

U21 Ranking of National Higher Education Systems

A project sponsored by *Universitas 21*

Ross Williams, University of Melbourne
Gaetan de Rassenfosse, University of Melbourne
Paul Jensen, University of Melbourne
Simon Marginson, London University

May 2014

The project is based at the
Melbourne Institute of Applied Economic and Social Research
University of Melbourne

U21 Ranking of National Higher Education Systems 2014

Contents

Executive Summary	5
Overall Table of Rankings	6
1. Introduction	8
2. Changes in Methodology from the 2013 Rankings	9
3. Measures and Results	10
3.1 Resources	10
3.2 Environment	12
3.3 Connectivity	14
3.4 Output	16
3.5 Overall Ranking	18
4. Methodology of Adjusting for Levels of Economic Development	20
5. Results After Adjusting for Levels of Economic Development	21
5.1 Resources	21
5.2 Environment	21
5.3 Connectivity	21
5.4 Output	22
5.5 Overall Ranking	22
Table of Measures Adjusted for Levels of Economic Development	23
Overall Table of Rankings Adjusted for Levels of Economic Development	24
6. Concluding Remarks	26
Appendix & References	27

Acknowledgements

The Steering Group for the project is:

Dr Ying Cheng, Graduate School of Education, Shanghai Jiao Tong University

Professor David Greenaway, Vice-Chancellor, University of Nottingham

Professor Don Fisher, Department of Educational Studies, University of British Columbia

Professor Simon Marginson, Institute of Higher Education, University of London

Professor Ross Williams, Melbourne Institute, University of Melbourne

The *Universitas 21* (U21) Secretariat provided invaluable assistance. We especially thank Jane Usherwood, U21 Secretary General, and Lucy Smith, Media Manager for the Rankings project.

We are most grateful to Isidro Aguillo for providing the data from *Webometrics* and Robert Tijssen, Leiden University, for the data on co-authored research publications with industry.

Our thinking has been much informed by the invited speakers and other participants at the U21 Symposium, *National Systems of Higher Education: Criteria for Evaluation*, held in Shanghai, November 7, 2013.

Executive Summary

The 2014 *Universitas 21* ranking of national systems retains the methodology of the 2013 rankings, but supplements this with an auxiliary ranking that takes account of stages of economic development. 24 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 interaction with business and industry, in addition to numbers of international students, research articles written with international collaborators and web-based connectivity. 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 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 15 to 20 per cent and to lower the weight on the Resources component by five percentage points. The weights used in the 2014 rankings are: Resources (20%), Environment (20%), Connectivity (20%) and Output (40%). The widened definition of Connectivity has seen an improvement in the rankings for several Asian countries, and a decline for several Eastern European countries. Overall, though, the leaders in Connectivity are Switzerland, Sweden and the United Kingdom. Environment is topped by New Zealand and the Netherlands.

Resource levels are highest in Denmark, followed by Canada, Sweden and the United States. The biggest change since the 2013 rankings has been a fall of five places by Bulgaria, Hungary and the Russian Federation occasioned by relative declines in government expenditure. On Output measures, the top five countries are the same as in 2013: the United States is again clearly first followed by the United Kingdom, Canada, Sweden and Finland. Among the top eight countries for Output, all but two (the United Kingdom and Australia) are in the top eight for Resources.

Overall, the top 10 countries in rank order are: the United States, Sweden, Canada and Denmark, Finland, Switzerland, the Netherlands, the United Kingdom, Australia and Singapore.

Our main ranking compares a country's performance against the best in the world on each measure. In our auxiliary ranking, countries are scored on how they perform on each of the 24 measures relative to countries at similar stages of economic development as measured by GDP per capita. This produces marked changes in ranking. China (becomes ninth), India (becomes 23rd) and South Africa (becomes 17th) all improve their overall ranking by at least 25 places, although the three top-ranked countries are Sweden, Finland and Denmark. A noticeable feature is that several lower income countries show very marked improvements in the Connectivity ranking (the top two are now South Africa and Thailand, and Indonesia becomes seventh), an activity that is likely to be most beneficial to economic growth.

U21 Ranking 2014

Rank	Country	Score
1	United States of America	100.0
2	Sweden	86.7
3	Canada	82.9
3	Denmark	82.9
5	Finland	82.2
6	Switzerland	81.5
7	Netherlands	80.4
8	United Kingdom	79.2
9	Australia	78.0
10	Singapore	76.3
11	Norway	75.0
12	Austria	73.7
13	Belgium	73.1
14	Germany	71.1
15	Hong Kong SAR	70.6
16	New Zealand	70.4
17	Ireland	69.7
18	France	68.7
19	Israel	68.5
20	Japan	64.9
21	Korea	61.6
22	Taiwan-China	61.3
23	Spain	61.1
24	Portugal	60.3
25	Slovenia	59.6

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

National Higher Education Systems

Rank	Country	Score
26	Czech Republic	58.2
27	Italy	53.7
28	Malaysia	53.4
29	Hungary	52.5
30	Saudi Arabia	52.4
31	Poland	50.8
32	Greece	50.3
33	Chile	49.1
34	Serbia	48.7
35	China	48.6
35	Russian Federation	48.6
37	Slovakia	47.9
38	Brazil	46.1
39	Romania	45.4
40	Bulgaria	45.0
41	Argentina	44.9
42	Thailand	43.9
42	Ukraine	43.9
44	Croatia	43.7
45	South Africa	43.4
46	Mexico	42.6
47	Turkey	39.1
48	Indonesia	38.5
49	Iran	37.8
50	India	36.8

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

This report presents results for the third annual ranking of national systems of higher education undertaken under the auspices of the *Universitas 21* group of universities. Some 50 countries are ranked overall and in each of four areas: Resources, Environment, Connectivity and Output.

The essential logic behind the development of national rankings is that it is the higher education system as a whole, not only of research intensive universities, that matters for the economic and cultural development of a nation. The higher education system educates and trains people across a wide range of skills, it undertakes and fosters both basic and applied research, and promotes the transfer of knowledge both domestically and internationally.

The reasoning behind our methodology is set out in ‘The Determinants of Quality National Higher Education Systems’, Williams, de Rassenfosse, Jensen and Marginson (2013), and in the reports published on the U21 website (www.universitas21.com). The methodology assumes that the more resources going into higher education the better. On the output side it is assumed, for example, that the more research papers produced and the greater number of students that are taught the better. This might be described as ranking based on absolute excellence, where a country’s higher education system is judged against that of the best in the world.

A major innovation introduced in the present report, compared to previous years, is an auxiliary ranking which takes account of national levels of income as measured by GDP per capita. A nation’s resources are limited and have alternative uses. It would be economically indefensible for a low income country to spend as much per student in higher education as, say, the United States or a Nordic country. At the margin, the returns would be much higher elsewhere, not least in schooling. In this ranking, a nation’s higher education system is benchmarked against those in countries with similar levels of income.

2. Changes in Methodology from the 2013 Rankings

Two new variables have been added to the Connectivity module which significantly enhance its scope. These are, firstly, the views of business leaders on the extent of 'knowledge transfer' between companies and universities and, secondly, a measure of the extent of joint authorship of articles between universities and industry researchers. The latter is a new series constructed by Professor Tijssen of Leiden University. This brings the total number of variables to 24. In view of these additions, the overall weighting of Connectivity has been increased from 15 to 20 per cent. The weight on Resources is reduced commensurately from 25 per cent to 20 per cent to reflect our ongoing concerns about the data on private expenditure. These changes in weights simplify the contribution of each variable to the overall ranking.

There have been some changes in the nature of the *Webometrics* data used in the Connectivity module. The openness variable is now obtained from *Google* instead of *Google Scholar*, and there has been a change in the formula used to measure impact. To limit the effect of these changes, the combined *Webometrics* weight has been lowered slightly to four per cent, which is the same weight as the other four Connectivity variables.

In defining the percentage of the population with a tertiary qualification, we have changed from all those aged over 24 to all those aged 25-64.

For each variable, the highest scoring country is given a weight of 100 and all other countries are expressed as a percentage of this highest score. Where data are not available, we use the first quartile value. The individual series used in the 2014 rankings and the new results are presented on the following pages, with comments on major changes from the 2013 rankings. Sources are given in Appendix 1.

3. Measures and Results

3.1 Resources (weight of 20%)

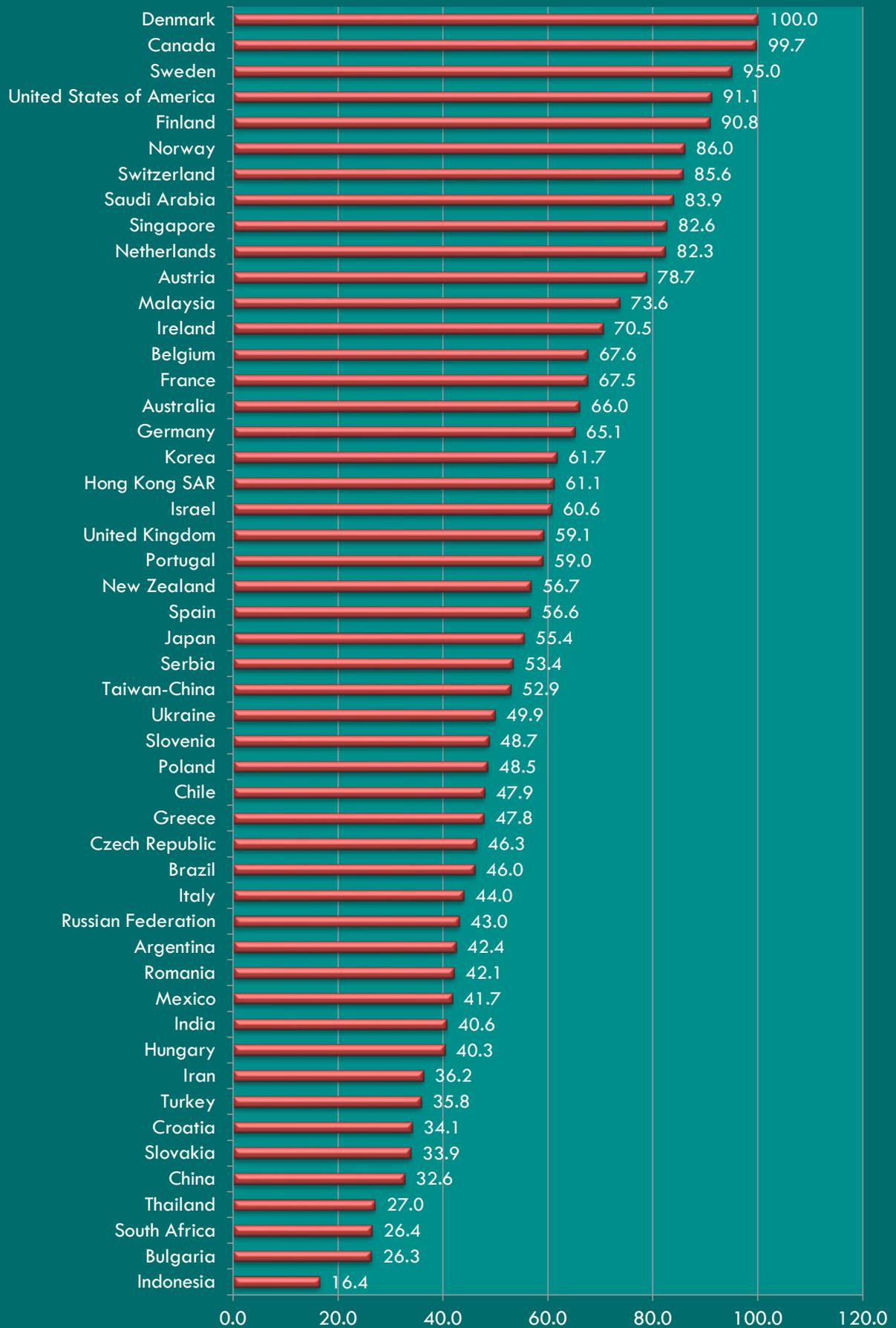
A necessary condition for a well performing higher education system is that it is adequately resourced, whether by government or the private sector. One measure is expenditure of tertiary institutions as a share of GDP. However, for low income countries, especially those with a high student-age population, 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. Consequently our five measures of Resources with weights are:

- R1: (5%) - Government expenditure on tertiary education institutions as a percentage of GDP, 2010.
- R2: (5%) - Total expenditure on tertiary education institutions as a percentage of GDP, 2010.
- R3: (5%) - Annual expenditure per student (full-time equivalent) by tertiary education institutions in USD purchasing power prices, 2010.
- R4: (2.5%) - Expenditure in tertiary education institutions for research and development as a percentage of GDP, 2011.
- R5: (2.5%) - Expenditure in tertiary education institutions for research and development per head of population at USD purchasing power prices, 2011.

The highest ranked countries for resources in the 2014 rankings are Denmark, Canada, Sweden, the United States and Finland, in that order. Norway has risen from 10th in 2013 to sixth following a restoration of its government expenditure to GDP ratio. Compared with 2013, the biggest changes have been a fall of five places in four countries: Bulgaria, Greece, Hungary and the Russian Federation. In each case, the fall has been driven by a fall in government expenditure as a share of GDP. The United Kingdom has risen six places to a still low 42nd on government expenditure.

Resources per student are highest in the United States, Singapore and Canada. Denmark and Sweden rank highest for research expenditure in tertiary institutions.

Resources



3.2 Environment (weight of 20%)

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.

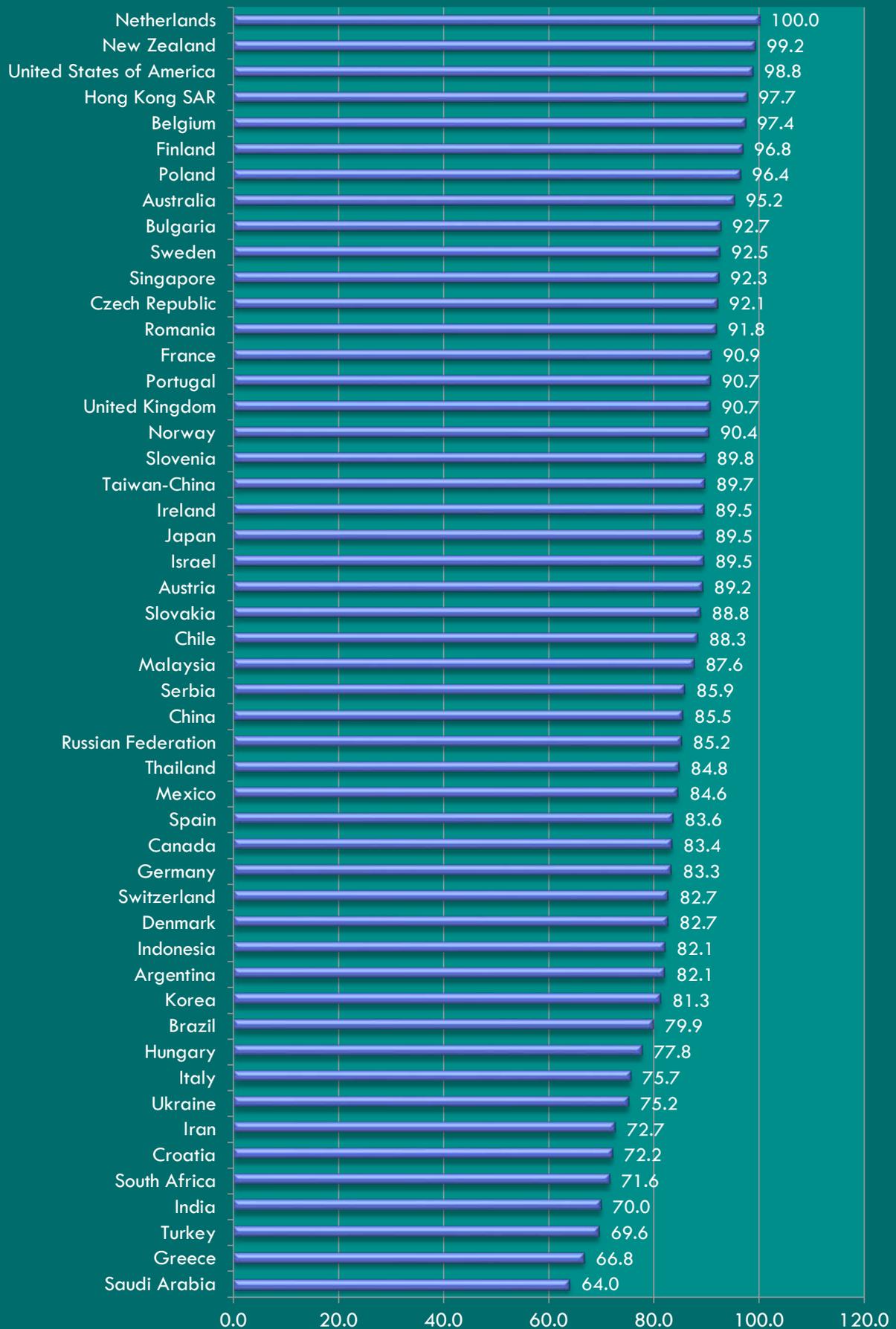
We use quantitative data supplemented by a questionnaire that is designed to measure the autonomy of tertiary institutions, complemented by measures of quality control. The measures we use are:

- E1: (2%) - Proportion of female students in tertiary education, 2011.
- E2: (2%) - Proportion of academic staff in tertiary institutions who are female, 2011.
- E3: (2%) - 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: (14%) - Qualitative measure of the policy and regulatory environment (see Appendix 2).

As is expected, the components of this variable are relatively slow moving. The top three countries remain as last year: the Netherlands, New Zealand and the United States. However Poland has slipped from fourth to eighth following a fall in its rating of business friendliness by the *World Economic Forum* (WEF). Argentina, Korea, Mexico and Taiwan-China have also fallen following a similar downgrade, but more positive WEF ratings have improved the ranks of Germany, