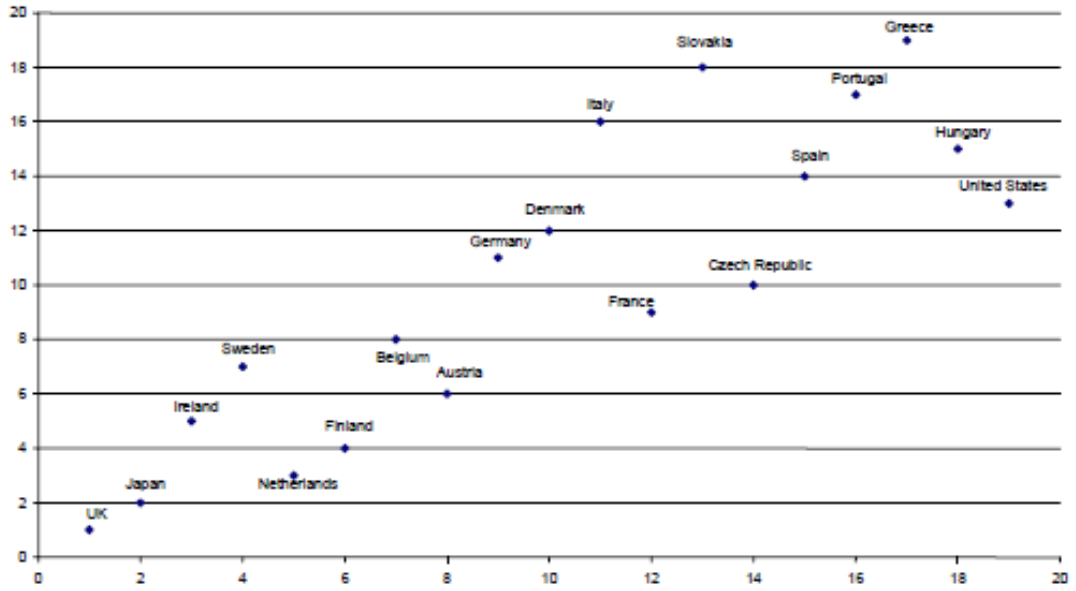
The DEA analysis considered relationships between inputs and outputs, either measured in monetary or physical terms. For example, inputs included students, FTE academic staff and various public expenditure measures. The outputs considered were graduates, employability of graduates, peer ranking of university quality, published articles and citations while also taking account of different organisational contextual and funding factors in different countries.

The SFA examined the cost of tertiary education institutions as explained by the various outputs produced.

As with many techniques, issues arise in terms of how accurate the measurements are, data constraints and the choice of weights when constructing efficiency frontiers. It is not within the scope of this report to detail the academic literature critiquing these techniques.

Figure 3 shows the results on how the countries ranked against each other using DEA and SFA to assess the efficiency of public spending on HEIs across 28 countries. The Horizontal axis shows the countries efficiency rankings using DEA and the vertical axis shows how the countries rank using SFA.

Figure 3: DEA and SFA efficiency rankings



Source: Report to EC, DG Economic and Financial Affairs

The UK ranks as the most efficient on both of these measures, that is to say the UK system is *relatively* more efficient than other countries on both teaching and research measures. Along with the UK, Sweden, Ireland, Japan and the Netherlands are identified as having the most efficient institutions while Bulgaria, Spain, Hungary, Portugal, Lithuania are among the worst performing. Some big EU countries perform poorly including Germany and Italy (due to low number of graduations which could arguably be due to institutional factors).

It should be noted that the techniques are used to measure *technical efficiency*. This type of analysis must be understood in context and comes with a set of assumptions and limitations (especially regarding data availability) For example, the US came out as relatively inefficient but this is partly explained by the techniques used. This is because the analysis only considered public institutions for the US and would thus miss many of the efficiencies apparent due to the high level of market-led competition between private institutions in the US.

Scottish institutions are included in the UK data and given the similarities with the English and Welsh institutional structure, the analysis can be assumed to at least partially represent the Scottish sector. Further examination of the indicators presented (in Section 3) below, allow for a more detailed exploration of potential divergence from the UK and, where possible, to compare against international comparators.

Despite the many caveats that come with the type of analysis presented above, several papers do draw interesting conclusions. Another report from the EC[6] suggests that technical efficiency can be improved by focussing on output orientated policy: "Within the different stages of the education and training system, the evidence suggests that the technical efficiency in educating both the disadvantaged and the student population at large can best be promoted by leaving behind a simple input orientation in favour of an output orientation. Such an output orientation can be achieved through institutional reforms that focus incentives on the performance of students."

[6] *"Efficiency and equity in European education and training systems" by L Wolfmann and G Schutz, Analytical Report for the European Commission, April 2006*

Section 3 - Scottish Indicators

This section considers input, output and quality indicators relating Scotland's HEIs to international comparators and, where data is not available, to nations within the UK or the UK as a whole. Indicators are included to cover the teaching, research and knowledge exchange activities of HEIs. The commentary in this section is purely descriptive with qualitative conclusions drawn in Section 4 below.

As with any indicator of activity, there are limitations to what the indicator reveals about the actual activity being undertaken. The indicators presented are only intended to give a broad outline of Scotland's comparative performance and reading too much into any one indicator without considering the demographic, economic, policy and institutional context will lead to misleading conclusions. It is not within the scope of this report to prepare detailed case studies of the difference in institutional structure, data collection procedures or policy prescriptions across borders and as such the international comparisons need to be viewed with caution.

Furthermore, a number of adjustments are necessary to facilitate international comparisons. For instance, due to data limitations it is necessary to compare HEIs in Scotland to tertiary provision in other nations for most of the teaching indicators.

3.1 Input Measures

Input measures could be taken to mean two things. In a narrow sense inputs are the public sector funding HEIs receive from the Scottish Government or public sector in Scotland. A broader definition considers all of the resource inputs that HEIs use (e.g. staff, students, buildings) funded via public and "leveraged in" private funding. The input indicators presented below provide a comparison of the funding and headline resource inputs for HEIs in Scotland the UK and, where possible, show international comparators as well. The information presented is, in most cases, for academic year 2008-09; this is for consistency of reporting with student statistics and information on international comparators.

3.1.1. Teaching

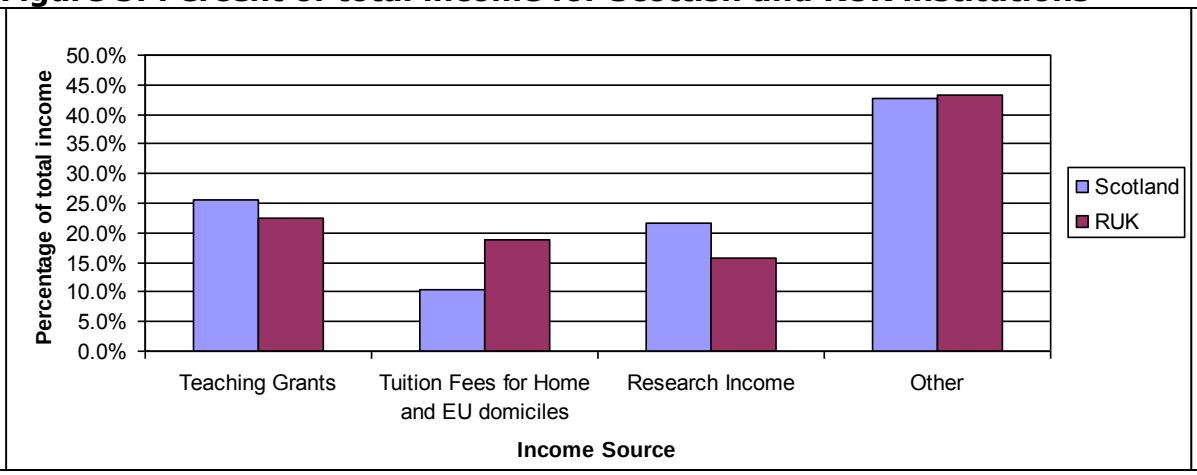
This section examines teaching funding in the UK context and students per staff member.

Figure 4 shows the overall income of Scottish HEIs and those in the rest of the UK, separately identifying teaching grants, tuition fees and research income.

Figure 4: Income of HEIs in Scotland and the rest of the UK(RUK), 2008-09 (£'000)		
	Scotland	**RUK**
Total Income	**2,663,203**	**22,676,462**
Teaching grants	680,464	5,074,098
Tuition fees for home and EU domiciles	274,801	4,243,536
research income	574,103	3,570,479
Other income	1,133,835	9,788,349
Source: Higher Education Statistics Agency (HESA)		

Figure 5 displays this income as a percentage of the total income of Scottish institutions and those in the rest of the UK. It shows that a higher proportion of income to Scottish HEIs is from teaching and research grants while a lower proportion is generated from tuition fees and other income sources, compared to all institutions in the rest of the UK. The varying proportions largely represent policy divergence since devolution (the Scott Moncrieff report on definitions of funding provides more information).

Figure 5: Percent of total income for Scottish and RUK institutions



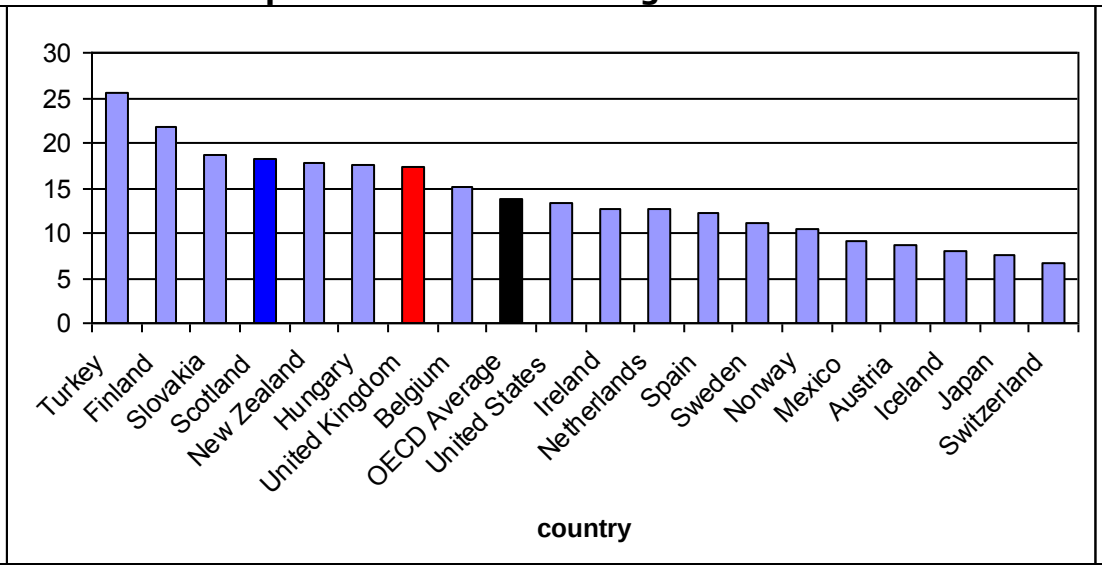
Source: Higher Education Statistics Agency (HESA)

Figure 6 describes the position of Scotland relative to other OECD member countries. Data from the United Nations Educational, Scientific and Cultural Organisation (UNESCO) education statistics have been used for input indicators relating to the numbers of students and teaching staff at Scottish institutions. Where possible data for Scottish institutions has been provided on a comparable basis to the data submitted for UK institutions to the UNESCO data collection[7]. Teaching staff defined by UNESCO exclude those academic staff engaged in only research activities.

[7] To account for unknown discrepancies in the definitions applied to UNESCO data and to data readily available for Scotland (mostly from published HESA statistics), UK inputs were calculated on the same basis as those for Scotland and compared to the UK data reported by UNESCO to provide a weighting factor for each Scottish input measure. This assumes that differences in reporting practices between UNESCO and HESA sources for UK data are identical and proportionate to those that would exist if Scotland was included separately in the UNESCO collections.

It was not possible to find readily available data to compare at university (or HEI) level internationally. As such, the indicator below includes all tertiary level education[8] for international comparators and compares HESA data from the academic year 2007-08 to international data in the UNESCO reference year of 2008.

Figure 6: Students per member of teaching staff



Sources: UNESCO 2008 (for international data) and HESA 2007-08 for Scottish data.
Note: For Scotland all HE students have been included

In 2008 Scottish HEIs had 18.3 students per member of teaching staff, slightly behind the UK as a whole with 17.4. This places Scotland in the highest quartile, 4th out of 19 OECD countries, for which data was publicly available and above the OECD average of 13.4 students per member of teaching staff. The value for this indicator ranges from 25.6 in Turkey and 6.6 in Switzerland. It could be argued that a high number of students per staff member indicates greater efficiency, with a high number of units processed (students) on average per unit of resource (teaching staff). In isolation this indicator doesn't make any inferences on the quality of the outputs (i.e. how skilled are the graduates) or the effectiveness of the processes (i.e. the teaching methods).

3.1.2 Research

This section examines four different research inputs: Higher Education Research and Development (HERD) funding; research income by source; research staff by funding source; and research council expenditure.

Higher Education Research and Development (HERD) is an easily comparable indicator of the research funding attributed to Scottish HEIs.

HERD is one component of Gross Expenditure on R&D (GERD). GERD also comprises business expenditure on R&D (BERD) and government expenditure on R&D (GovERD). According to Scottish Government statistics[9]:

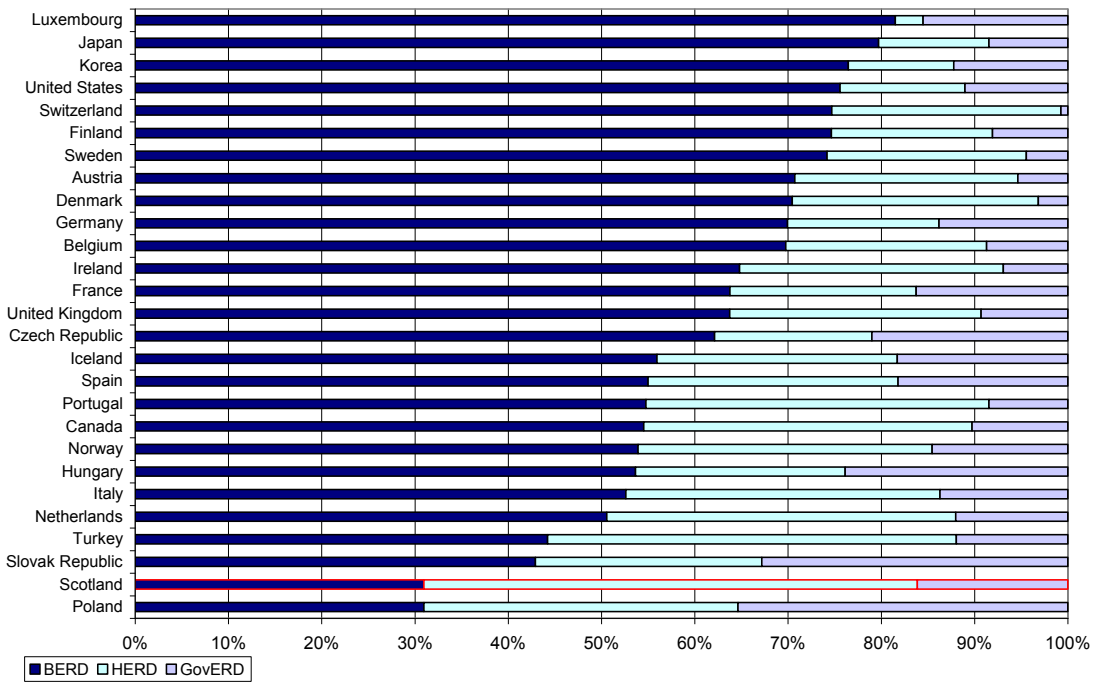
[8] defined as ISCED levels 5A, 5B and 6

[9] Scottish Government, Gross Expenditure on Research and Development Scotland 2008, 13th July 2010

- "In 2008 Scottish GERD reached £1,778 million.
- GERD was 1.55% of GDP in Scotland in 2008, compared to 1.79% in the UK, 1.81% in the EU and 2.33% for the OECD".

In the context of GERD, there is a large difference in Scotland's performance, for the business, higher education and government sectors: "The relatively low contribution of business R&D, alongside a high contribution of higher education R&D, is clear when comparing Scotland to other countries".

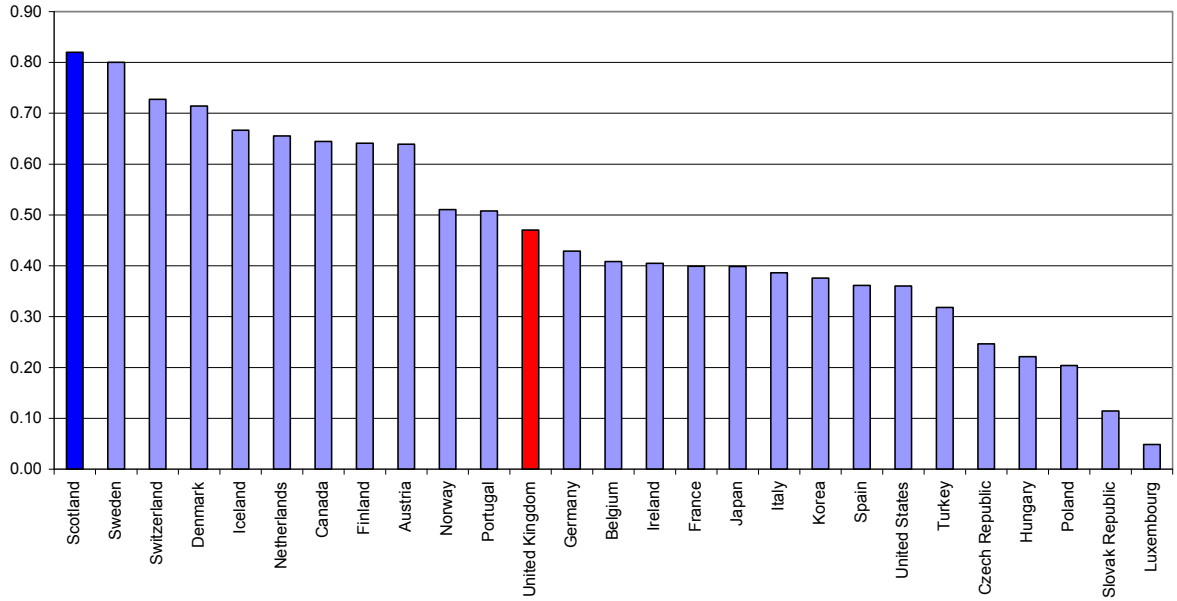
Figure 7:Components of GERD in OECD countries that reported in 2008



Source: Scottish Government and OECD

Scotland's expenditure on HERD represents the greatest proportion of total GERD when compared to the OECD countries.

Figure 8: HERD as a % of GDP in OECD countries that reported in 2008

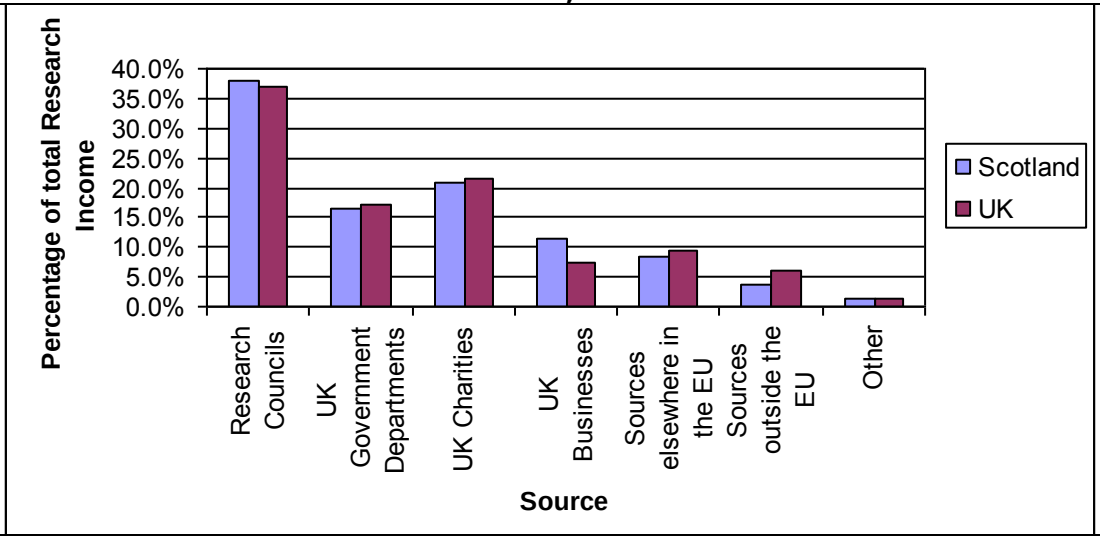


Source: Scottish Government and OECD

Examination of the HERD spending as a proportion of GDP is shown in Figure 8 above. Scotland's expenditure on HERD was the highest compared to the OECD countries reporting in 2008.

