

U21 Ranking of National Higher Education Systems 2013



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A project sponsored by *Universitas 21*

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Executive Summary

The 2013 *Universitas 21* ranking of national systems retains the methodology of the 2012 rankings. 22 desirable attributes are grouped under four broad headings: Resources, Environment, Connectivity and Output. The Resources component covers government expenditure, total expenditure, and R&D expenditure in tertiary institutions. The Environment module comprises a quantitative index of the policy and regulatory environment, the gender balance of students and academic staff, and a data quality variable. The Connectivity component has been extended by including measures of web usage in addition to numbers of international students and research articles written with international collaborators. Nine Output variables are included that cover research output and its impact, the presence of world-class universities, participation rates and the qualifications of the workforce. The appropriateness of training is measured by relative unemployment rates.

The country coverage has been extended to 50 by the inclusion of Saudi Arabia and Serbia. Data quality has improved significantly since 2012, in some cases occasioned by publicity arising from the inaugural rankings – thus meeting the hope we expressed a year ago.

The overall country ranking is a weighted average of each module. The improvement in the scope of the Connectivity module has led us to increase the weight on this component from 10 to 15 per cent and to lower the weight on the Environment component by 5 percentage points. The weights used in the 2013 rankings are: Resources (25%), Environment (20%), Connectivity (15%) and Output (40%). The effect of changing the weights was very modest: the biggest change was that two countries moved three places. Nevertheless, within the Connectivity module there were substantial changes, with the United States moving up 26 places to 10th. The top three countries with greatest connectivity were Switzerland, Australia and Singapore.

Resource levels are highest in Denmark, followed by Canada and Sweden. Changes in the ranking of countries by resource levels per student were much smaller than the changes in the rankings of expenditure shares of GDP, implying that expenditure on higher education does not closely follow short term fluctuations in GDP.

On Output measures the United States is again clearly first followed by the United Kingdom and Canada but the biggest improvers are France and Singapore which have each risen four places – to 15th and 18th respectively. Again we find that of the top eight countries for output, all but two (the United Kingdom and Australia) are in the top eight for resources. But there are lags before additional resources translate into an increase in output. The top eight in Resources include Saudi Arabia and Singapore, countries that are significantly strengthening their higher education systems. Overall, the top 10 countries in rank order are the United States, Sweden, Switzerland, Canada, Denmark, Finland, the Netherlands, Australia, Singapore and the United Kingdom. The countries making the top 10 are the same as in the 2012 rankings except that Singapore has replaced Norway which falls to equal 11th, largely due to a fall in its public expenditure on higher education as a share of GDP.

U21 Ranking 2013

Rank	Country	Score
1	United States	100.0
2	Sweden	85.2
3	Switzerland	81.6
4	Canada	80.0
5	Denmark	79.8
6	Finland	79.4
7	Netherlands	78.2
8	Australia	77.2
9	Singapore	76.6
10	United Kingdom	74.9
11	Austria	71.8
11	Norway	71.8
13	Belgium	71.0
14	New Zealand	69.7
15	Germany	68.2
16	Hong Kong SAR	67.6
16	France	67.6
18	Ireland	66.8
19	Israel	63.8
20	Spain	60.5
21	Japan	59.6
22	Portugal	59.1
23	Slovenia	58.4
24	Korea	57.6
25	Czech Republic	56.7

The measures are grouped under four main headings:
Resources, Environment, Connectivity and Output.

National Higher Education Systems

Rank	Country	Score
26	Taiwan	56.0
27	Malaysia	52.4
28	Saudi Arabia	52.3
29	Italy	52.1
30	Poland	51.9
31	Greece	50.5
32	Serbia	50.0
33	Russian Federation	49.5
34	Hungary	49.2
35	Chile	49.0
35	Ukraine	49.0
37	Slovakia	47.9
38	Bulgaria	47.7
39	Romania	47.5
40	Argentina	45.8
41	Brazil	45.6
42	China	44.5
43	Mexico	42.8
44	Croatia	39.2
45	Turkey	38.9
46	South Africa	38.1
47	Thailand	37.9
48	Iran	37.2
49	India	36.3
50	Indonesia	35.3

All the variables and the weighting are explained in this report.

The measures are constructed for 50 countries at various stages of development.

1. Introduction

The first ranking of national higher education systems was published in May 2012 by the *Universitas 21* group of universities (www.universitas21.com). Some 48 countries were ranked separately in four areas (Resources, Environment, Connectivity and Output) and overall. The rankings met a long-standing need to shift discussion from the existing rankings of the world's best universities to the standing of the whole higher education system in each country.

What is important for economic development is how well a national system of higher education educates all its students, fosters research, and links the country with the rest of the world. A nation's economic development depends crucially on the presence of an educated and skilled workforce and on technological improvements that raise productivity. The higher education sector contributes to both these needs: it educates and trains; it undertakes pure and applied research. Thus a quality higher education system with high rates of participation is a necessary requirement for improvements in living standards and the broad distribution of those improvements. Furthermore, in a globalised world, a quality higher education system that is well connected internationally facilitates the introduction of new ideas, and fosters trade and other links with foreign countries, through the movement of students and researchers across national frontiers. Appropriate levels of resources for teaching and research are a necessary condition to achieve a well-performing higher education sector, but whether resources feed through to output depends on a favourable regulatory environment and well-managed institutions.

An important aim of the U21 rankings is to encourage improved performance by benchmarking national systems against the performance in other countries. The rankings for our various measures facilitate benchmarking, not only against the best systems but against countries at similar levels of economic development.

Systems of higher education evolve over time and the provision of annual updates permits the monitoring of performance over time. Annual updates will throw light on relationships between attributes over time. Increases in resources devoted to higher education, for example, may not show up in improvements in output measures for several years. In order to monitor change, the methodology needs to remain reasonably constant, but we outline some changes in this report which improve the quality of the measures.

2. Changes in Methodology from the 2012 Rankings

The country coverage has been extended to include Serbia and Saudi Arabia. These two countries reached our selection standards in 2012 (based on NSF research rankings or member of G20) but were not included because of data deficiencies, which have now been overcome. The total number of countries included is now 50. For several other countries, particularly India, Indonesia and Malaysia, there has been a marked improvement in the quality and timeliness of data.

In a world with greater emphasis on communication technologies, connectivity between individuals and institutions is heavily based on online interactions. In recognition of this, two new web-based measures have been included in the Connectivity variables. The added variables are the average number of open access web documents in tertiary institutions in a country, and the extent to which the documents are externally accessed by third parties. In the 2012 rankings we gave a weight of only 10 per cent to Connectivity because of the limited range of the variables. In recognition of the improved coverage we have increased the weight by five percentage points to 15 per cent (and lowered that on Environment by the same amount).

The treatment of missing data has also been improved. In constructing the 2012 rankings, in some instances where country data for a variable were missing, averaging for the country was undertaken over the variables for which data were available. In other cases where data were missing, first quartile values were used. In 2013 the first quartile value is used to replace missing data in all cases, thereby ensuring methodological consistency. The use of first quartile values avoids distortions that occur when a variable has a high average value across countries for which data are available (excluding this variable in the averaging procedure severely penalises countries for which data are not available). The new procedure also simplifies the construction of averages. In a related change, for countries where total expenditure on higher education as a share of GDP is missing, it has been estimated by adding the first quartile value of private expenditure to the known values for government expenditure.

3. Disaggregated Measures and Results

In this section we explain the rationale behind each of the four modules (Resources, Environment, Connectivity and Output), and the choice of individual measures within each module. In evaluating the quality of a national higher education system we control for national size in most measures. The diversity of higher education systems across countries, notwithstanding convergence over time, means that for many variables data are most readily available for the whole of the tertiary sector. However, data for research output variables relate solely to universities or comparable institutions. Sources of data are given in Appendix 2.

Data quality has improved significantly since our 2012 rankings, in some cases occasioned by publicity arising from rankings – thus meeting the hope we expressed a year ago.

For each variable, the highest scoring country is given a score of 100 and all other countries are expressed as a percentage of the highest score. Results are presented for each measure and for the four modules. The overall ranking is discussed in section 4.

In discussing the results of these rankings, we compare country results for 2013 and the changes from the 2012 rankings. Because it is inappropriate to comment on changes in scores of only one or two points, we report only relatively large changes in performance. Some of the significant changes in ranking that occur between 2012 and 2013 owe to changes in methodology, and where this occurs it is noted.

3.1 Resources

A necessary condition for a well performing higher education system is that it is adequately resourced, whether by government or the private sector. One measure is expenditure of tertiary institutions as a share of GDP. But for low income countries, especially those with a high student-age population, a high share of GDP may not translate into high expenditure per student, so we also include the latter. In the absence of quality of teaching measures that are comparable across countries, resources per student in part serve as a proxy. In order to measure the contribution of tertiary education to a nation's research effort we also include measures of expenditure on R&D in tertiary institutions. Thus our five measures of resources are:

- R1: Government expenditure on tertiary education institutions as a percentage of GDP, 2009.
- R2: Total expenditure on tertiary education institutions as a percentage of GDP, 2009.
- R3: Annual expenditure per student (full-time equivalent) by tertiary education institutions in USD purchasing power prices, 2009.
- R4: Expenditure in tertiary education institutions for research and development as a percentage of GDP, 2010.
- R5: Expenditure in tertiary education institutions for research and development per head of population at USD purchasing power prices, 2010.

Government expenditure on higher education as a percentage of GDP is highest in Saudi Arabia, with four countries equal second: Denmark, Finland, Malaysia and Ukraine. Malaysia's high position is in part due to its high capital expenditure. Compared with last year's rankings, the median level of expenditure has increased from 0.95 to 1.10 per cent of GDP, so that for a country to maintain its ranking, government expenditure must have increased. Norway, where government expenditure fell as a share of GDP, has fallen from equal first ranked in the 2012 rankings to 14th in the 2013 rankings. The United States slipped from rank 19 to rank 27, Croatia from 28 to 37. Conversely, Russia's ranking improved from 26 to 18. Malaysia and India improved markedly in the rankings as a result of more recent data becoming available (previously data were available for 2006 only).

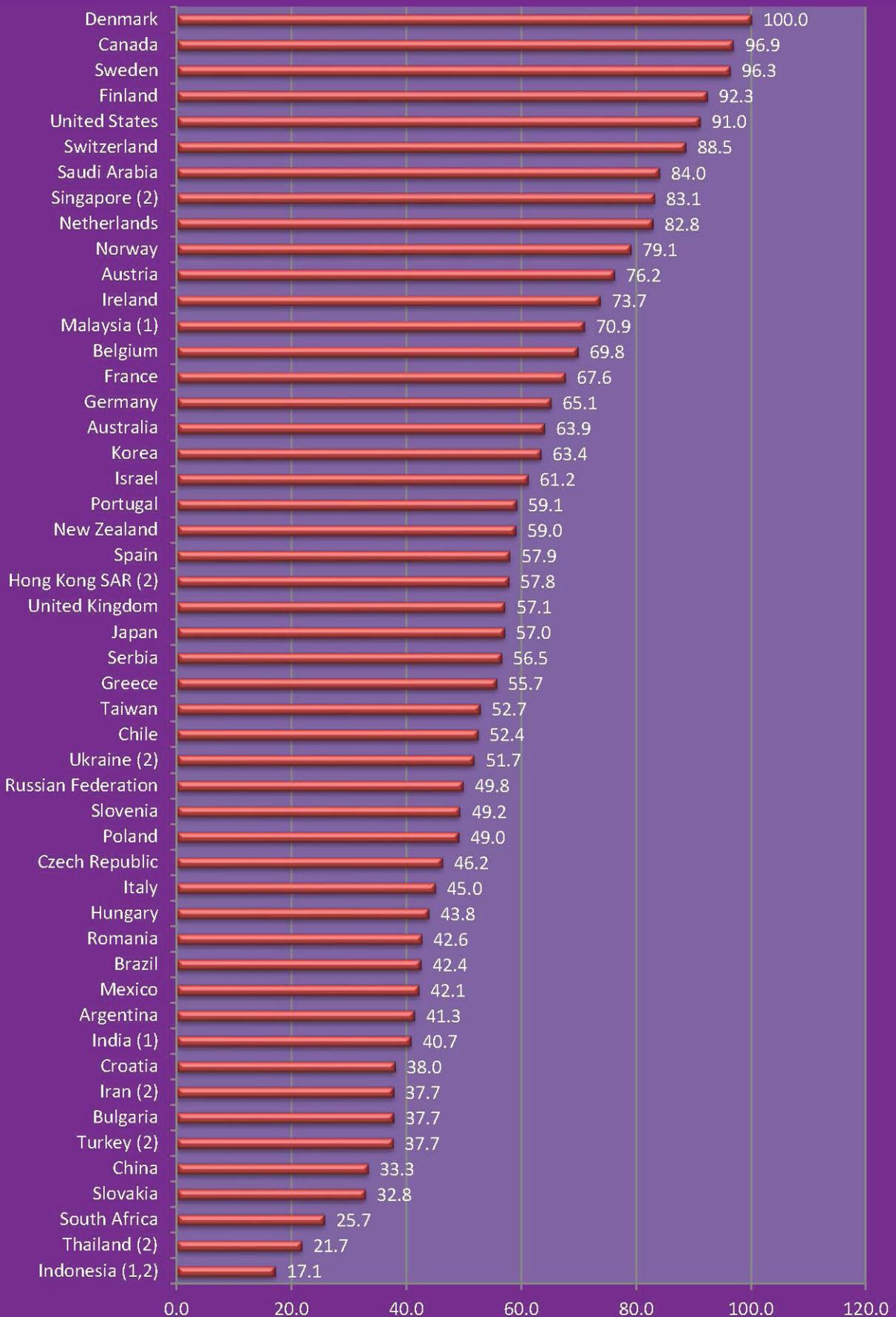
As in last year's rankings, the highest levels of total expenditure on education as a share of GDP occur in two countries with high levels of private expenditure (above 1.5 per cent of GDP), Korea and the United States. Total expenditure as a share of GDP is next highest in Canada, Chile, Malaysia and Saudi Arabia.

The United States continues to dominate the expenditure per student rankings. Switzerland and Canada are next in the rankings but the absolute level of expenditure per student is only three-quarters that in the United States. Changes compared with the 2012 rankings are small (never more than four places) which implies that changes in the GDP shares (both R1 and R2) are driven primarily by changes in GDP and that expenditures on higher education do not closely follow short-term fluctuations in GDP. Note that the data relate to a period of above average variations in GDP during the Global Financial Crisis.

Expenditure by tertiary institutions on research and development is highest in Denmark and Sweden; expenditure is also high in Finland, the Netherlands and Switzerland. Compared with the 2012 rankings, R&D expenditure in tertiary institutions has risen relatively in Poland and Slovakia but fallen in Croatia and Italy.

In averaging over the five variables we give a double weight to R1, R2 and R3. The highest ranked country is Denmark followed by Canada and Sweden. The next ranked countries are Finland, the United States and Switzerland. Compared with the 2012 rankings, Chile has risen 10 places and Malaysia has risen 11 places. Our previous method of dealing with missing values gave an upward bias to the ranking of countries with relatively low levels of GDP. The new rankings for Iran, Thailand, Turkey and Ukraine more accurately reflect their true positions.

Resources



1: Major data improvement from 2012

2: Improved method of averaging over components compared with 2012

3.2 Environment

Resources are a necessary condition for excellence in tertiary education but they are not sufficient. The regulatory environment is important for ensuring that resources are used efficiently. Excessive regulation of employment conditions will limit the contributions of academics and the capacity to attract and retain globally-competitive talent. Restraints on competition may hinder innovation in teaching methods. A narrow choice of alternative forms of higher education is likely to lower participation rates.

As has been observed by Salmi (2007, 2009, 2011), Aghion et al (2010) and others, the best performed national tertiary education systems are ones in which governments set broad parameters and monitor performance but allow institutions to operate independently from direct government interference. In order to capture the characteristics of such a model we use quantitative data supplemented by a questionnaire that is designed to measure the autonomy of tertiary institutions, complemented by measures of quality control. The measures we use are:

E1: Proportion of female students in tertiary education, 2010.

E2: Proportion of academic staff in tertiary institutions who are female, 2010.

E3: A rating for data quality. For each quantitative series, the value is 1 if the data are available for the exact definition of the variable, 0.5 if some data are available which relate to the variable but some informed adjustment is required; 0 otherwise.

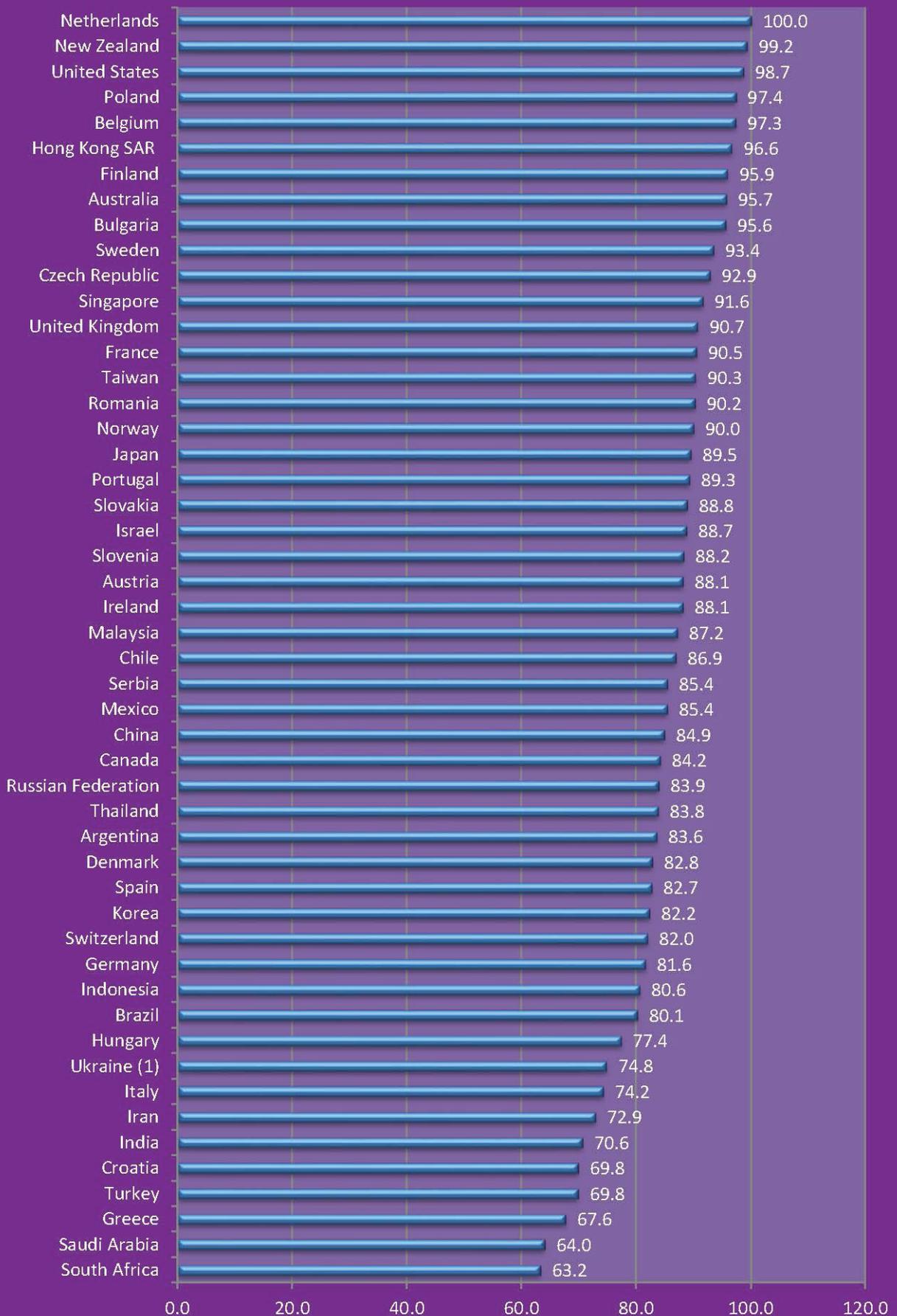
E4: Qualitative measure of the policy and regulatory environment (see Appendix 1).

Measures of the regulatory environment in which higher education providers operate move only slowly over time so the results here are similar to those in the 2012 rankings. The largest change is for Slovenia which has improved its ranking due to an increase in the diversity of its institutions, a variable that is a component of E4.

In most countries females make up at least 50 per cent of students; Korea and Turkey have the lowest percentage. By contrast, in only four countries do females comprise at least 50 per cent of academic staff (Finland, New Zealand, Russia and Thailand). The countries with the lowest proportion of female academic staff are Iran and Japan.

The overall measure of Environment is obtained by giving a weight of 70 per cent for the qualitative variable and 10 per cent for each of E1 to E3. The countries with the most favourable environment are the Netherlands, New Zealand and the United States.

Environment



1: Data quality improvement from 2012

3.3 Connectivity

The worth of a national higher education system is enhanced if it is well connected with the rest of the nation's society and is linked internationally in education and research. High connectivity provides two measures of the worth of a nation's higher education system: it is an indicator of the quality of teaching and research, and it is an indicator of absorption of new discoveries and ideas. We use four measures:

- C1: Proportion of international students in tertiary education, 2010.
- C2: Proportion of articles co-authored with international collaborators, 2006-2010. The data are a weighted average for each country where the weights are the proportion of output from each higher education institution.
- C3: Number of open access full text files on the web, published 2007-2011, average for institutions.
- C4: External backlinks to higher education web pages from third parties, average for institutions.

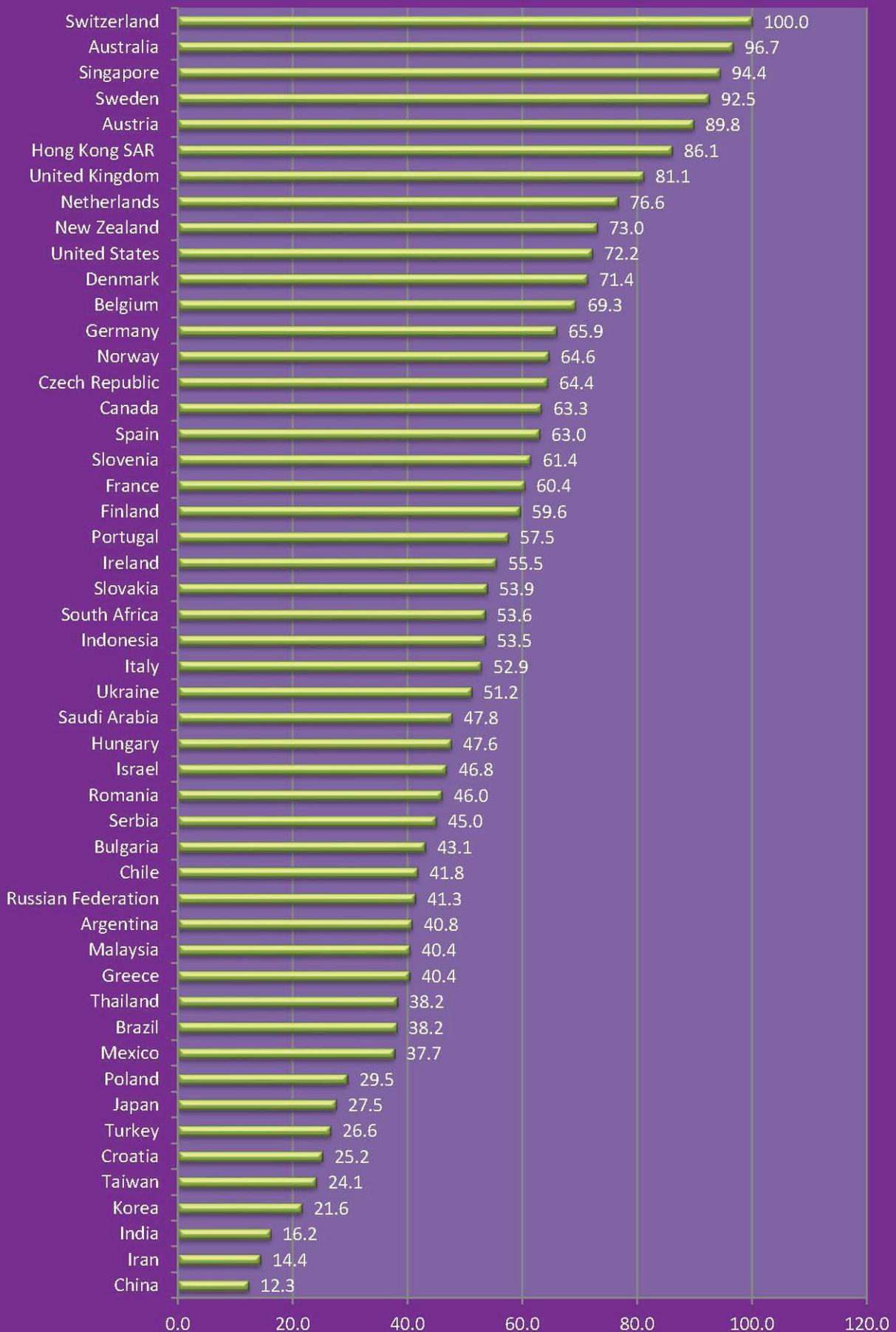
The data for C3 and C4 were supplied by the Spanish research group *Cybermetrics Lab* that publish a biannual *Webometric Ranking of World Universities*. We included all tertiary institutions ranked in the top 10,000.

The two countries with the highest percentage of students who are international are Singapore and Australia. Other countries with high concentrations of international students are Austria, the United Kingdom and Switzerland. The largest relative increase from the 2012 rankings occurred in Hong Kong SAR.

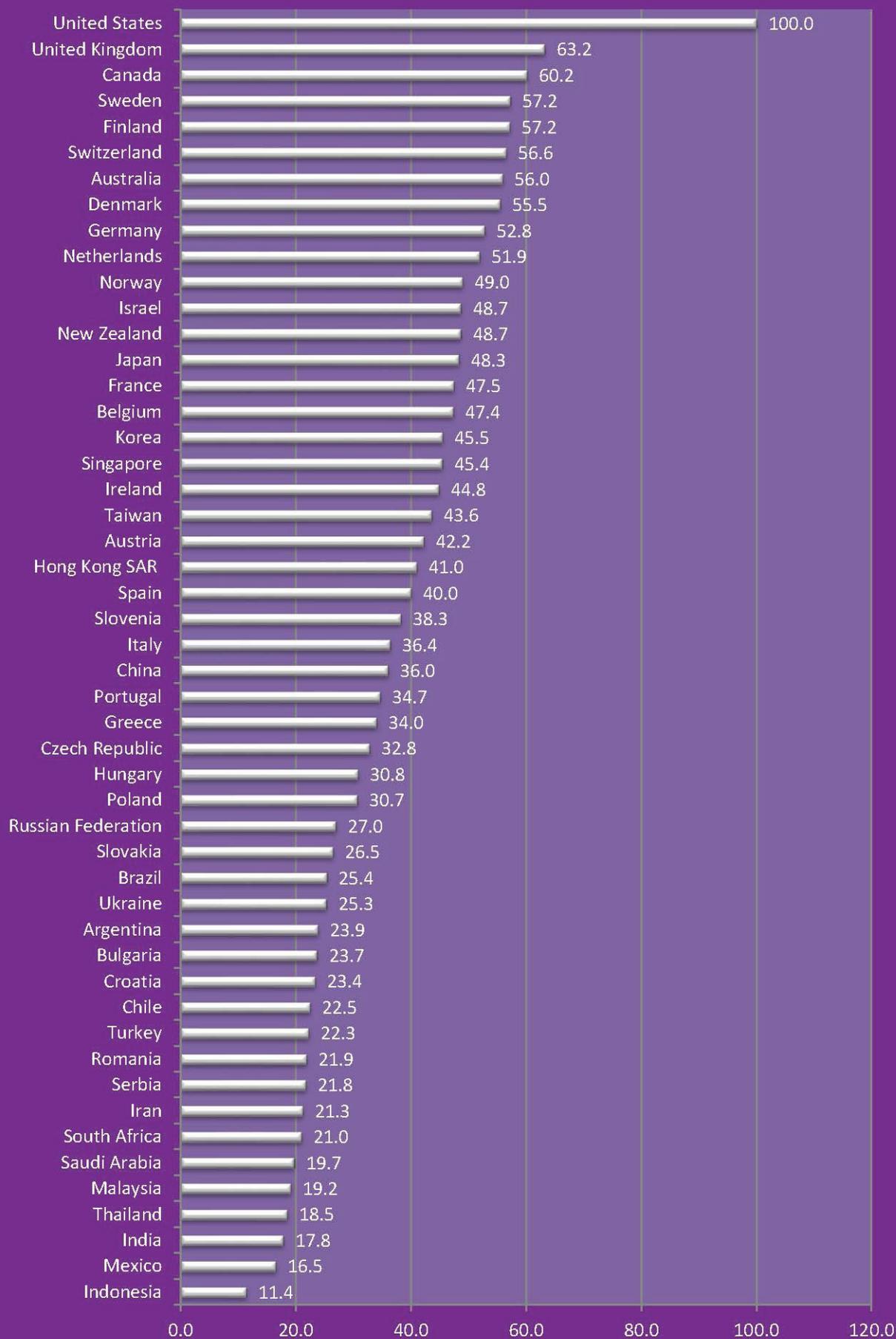
The country with the largest percentage of articles written jointly with an international collaborator is Switzerland. Next highest ranked countries are Hong Kong SAR, Indonesia, Denmark and Belgium. Turning to the new connectivity variables, Sweden and the Netherlands have the most extensive open access website material, but the United States dominates the extent to which external agents access information on the websites of tertiary institutions.

Averaging over the four variables, Switzerland is ranked first and Australia second. Next in order are Singapore, Sweden and Austria. The addition of the web-based variables has raised the ranking of the United States by 26 places to 10th. Other countries to raise their rankings by over 10 places are Slovenia, Spain and the Netherlands. Conversely four countries fell by more than 10 places: Bulgaria, France, Chile and Ireland.

Connectivity



Output



3.4 Output

A good higher education system provides the nation with a well-trained and educated workforce that meets the country's needs, provides a range of educational opportunities for people with different interests and skills, and contributes to national and world knowledge. To capture these desired outcomes we use measures of research output and impact, student throughput, the national stock of researchers, the number of excellent universities, and employability of graduates. Each measure is now explained in turn:

- O1: Total articles produced by higher education institutions, 2006-2010.
- O2: Total articles produced by higher education institutions per head of population, 2006-2010.
- O3: An impact measure calculated from the SCImago database, 2006-2010. The measure is a weighted average of the Karolinska Institute normalized impact factor for each higher education institution, where the weights are each institution's share of national publications from higher education institutions.
- O4: The depth of world class universities in a country calculated as a weighted average of the number of institutions listed in the top 500 according to the 2012 Shanghai Jiao Tong index divided by country population. The weights used are the scores out of 100 for each university.
- O5: The research excellence of a nation's best universities calculated by averaging the 2012 Shanghai Jiao Tong index scores for the nation's three best universities.
- O6: Enrolments in tertiary education as a percentage of the eligible population, defined as the five-year age group following on from secondary education, 2010.
- O7: Percentage of the population aged over 24 with a tertiary qualification, 2010.
- O8: Number of researchers (full-time equivalent) in the nation per head of population, 2010.
- O9: Unemployment rates among tertiary educated aged 25-64 years compared with unemployment rates for those with only upper secondary or post-secondary non-tertiary education, 2010.

The United States dominates the total number of articles published; China comes second with a little over half the United States number. The next ranked countries, the United Kingdom and Japan, each produce about one-quarter of the United States total. Swedish institutions produce the largest volume of research articles per head of population, followed by Switzerland, Finland and Australia. The average impact of articles is greatest for authors affiliated with tertiary institutions in Switzerland, the Netherlands and the United States.

The three variables relating to the output of articles (O1-O3) are calculated using five-year moving averages which smooth changes. Nevertheless a few noticeable movements in rankings have occurred in the update. Singapore has risen 14 places in the number of articles published and five places for impact. France has risen eight places in publications per head. China's output of articles has increased from 44 to 52 per cent of the United States total.

Switzerland and Sweden top the rankings for world class universities per head of population, but the United States is clearly ranked first on the criterion of quality of 'best three universities', with the United Kingdom coming next.

Enrolment rates are highest in Korea followed by Canada, Finland and the United States. But the stock of graduates as a percentage of the work force is highest in Canada and Israel. Compared with our 2012 rankings, participation rates have increased in relative terms in Austria and Chile but fallen in Romania. More recent data on the stock of graduates has raised the ranking of New Zealand, Malaysia and Singapore. Finland has the largest number of researchers per head of population, followed by Denmark and Singapore.

The scores for the broad category Output are obtained by averaging over all nine variables with a weight of four on research output (equivalent to a weight of one-third in the output module). The United States is clearly ranked first followed by the United Kingdom and Canada. Changes are small compared with the 2012 rankings: France and Singapore have each risen four places, no country has fallen more than three places.

4. Overall Ranking

The results for each category are combined into an overall ranking by using the following weights:

Resources (25%)

Environment (20%)

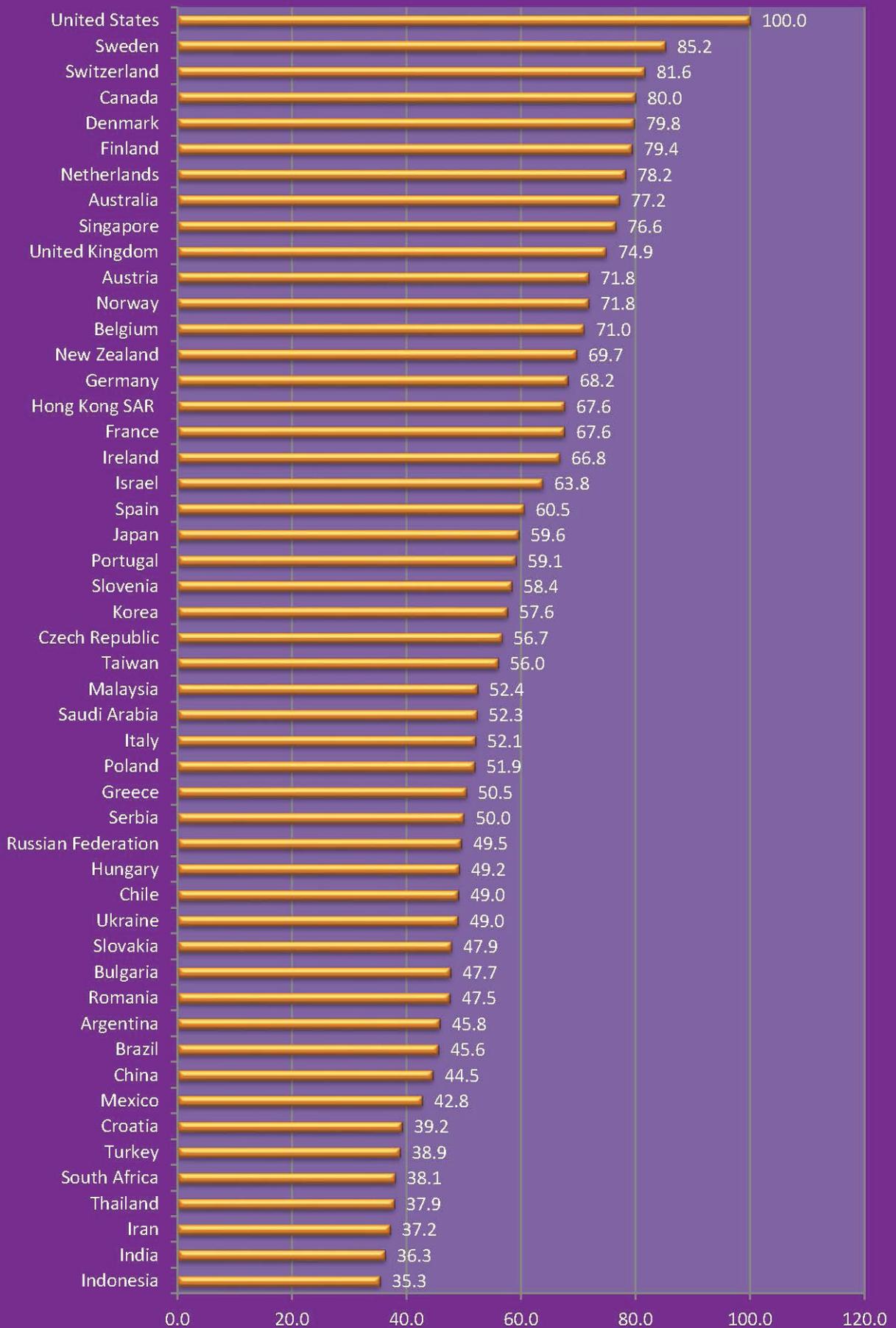
Connectivity (15%)

Output (40%)

The first ranked country is the United States followed by Sweden, Switzerland, Canada and Denmark. Moving five percentage points in the weights from Environment to Connectivity has little effect on the overall rankings: the largest change is three places which occurs in two countries only (Finland down three, South Africa up three).

The top 10 countries are the same as in the 2012 rankings except that Singapore replaces Norway which falls to 12th. The largest changes reflect better data: Malaysia rising from 36th to 27th and Ukraine falling from 25th to 36th.

Overall Ranking



5. Concluding Comments

The rankings provide a wealth of information for examining the relationship between components. One result that stands out is that resources are an important determinant of output. Of the top eight countries for output, all but two (the United Kingdom and Australia) are in the top eight for resources. Interestingly, their spots are taken in the top eight in resources by Saudi Arabia and Singapore, two countries committed to building a strong higher education system. At the more disaggregated level there is strong correlation between research performance and R&D expenditure in tertiary institutions.

The major omission from our list of variables is a quality of teaching measure. No data exist which would permit sensible comparisons across countries. It is difficult enough to measure teaching quality across different types of tertiary institutions within a country; comparisons across countries are much more complex. We do, however, include in our measures expenditure per student in purchasing power prices. This provides some measure of resources going into teaching but provides no information on how effectively the resources are being used.

We have been selective in our choice of countries (50 from a database of around 200 countries) so that those at the bottom of our rankings could be expected to be well above the median on a ranking of all countries. Many of the countries omitted are lower income countries in Africa and Latin America. Even in the medium term these countries cannot expect their systems to reach the levels of our top ranked countries. But a necessary condition for building up a strong higher education sector is to establish a favourable environment, to connect with other national systems in research and training and to fund appropriately.

Appendix & References

Appendix 1: Details of E4, a qualitative measure of the environment

This variable has three components:

E4.1: Diversity of institutions. The OECD classifies institutions into three categories: public, government dependent private, and independent private. We define a variable as 1 if less than 90 per cent of students are enrolled in any one of the three categories; 0 otherwise. This is done for tertiary type A/advanced research programme institutions.

E4.2: An index constructed by the World Economic Forum as part of its Global Competitive Index. The index for higher education and training includes a rating based on the question 'how well does the educational system in your country meet the needs of a competitive economy', which we use.

E 4.3: An index based on a survey we conducted among *Universitas 21* institutions. The questions cover degree of monitoring (and its transparency) of tertiary institutions, freedom of employment conditions, and choice of CEO

We score the desirable characteristics as: the existence of national monitoring agencies, especially ones that make public their findings; academics are not government employees and are free to move institutions; the CEO is chosen by the university; and there is complete flexibility to appoint foreign academics. For European countries that are not members of *Universitas 21* we make use of the work of Estermann, Nokkala and Steinel (2011), Fielden (2008), Eurydice and others and use their findings on three key attributes: the existence or not of a regulatory agency, whether academics are government employees/ civil servants or not, and the method of appointing the CEO. For countries not covered above we use information from the web, both country sites and reviews by international agencies.

The composite variable E4 is obtained by weighting the three components as follows: E4.1 (4), E4.2 (16) and E4.3 (24).

Appendix 2: Sources

- R1: OECD, *Education at a Glance, 2012, Table B2.3* and UNESCO, *Institute for Statistics* (www.uis.unesco.org)
- R2: OECD, *Education at a Glance, 2012, Table B2.3* and UNESCO, *Institute for Statistics* (www.uis.unesco.org)
- R3: OECD, *Education at a Glance, 2012, Table B1.1α, col 9* and UNESCO, *Institute for Statistics and IMF, Data and Statistics*. UNESCO student numbers converted to full-time equivalents using average for countries where both sets of student data exist.
- R4: UNESCO, *Institute for Statistics and IMF, Data and Statistics*
- R5: UNESCO, *Institute for Statistics and IMF, Data and Statistics*
- E1: UNESCO, *Institute for Statistics*
- E2: UNESCO, *Institute for Statistics and Global Education Digest 2012*
- E4.1: OECD, *Education at a Glance 2012, Table C1.5*; UNESCO, *Global Education Digest, 2012, Table 17*.
- E4.2: World Economic Forum, *The Global Competitiveness Report 2012-2013, Table 5.03, p. 442*.
- C1: OECD, *Education at a Glance 2012, Table C3.1*; UNESCO *Global Education Digest, 2012, Table 9*.
- C2: SCImago data, *Scopus data bank* (www.scimagoir.com)
- C3: Webometrics (www.webometrics.info), July 2012 version
- C4: Webometrics (www.webometrics.info), July 2012 version
- O1: SCImago data, *Scopus data bank* (www.scimagoir.com)
- O2: SCImago data, *Scopus data bank* (www.scimagoir.com)
- O3: SCImago data, *Scopus data bank* (www.scimagoir.com)
- O4: Shanghai Jiao Tong University Rankings , 2012(www.shanghairanking.com)
- O5: Shanghai Jiao Tong University Rankings, 2012 (www.shanghairanking.com)
- O6: OECD, *Education at a Glance, 2012, Table C1.1a* and UNESCO, *Institute for Statistics*
- O7: UNESCO, *Institute for Statistics*
- O8: UNESCO, *Institute for Statistics*
- O9: OECD, *Education at a Glance, 2012, Table A7.4a*; ILO (www.laboursta.ilo.org), UNESCO, *Institute for Statistics*

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