Turning to funding sources for which universities compete across the UK and beyond, Scotland's HEIs gain a greater share of total research income from Research councils and UK businesses in comparison to HEIs in the rest of the UK. UK HEIs draw more of their research funding from government departments, charities, international and EU sources. As Figure 9 demonstrates, these differences between Scottish HEIs and those in the rest of the UK are generally small, with the most significant percentage variations occurring in relation to income from UK Business and Sources outside the EU.

Figure 9: Comparison of the percentage of total research income by source for Scottish HEIs and UK HEIs, 2008-09



Source: HESA 2008-09

There are 14,565 'Teaching and research' staff and 'research only staff' in Scotland. Around a third of these staff receive their salary from an external source. This compares favourably with UK HEIs where around 29% of staff are externally funded and demonstrates the "levered in" research funding attracted by HEIs.

Figure 10: Academic Staff at Scottish and UK HEIs by function and source of salary: 2008-09

	Staff Function		% staff receiving salary from external source	
	Research Staff[1]	Non-Research Staff[2]	Research Staff[1]	Non-Research Staff[2]
Scottish HEIs	14,565	2,170	32.7	21.4
UK HEIs	132,045	46,995	28.5	4.1

Source: Higher Education Statistics Agency (HESA).
Notes:
1. Research staff includes academic staff with research functions even if they are also engaged in other activities (e.g. teaching).
2. Non-Research staff includes academic staff fulfilling no research function (e.g. teaching only staff).

It is possible to look in more detail at the UK Research Councils' funding to Scottish HE institutions[10]. Two points are evident from the data: the bulk of the research council funding for research in Scottish HE is in the form of research grants; and Engineering & Physical Science, Medical and Biotechnology & Biological Research Councils were responsible for the highest amounts of expenditure in 2008/09.

[10] Note that the HESA and RCUK figures on research council expenditure in Scottish HEIs do not match. They include different items of expenditure and are calculated using different methodologies.

Figure 11: Research Council Expenditure in Scotland 2008/09 (£000)								
Category of Expenditure	**Arts and Humanities**	**Biotechnology and Biological Research**	**Engineering and Physical Science**	**Economic and Social Research**	**Medical**	**Natural Environment**	**Particle Physics and Astronomy**	**Total**
Grants	6,976	53,304	67,420	11,178	26,632	17,274	9,892	**192,676**
Studentships	3,181	6,076	28,754	7,666	9,122	4,891	1,870	**61,560**
Establishment /Institutes	0	0	0	0	28,888	20,785	6,614	**56,287**
Totals	10,157	59,380	96,174	18,844	64,642	42,949	18,376	**310,522**
Source: Research Council UK (RCUK)								

Looking at the share of Research Council UK expenditure spent in Scotland, Scotland gained an 11.2 per cent share in 2008/09. In that year Biotechnology & Biological Research Council spent the greatest proportion of its UK expenditure in Scotland and Particle Physics and Astronomy the least.

Figure 12: Research Council Spending in Scotland as a Percentage of the UK Total				
	2005-06	**2006-07**	**2007-08**	**2008-09**
AHRC	9%	9%	9%	10%
BBSRC	13%	11%	12%	15%
EPSRC	13%	12%	13%	13%
ESRC	9%	8%	10%	11%
MRC	9%	8%	11%	11%
NERC	12%	10%	11%	11%
PPARC	16%	16%	7%	6%
Total	11.6%	10.5%	11.1%	11.2%
Source: Research Council UK (RCUK)				

3.1.3. Knowledge exchange

In 2008-09 the SFC awarded around £280m in research and knowledge transfer grants. This represented around 28 per cent of the total budget for academic year 2008-09. Of this, around £21.5m was awarded specifically as a Knowledge Transfer Grant. In Scotland the Knowledge Transfer Grant made up approximately 2.1 per cent of total budget for academic year 2008-09[11]. In addition, £2m was spent on the 'Strategic Priority Investment in Research and Innovation Translation (SPIRIT)' grant. Including this spending takes the *specific* Knowledge Transfer expenditure to 2.3 per cent of the total budget for academic year 2008-09[12].

[11] Source: SFC, Main grants in support of teaching & research for HE institutions for AY 2008-09, Circular SFC/10/2008.

[12] Source: SFC, Main grants in support of teaching & research for HE institutions for AY 2008-09, Circular SFC/10/2008.

In 2008-09 HEFCE awarded around £1.46bn in research funding. This represented around 24 per cent of the total recurrent grant issued to HEIs in England in 2008-09. In England the Higher Education Innovation Fund (HEIF) supports a broad range of knowledge exchange activities. In 2008-09 around £112m was issued via this funding stream. This represents around 1.9 per cent of the total recurrent grant issued to HEIs in England in 2008-09[13].

It has not been possible to find suitable, publically available information to compare knowledge exchange funding internationally.

3.1.4. Capital

The economic definition of capital relates to investments in capital goods such as machinery, buildings and technology. There are complexities in linking funding provided to universities to expenditure on capital goods. The Scottish Budget Bill sets out ring fenced capital funding each year while the SFC allocate funding specifically for capital investment. However, the teaching grant also includes some provision for capital goods or their maintenance. The SFC include under the 'purpose of funding for teaching provision' the following inclusive costs "facilities, accommodation, equipment and materials"[14].

The OECD provides information on the percentage of total tertiary funding allocated to capital[15]. However, given the complications with measuring this for Scotland a comparison with OECD countries is not presented in this report.

3.2 Output Measures

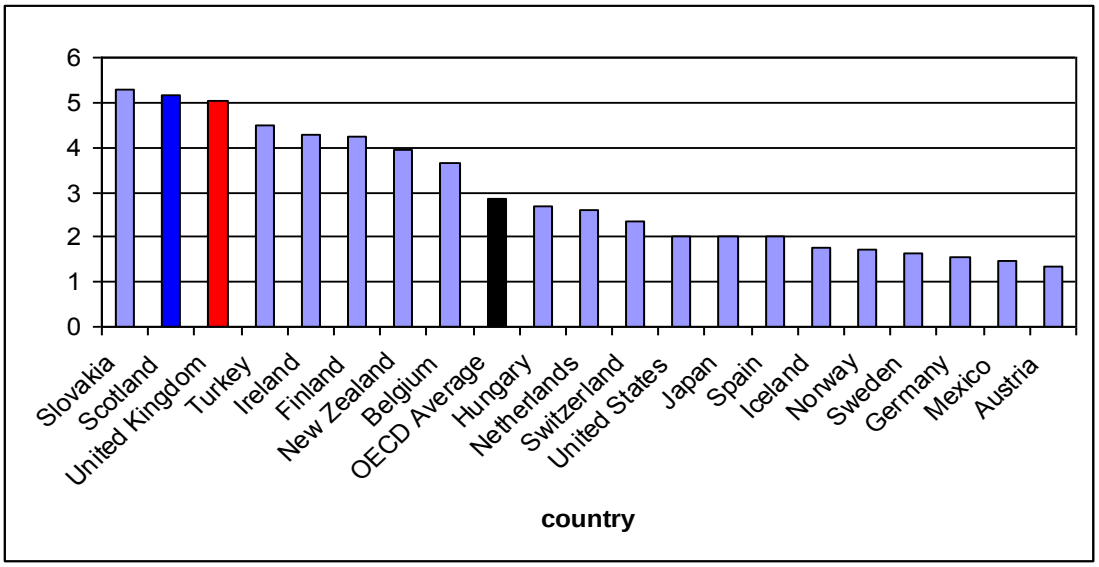
The output measures considered in this section are standardised using the common denominators of outputs per resource input or spend. The presentation of outputs as a proportion of resource inputs offer a very basic description of technical efficiency. For example, output measures include: graduates per US dollar spend and per member of staff; and citations per researcher and per US Dollar Higher Education Research and Development (HERD) spend.

3.2.1 Teaching

The following three charts describe the position of Scotland relative to other OECD member countries (where data are available) for output indicators relating to *recent graduates from* Scottish institutions. Graduate figures for Scotland include all HE qualifiers.

[13] Source: HEFCE, Recurrent grants for 2008-09, Circular 2008/40
[14] Main grants in support of teaching and research for higher education institutions for academic year 2008-09, SFC/10/2008
[15] See Chart B6.3 on p262 of OECD Education At a glance, 2009

Figure 13: Graduates per member of teaching staff

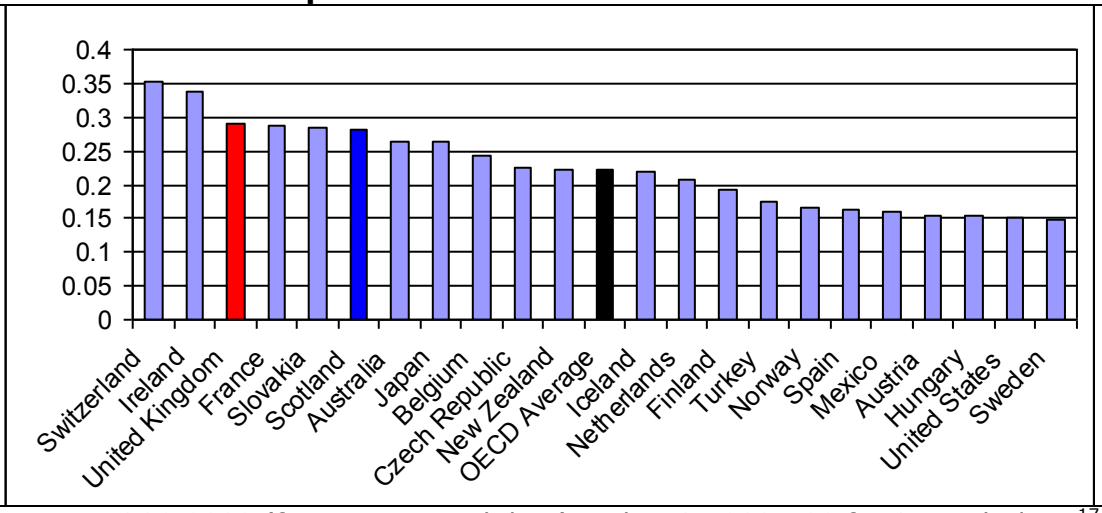


Sources: UNESCO 2008 (for international data) and HESA 2007-08 for Scottish data.[16]
Note: For Scotland all HE graduates have been included

Scottish HEIs have a relatively high value of graduates per member of teaching staff with 5.2, just above the UK value of 5.0 and higher than the average for OECD countries (2.8). There is a high degree of variation among OECD countries, ranging from 5.3 in Slovakia to 1.3 in Austria. There are institutional factors that will influence the ratio in different nations. For example, a longer course length might require more teaching time (and potentially more teaching staff) per graduate. For the countries investigated there does not appear to be any strong relationship between this indicator and typical degree length, a finding which could be explained by variation in the subject mix and teaching intensity across nations. As with the other indicators, this on its own is not enough to draw firm conclusions about efficiency of Scotland but it does add to the general picture where Scotland performs well.

[16] To account for unknown discrepancies in the definitions applied to UNESCO data and to data readily available for Scotland (mostly from published HESA statistics), UK inputs were calculated on the same basis as those for Scotland and compared to the UK data reported by UNESCO to provide a weighting factor for each Scottish input measure. This assumes that differences in reporting practices between UNESCO and HESA sources for UK data are identical and proportionate to those that would exist if Scotland was included separately in the UNESCO collections.

Figure 14: Graduates per student



Source: UNESCO 2008 (for international data) and HESA 2007-08 for Scottish data.[17]
Note: For Scotland all HE graduates have been included

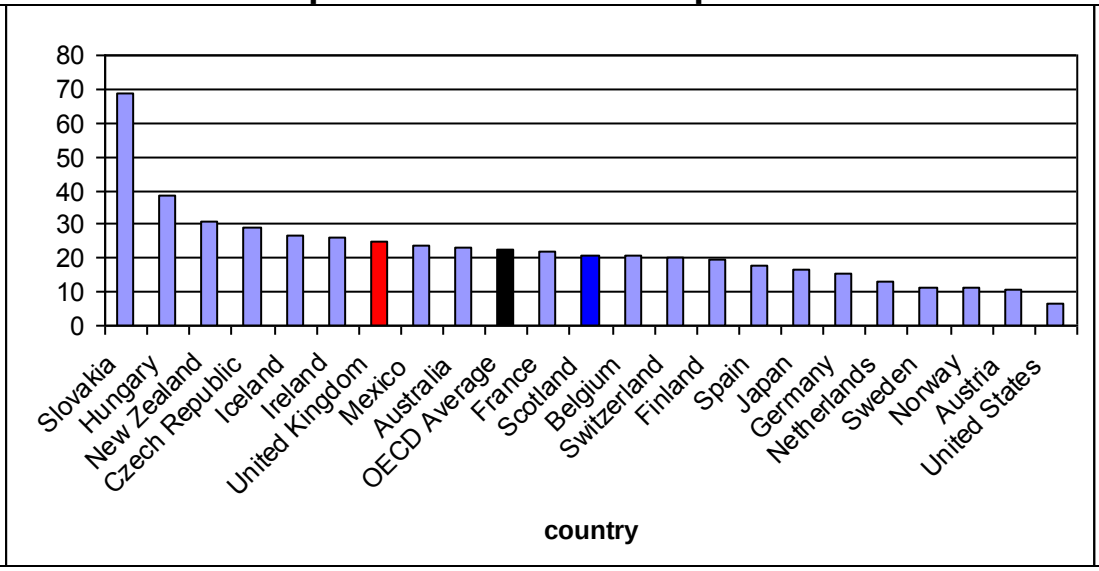
The indicator shown in Figure 13 estimates the proportion of students expected to complete their course of study and hints at the efficiency of educational attainment. However, it is difficult to interpret the results comparatively as the measure will be heavily influenced by differing patterns of tertiary provision in different countries. For example, while a low ratio of graduates to students might be interpreted as representing a lower rate of attainment among students it may be caused by other factors such as the average length of courses (countries with shorter average course lengths will see a faster turnover of graduates and higher ratio of graduates to students than countries with longer average course lengths).

Differences between the structure of HE provision between HEIs in Scotland and those in the rest of the UK will hamper comparisons based on this indicator. In Scotland many of the shorter HE courses are delivered through Scotland's Colleges, whereas relatively little HE provision in the rest of the UK is delivered through colleges. In particular, the average length of an honours degree course is four years in Scotland, compared to three years in England.

The number of graduates per student at Scottish HEIs is below that of the UK and above that of the OECD average (Figure 14). Scottish HEIs had 0.28 graduates per student, compared to 0.29 for the UK and 0.22 on average for the OECD. There was again a high degree of variation in this indicator, ranging from 0.35 in Switzerland to 0.15 in Sweden. This variation may in part reflect structural differences in the nature of higher education provision in different jurisdictions (for example the length of degree programmes will affect the total student population).

[17] To account for unknown discrepancies in the definitions applied to UNESCO data and to data readily available for Scotland (mostly from published HESA statistics), UK inputs were calculated on the same basis as those for Scotland and compared to the UK data reported by UNESCO to provide a weighting factor for each Scottish input measure. This assumes that differences in reporting practices between UNESCO and HESA sources for UK data are identical and proportionate to those that would exist if Scotland was included separately in the UNESCO collections.

Figure 15: Graduates per million US Dollars spent



Source: Scottish data was sourced from HESA (2007) and Scottish Government GDP estimates.
Note: Calculated from OECD (reference year 2007) figures on GDP, Spend on tertiary education and purchasing power parity (PPP)

There is a high degree of variation in the number of graduates produced per million US dollars spent on tertiary education, ranging from 68.7 in Slovakia to 6.4 in the United States. This variation may in part reflect structural differences in the nature of higher education provision in different jurisdictions (for example the length of degree programmes will affect the total cost).

Scotland produced 20.9 graduates per million US Dollars spent on tertiary Education in 2007-08, compared to the OECD average of 22.7 and the UK as a whole at 25.0 (Figure 15). This places Scotland 11th out of 22 countries. High financial efficiency would be reflected by a high number of graduates per million dollars spent. It is important to note that this is purely a quantitative measure and does not provide any indication of the quality of graduates.

3.2.2 Research

In a report for Scotland's Chief Scientific Adviser, '*Evidence* Thomson Reuters'[18] provided a range of metrics on the comparative international performance of the research base in Scotland. Many of the indicators are relevant as indicators of the research output of Scotland's HEIs; the most relevant headline figures are reproduced here as well as further indicators based on the data.

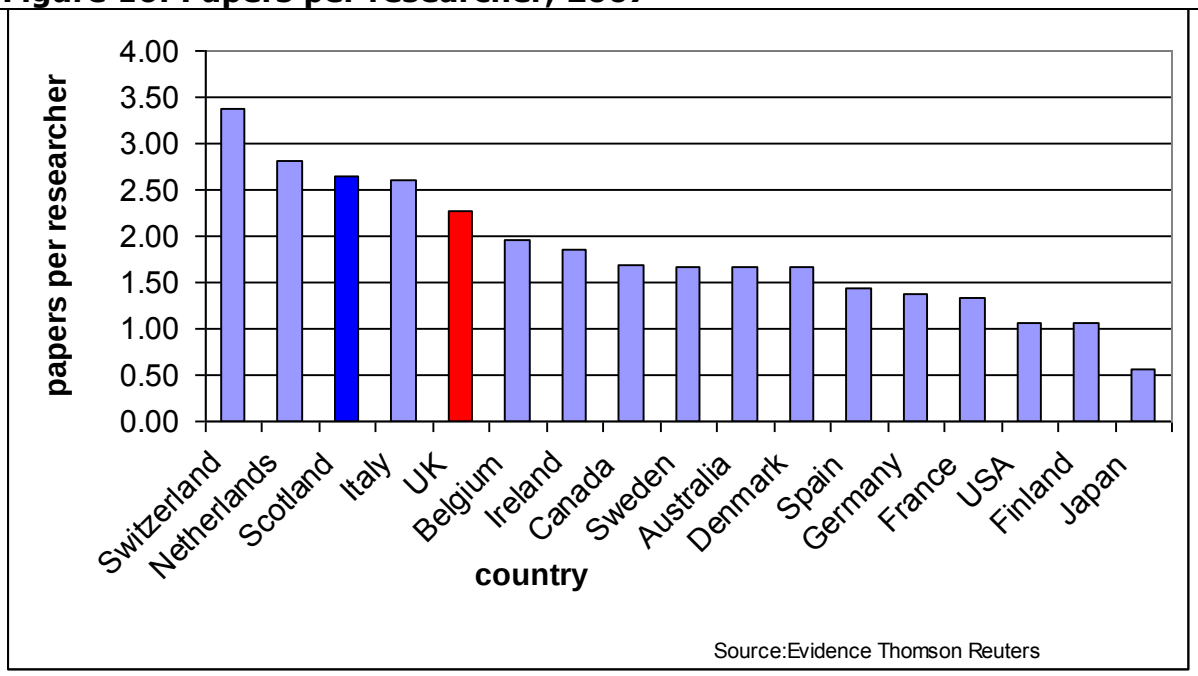
In 2007, 10,951 academic papers were produced and this represented 4.9 papers per million US dollars of Gross Expenditure on Research and Development (GERD) in 2007. Scotland Ranks 1st out of the comparator group of 27 on this measure. The '*Evidence* Thompson Reuters' report (p75), contextualises the finding, saying "Scottish GDP is relatively low and public funding comprises an unusually high proportion of GERD. Consequently only a

[18] *International comparative performance of Scotland's research base,* 'Data and analysis: *Evidence* Thomson Reuters', November 2009, available at http://www.scotland.gov.uk/Topics/Business-Industry/science/research-1/ResearchReport

small proportion of Scottish research is in the business sector and unlikely to remain unpublished".

In terms of the number of papers per researcher, in 2007 Scotland ranked 3rd in the comparator group of 27 with 2.64 papers per researcher[19], coming behind only Switzerland with 3.21 and Netherlands with 2.68. This output measure partly reflects the fact that Scotland has a higher proportion of researchers working in the public sector who are hence more likely to produce published outputs.

Figure 16: Papers per researcher, 2007

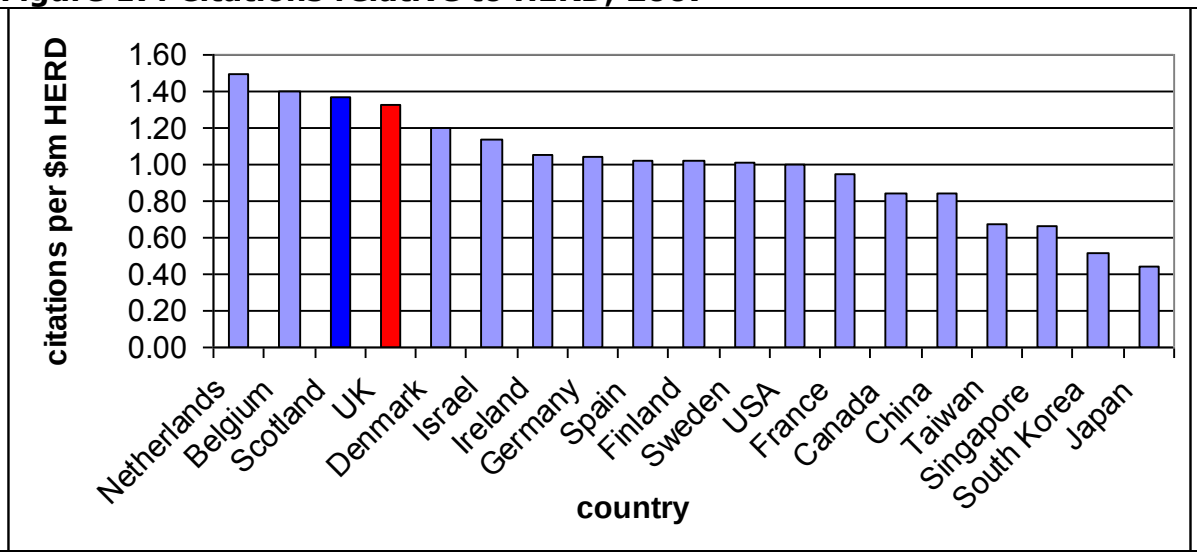


Source: Evidence Thomson Reuters

There were 17.2 citations per million US dollars of Gross Expenditure on Research and Development (GERD) in Scotland in 2007. Scotland ranks 1st in the comparator group for this indicator. In terms of citations per million US dollars Higher Education Research and Development expenditure Scotland ranked 3rd out of the comparator group of 27 with 33.81.

[19] Evidence Thomson Reuters drew information on researchers from OECD MSTI2009-1 Indicator 7: Total researchers (FTE)

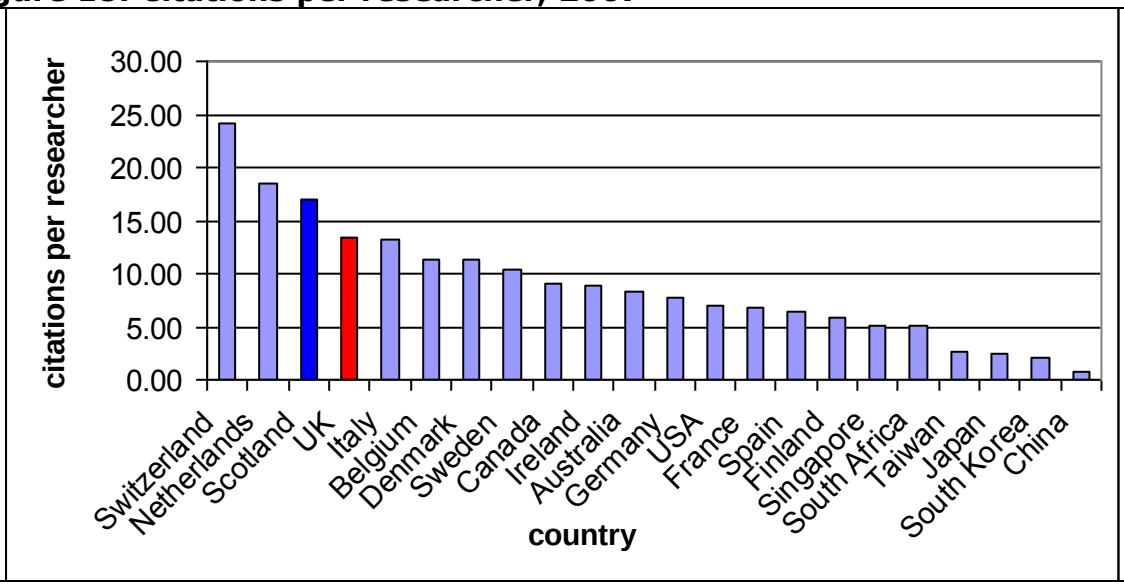
Figure 17: Citations relative to HERD, 2007



Source: Evidence Thomson Reuters

The number of citations per researcher has been steadily increasing in Scotland indicating the relative effectiveness of the papers produced. Scotland ranked third in the comparator group of 27 with an average of 17.03 citations per researcher. Scotland is behind Switzerland (24.4) and the Netherlands (18.6) and compares favourably to the UK research base (13.4).

Figure 18: Citations per researcher, 2007



Source: Evidence Thomson Reuters

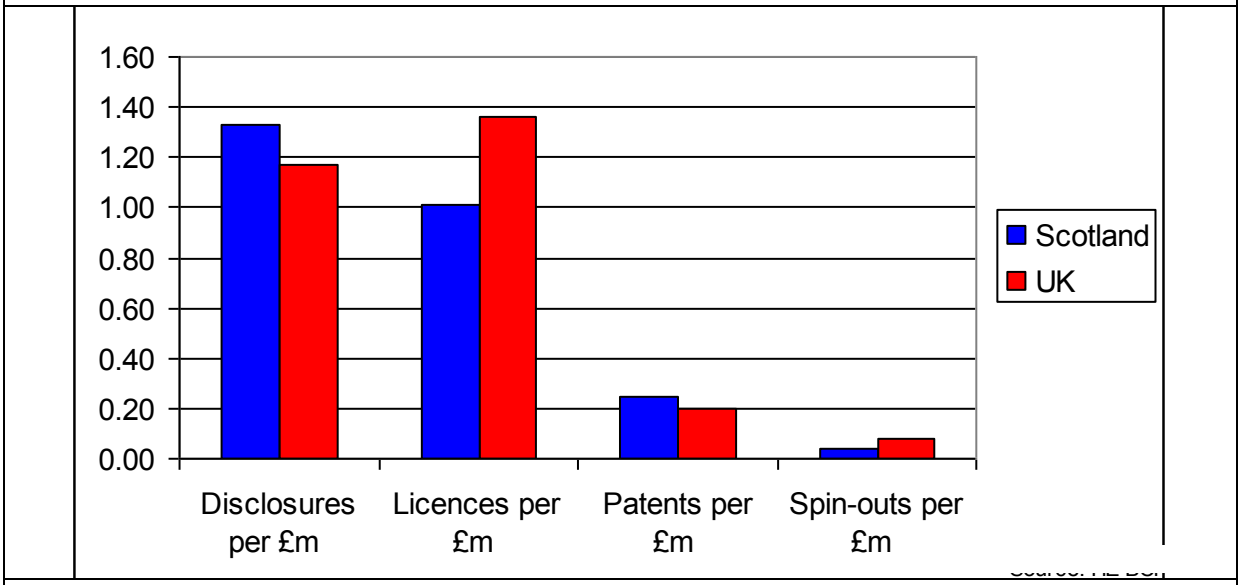
3.2.3 Knowledge exchange

Knowledge exchange refers to the exchange of ideas, research results, technology, and skills between universities, other research organisations, businesses, government, the public sector and the wider community. The exchange of knowledge enables the development of innovative new products,

processes, services and policies. Knowledge Exchange between HEIs and the wider world occurs through a number of channels and across academic disciplines[20]; however, at a Scottish level, systematic quantitative evidence does not exist to draw this together.

The higher education-business and community interaction survey (HE-BCI), does however, report on the traditional indicators of commercialisation activity though there are some concerns over the quality of the survey[21]. In 2008-09 there were 5 Scottish institutions that chose not to return the HE-BCI survey: Queen Margaret University, Edinburgh; The Royal Scottish Academy of Music and Drama; The University of the West of Scotland; Edinburgh Napier University and Scottish Agricultural College. In future Scottish HEIs in receipt of SFC Knowledge Exchange funding will be required to complete a HE-BCI return but the currently available data severely constrains comparison of the results for Scotland with those of the other UK administrations or with the UK as a whole. It is possible to avoid making an overall comparison by comparing outputs per £m knowledge exchange income[22]; though this will still be biased by the exclusion of some institutions.

Figure 19: Commercialisation activity per £m knowledge exchange income 2008-09



Source: HE-BCI

Based on the limited information from the HE-BCI survey, Scotland performs relatively well on disclosures and patents in comparison to the UK. However, with missing information it is impossible to know if this is a fair comparison.

There is currently no internationally agreed approach to measuring knowledge exchange and neither OECD nor Eurostat currently produce international

[20] At the UK level research from the UK-Innovation Research Centre suggests that commercialisation is only a small component of Knowledge Exchange activity. Available at: http://www.ukirc.ac.uk/research/article/?objid=3203

[21] It is completed by staff in the technology transfer offices of universities, and this may result in different interpretation of questions by individual respondents.

[22] Knowledge exchange income is as per the data gathered in the HE-BCI survey. This means the funding denominator used excludes funding to the five missing Scottish institutions.

datasets or composite measures. Data availability varies across countries with it being easier to compare with the US or Canada, for example.

The University of Edinburgh produced a study[23] comparing the commercial exploitation performance of the "top 8 Scottish Universities[24]" to the "top 11" and "all" returning US universities. This showed that Scotland performed well in terms of the funding required to commercially exploit research.

Figure 20: Comparison of commercial exploitation performance			
2007-08	**All US Universities**	**Top 11 US Universities**	**Top 8 Scottish Universities**
Total Research Income ($m)	443,385	13,605	840.4
$m research funding required for:			
1 Disclosure	2.6	3.1	2.6
1 Patent	4.1	5.4	5.1
1 Licence	10.2	14.2	7.5
$1m royalties received	18.6	31.1	53.1
1 Spin-out	81.7	95.1	46.7
Source: Edinburgh Research & Innovation Ltd, University of Edinburgh			

There is ongoing work on knowledge exchange being undertaken at the SFC following the consultation on knowledge exchange funding. A Working Group will recommend outcome measures or assessment measures by end 2010, for implementation in academic year 2011-12.

3.2.4 Physical capital

The normal definition of capital relates to investments in capital goods such as machinery, buildings and technology. However, due to complexities in equating the ring fenced funding for capital and the spend on items that might be classed as capital goods, we instead focus on the physical or estate capital stock of HEIs in the regions of the UK.

The Higher Education Funding Council for England (HEFCE) provide estate management statistics[25] that compare Scotland, England and Wales to the UK. This report contains a range of statistics for the 2006-07 financial year.

Scotland's relative position can be summarised as follows:

- Scotland is below the UK and English average in terms of property costs per metre squared.
- Despite improvements over time, Scotland still has the highest property cost relative to total HEI income, albeit by a small margin.
- Scotland has the highest property cost per FTE student and, although not the worst performing country, is below the UK average in the utilisation of teaching space.

[23] "Comparison of Exploitation Performance of Scottish Universities with US institutions", available at: http://www.research-innovation.ed.ac.uk/information/Exploitation-Efficiency-Report-2009.pdf

[24] Aberdeen, Dundee, Edinburgh, Glasgow, Herriot-Watt, St Andrews, Stirling and Strathclyde.

[25] "Performance in Higher Education Estates. Available at: http://www.sfc.ac.uk/web/FILES/StatisticsHEstatistics/EMS_annual_report_2008.pdf

- Scotland performs best in terms of the maintenance backlog affordability score where it is significantly above of the UK average; a considerable improvement over the last five years.
- Scotland performs below England, Wales and the UK average in all of the environmental indicators (energy, water and recycled waste).

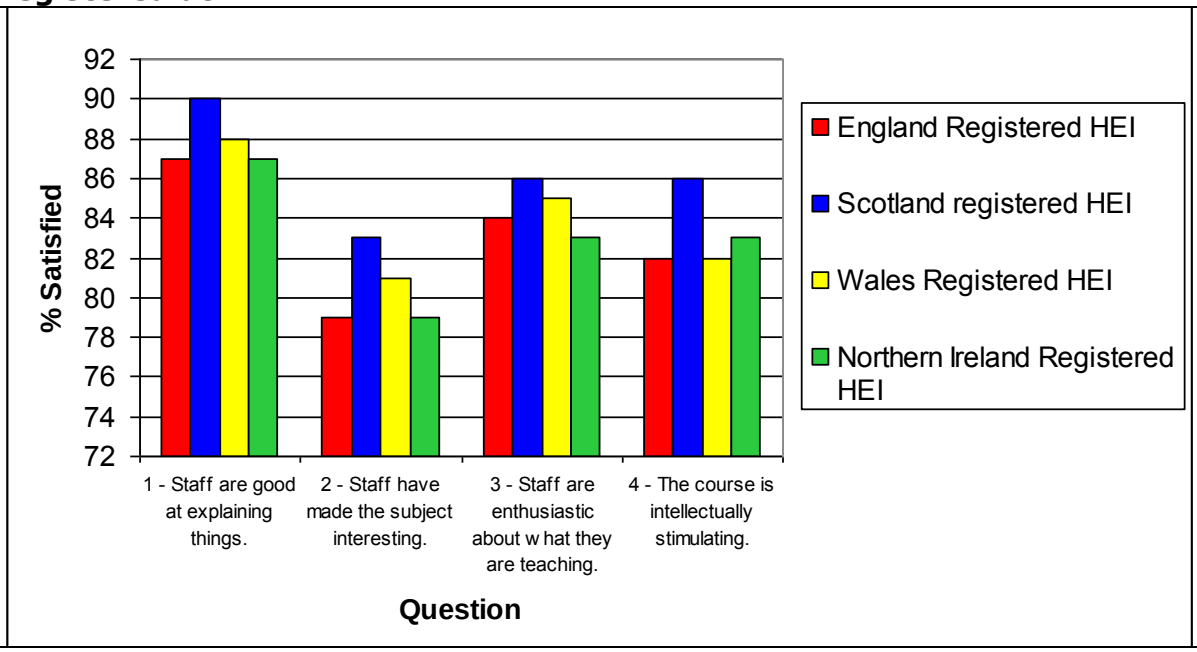
The estate management statistics appear to show that Scotland has a larger than average estate, that is well maintained and managed in relative terms but that could be utilised to a greater extent and improved in terms of environmental performance. It should be noted that sector level comparison figures across the UK will not take account of factors which might affect estates requirements and performance. Such issues might include subject mix, balance of research and teaching activity and the historic nature of and investment in universities estates over many decades.

3.3 Quality Measures

3.3.1. Teaching

One measure of teaching quality is the National Student Survey Data, this provides information on student satisfaction with teaching at their HEI. Though there is not complete coverage of students in Scottish HEIs with the University of Abertay Dundee, Edinburgh College of Art, Queen Margaret University, Royal Scottish Academy of Music & Drama, Scottish Agricultural College, the UHI Millennium Institute and the University of the West of Scotland missing from the sample. The most relevant measures from the survey are questions relating to teaching on the course. It is possible to report absolute scores at national levels for Scotland, England, Wales and Northern Ireland.

Figure 21: National Student Survey 2010 – teaching – FT students registered at HEI



Source: National Student Survey 2010

Scotland has higher student satisfaction rates for teaching than the other nations. It should be noted that the non-participation of some Scottish institutions may influence this data (either positively or negatively).

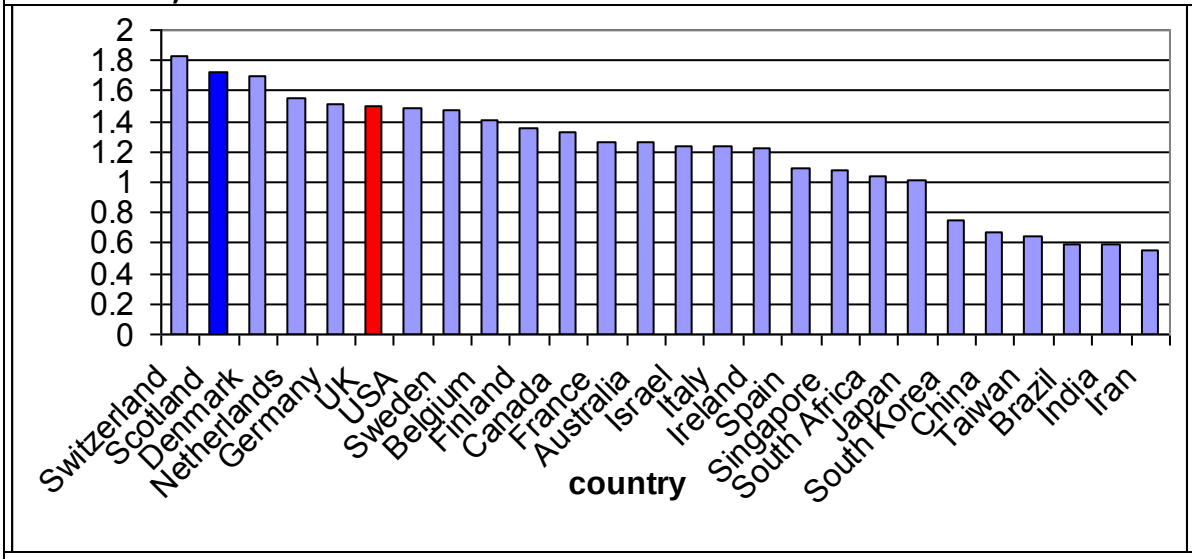
Another indicator of the quality of graduates from HEIs is the judgements on graduates preparedness for work as gathered from employer surveys. The 2008 Scottish Employers Skills Survey showed that 83% of employers considered HE graduates to be well prepared for work while 13% considered HE graduates to be poorly prepared. The equivalent survey for England (the National Employers Skills Survey) was carried out a year later and relates to 2009. This survey showed that 84% of employers considered HE graduates to be well prepared for work while 11% considered HE graduates to be poorly prepared.

3.3.2 Research

Research quality is often measured by impact, examining the number of citations per paper. Scotland's relative international position is detailed in a report[26] for the Chief Scientific Adviser.

[26] 'Data and analysis: *Evidence* Thomson Reuters' available at http://www.scotland.gov.uk/Topics/Business-Industry/science/research-1/ResearchReport

Figure 22: Citation impact (citations per paper) relative to world baselines, 2008



Source: Evidence Thomson Reuters

To account for the fact that papers accumulate citations over time the index is normalised (rebased) relative to the world average for the given year. Scotland ranks second in the comparator group with only Switzerland performing better.

Another indicator of research quality is the periodical Research Assessment Exercise (RAE); an exercise carried out by higher education bodies in the UK to measure the volume and assess the quality of research in UK higher education institutions. It works on a principle of peer assessment whereby panels of experts measure submissions from different academic disciplines. Institutions select which staff to include in submissions. These decisions will be influenced by the policies of the different funding councils and therefore may vary across the UK. For example, in 2008-09, SFC funded research graded "1*", whereas HEFCE did not.

Scotland has 15% of its researchers submitted in the 2008 RAE graded as world-leading compared with 17% in the UK. We also have 52% of our researchers described as internationally excellent or above compared with the UK's 54%.

Scotland has an excellence rating of 8.4 compared to the UK total of 8.7 (based on SG analysis). This is broadly consistent with other analyses: Research Fortnight suggest Scotland's excellence is 7.2 compared with 7.5 for the UK; Times Higher Education Supplement suggest that Scotland's excellence is 2.5 compared with 2.6 for the UK.

Section 4 - Findings and Conclusions

Scotland performs well in terms of the indicators examined, suggesting 'the HEI sector' is relatively technically efficient in international terms. This does not indicate whether the 'within sector' system is either technically efficient or technically inefficient. Nor does it suggest whether or not there exists the opportunity to become more efficient in the sense of getting more outputs per unit of input. The project did not consider allocative efficiency, if the current use of resources is what best suits social preferences for higher education.

The headline findings based on indicators of HEIs' teaching, research and knowledge exchange functions are set out below alongside a brief comment on the use of capital.

Findings from teaching indicators

The most common output measure of HEI teaching activity is the number of graduates produced. In terms of the efficiency of the system (e.g. maximising outputs per unit input, or minimising inputs per unit output) the main findings on teaching can be drawn from the indicators presented.

In terms of efficiency the most relevant input indicator is staff per student. In terms of outputs, graduates per staff and student are relevant in terms of converting inputs to outputs. Quality measures are considered alongside this information as a check.

If a large number of students per staff member is seen as desirable for efficiency then Scotland performs relatively well, sitting in the second quartile.

The teaching outputs are expressed both in relation to the spend but also to the resource (staff and student) inputs. Scotland is in the top performing quartile in terms of *recent graduates* per member of staff and in the second quartile in terms of *recent graduates* per student. Scotland is at the lower end of the second quartile in terms of graduates per US dollar spent.

Of course, Scotland's position depends on the data used and the comparator nations for which data is available, however this qualitative analysis suggests that Scotland performs well internationally on the efficiency in creating graduates with the staff and student input, though slightly poorer per US dollar spent. Although international quality comparisons have not been made, UK indicators suggest the graduates produced compare well.

Findings from research indicators

The most common output measures for HEI research activity are the number of papers produced and citations to those papers.

In terms of the internationally comparable inputs, Scotland spent the highest proportion of GDP on Higher Education Research and Development (HERD). This suggests a large input contribution. Of the staff employed in research activities approximately a third have salaries funded from external sources. This demonstrates the 'levered in' research funding attracted by HEIs.

In terms of the output measures, efficiency indicators for research are drawn from a report that makes international comparisons of Scotland's research base. Scotland sits in the first quartile for papers per researcher, citations per researcher and citations relative to HERD.

In quality terms Scotland is in the first quartile and outperforms the UK as a whole on citation impact measures but is slightly below the UK on excellence ratings as part of the Research Assessment Exercise (though this is affected by institutional decisions on what research to submit, which in turn is affected by the different policies of the funding councils).

In comparison with other OECD countries, Scotland spends a relatively large proportion of GDP on research in HEIs: the use of those resources when generating measurable research outputs is relatively efficient in comparison to other nations.

Findings on capital and knowledge exchange

Compared to other regions in the UK, Scotland has a relatively well managed estate, though some improvements could be made on environmental performance. Data available for knowledge exchange output indicators are limited to the more traditional commercialisation performance on licences, patents, spinouts and disclosures. Where comparisons were made against US institutions it was found that the top eight Scottish institutions were able to generate a greater level of commercialisation activity per US dollar spent.

Summary

In summary, this report examined the approach taken in studies on efficiency and effectiveness, with efficiency defined as production of outputs with the fewest possible units of input. Scotland's Higher Education Institution sector was compared to the UK and other international comparators via the presentation of a number of performance indicators and findings from international reports.

A picture emerges where Scotland is above average in terms of teaching activity and with high levels of spend on research relative to GDP, performs in the top quartile on measures of research efficiency. Although no one indicator can provide a definitive measure of the efficiency of the Scottish system, Scotland performs well in terms of the indicators examined. These findings cannot indicate whether or not the system in Scotland is perfectly efficient or whether 'within system' changes to improve efficiency may be possible. Follow up work might include drawing together a composite indicator or monitoring of the presented indicators over time. A more academic approach might consider using efficiency frontier analysis to examine the Scottish system relative to other nations or to consider similar groups of institutions within the system.

ANNEX 1 - INDICATORS USED IN INTERNATIONAL REPORTS

"Higher education: Quality, Equity and Efficiency", background report for meeting of OECD Education Ministers, June 2006

Access, Participation, Progression

- Educational attainment
- Number of science graduates
- Survival rates in university-level education
- Students with disabilities in higher education
- Higher education R&D expenditure by field of study
- Higher education researchers
- Women researchers

Expenditure on Higher Education

- Expenditure per student
- Changes in expenditure per student
- Cumulative expenditure per student
- Expenditure on educational institutions as percentage of GDP
- Public subsidies in higher education
- Research and development in higher education
- Higher education R&D financed by industry

The Returns on Higher Education

- Education and earnings
- Differences in earnings between females and males
- Private internal rate of return of higher education
- Education and work status (25-to-29-year-olds)
- Situation of the youth population with low levels of education (20-to-24-year-olds)
- Participation in continuing education and training (25-to-64-year-olds)

Internationalisation of Higher Education

- Foreign students in higher education
- Foreign students in higher education by country of destination
- Migration of the highly educated
- Foreign scholars in the United States

"Study on the efficiency and effectiveness of public spending on tertiary education", by M St.Aubyn, A Pina, F Garcia and J Pais, European Economy Economic Papers 390, November 2009

- Expenditure on PGD Institutions of Higher Education as Percentage of GDP 2005
- Academic Staff per 1000 Inhabitants 2005
- Share of Students in PGD Institutions
- Students per Academic Staff 2005
- Graduates per 1000 Inhabitants 2005
- Graduates per Academic Staff 2005
- Graduates per Student 2005
- Publications 1000 Inhabitants 2005

- Articles per 1000 Inhabitants
- Articles per Academic Staff
- Academic Staff per 1000 Inhabitants
- Average ISI Citation Index
- Standardised Recruiter Review Country Indicator
- Standardised Peer Review Country Indicator
- PISA 2000 - average of reading, science and mathematics scores
- Score for Funding Rules Indicator
- Score for Staff Policy Indicator
- Score for Evaluation Indicator

ANNEX 2 - INPUT AND OUTPUT MEASURES STANDARDISED BY POPULATION SIZE

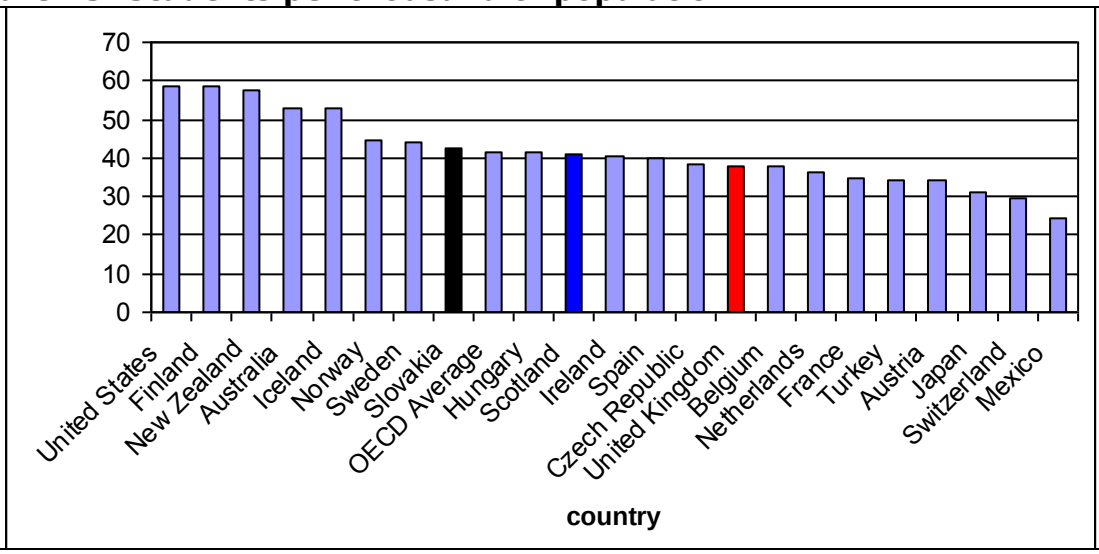
Any measure standardised by population will be influenced by differences in the demographic make up of individual countries, this makes it difficult to assess the results of the comparisons. The population figures used here are total population, but we would not expect individuals close to the bottom or top of the age range of a population to participate in education. For this reason working age population would be a more reasonable indicator, however working age population figures were not readily available at the time of analysis and will vary by country. These indicators will also be influenced by the average age (and the minimum age) of participation in tertiary education which too is expected to vary across different countries. These measures do not reflect the level of educational attainment within the overall population and do not distinguish between first time entrants to tertiary education and those returning to further study. The following indicators show relative rates of: participation (students by population), resourcing (teaching staff by population) and attainment (graduates by population) in a given year. A relatively high rate of outputs (graduates) together with a relatively low rate of inputs (teachers) would suggest relatively high efficiency.

The following charts describe the position of Scotland relative to other OECD member countries. Data from the United Nations Educational, Scientific and Cultural Organisation (UNESCO) education statistics have been used for input indicators relating to the numbers of students and teaching staff at Scottish institutions. Where possible data for Scottish institutions has been provided on a comparable basis to the data submitted for UK institutions to the UNESCO data collection[27.] Teaching staff defined by UNESCO exclude those academic staff engaged in only research activities. Information on research outputs have been drawn from the Evidence Thomson Reuters report for the Chief Scientific Adviser, the OECD, GROS and UNESCO

[24]To account for unknown discrepancies in the definitions applied to UNESCO data and to data readily available for Scotland (mostly from published HESA statistics), UK inputs were calculated on the same basis as those for Scotland and compared to the UK data reported by UNESCO to provide a weighting factor for each Scottish input measure. This assumes that differences in reporting practices between UNESCO and HESA sources for UK data are identical and proportionate to those that would exist if Scotland was included separately in the UNESCO collections.

Input Measures

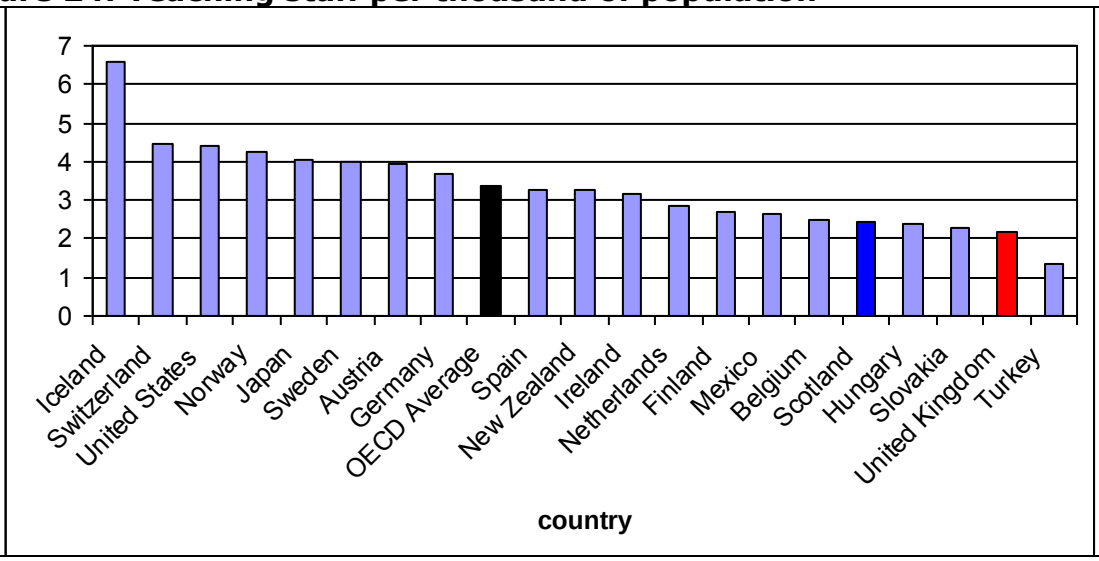
Figure 23: Students per thousand of population



Sources: UNESCO 2008 (for international data), HESA 2007-08 for student numbers and ONS 2007 population estimates.
Note: For Scotland all HE students have been included.

The number of students at Scottish HEIs per thousand of the total population in Scotland is 41, just below the OECD average of 42 but above the UK as a whole with a value of 38 Graduate figures for Scotland include all HE qualifiers. This value places Scotland in the second quartile at 10th out of 22 countries with publicly available data.

Figure 24: Teaching staff per thousand of population

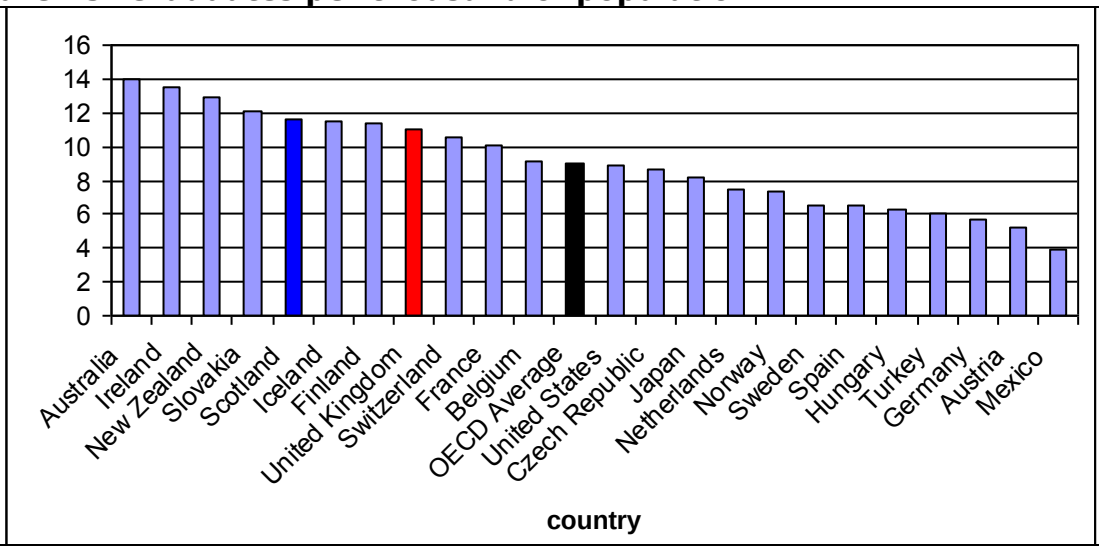


Sources: UNESCO 2008 (for international data), HESA 2007-08 for student numbers and ONS 2007 population estimates.

Among OECD member countries the number of teaching staff per thousand of the population ranges from 6.6 in Iceland to 1.3 in Turkey (Figure 24). Scottish HEIs have a value of 2.2, below the OECD average of 3.4 and roughly the same as the UK as a whole with a value of 2.2 (after rounding). This places Scotland in the lowest quartile.

Output Measures

Figure 25: Graduates per thousand of population



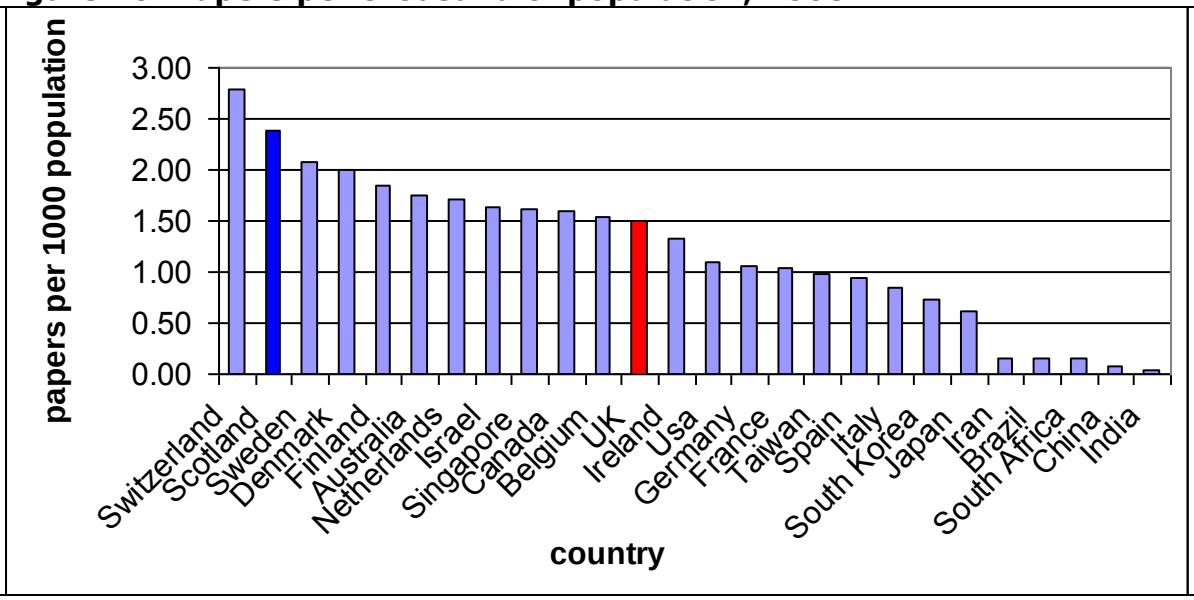
Sources: UNESCO 2008 (for international data), HESA 2007-08 for student numbers and ONS 2007 population estimates.
Note: For Scotland all HE students have been included.

Scotland marginally outperforms the UK in terms of graduates per thousand of the population, with a value of 11.6 for this indicator (Figure 25). The UK as a

whole has a value of 11.0, while the average for OECD countries with publicly available data was 9.0. Scotland ranked 5th out of 23 countries in this indicator.

In 2008, 12,327 academic papers were produced in Scotland; 2.39 papers per 1000 people in Scotland (Figure 26). Scotland ranks in the second quartile, 2nd out of the 27 comparator countries on this indicator.

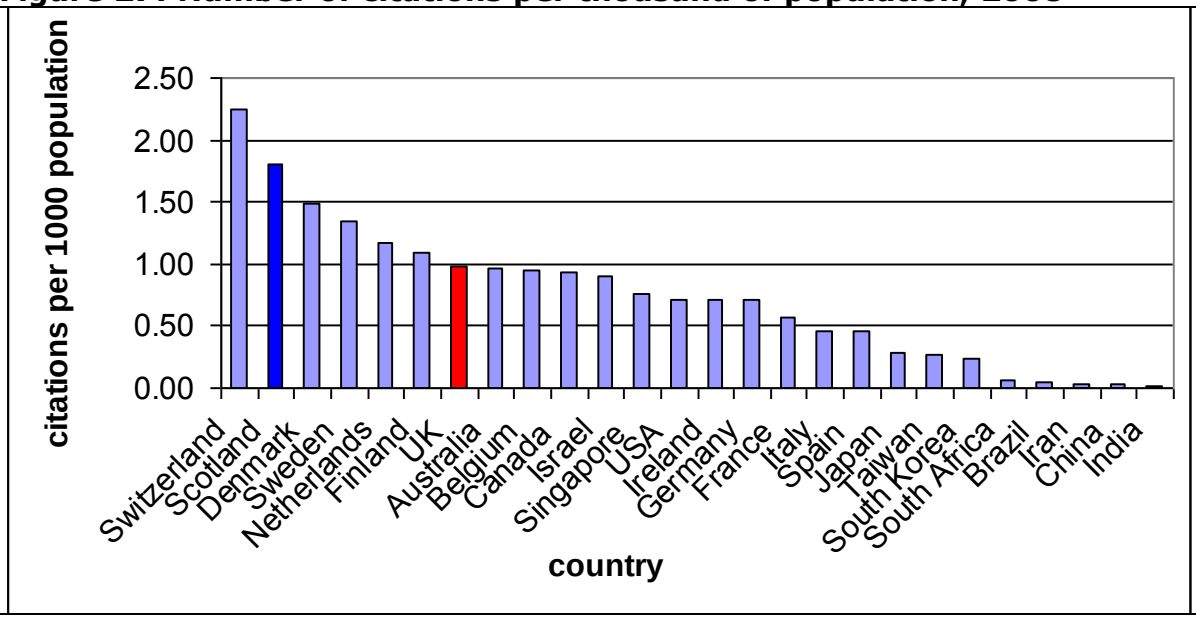
Figure 26: Papers per thousand of population, 2008



Source: Evidence Thomson Reuters, GROS, UNESCO

In addition, there were 9,340 citations to Scottish papers in 2008 (Figure 27). This represents 1.81 citations per 1000 people in Scotland. Scotland ranks 2nd in the comparator group of 27 on this measure.

Figure 27: Number of citations per thousand of population, 2008



Source: Evidence Thomson Reuters, GROS, UNESCO

ISBN 978 0 7559 9774 9 (web only publication)
DPPAS 10949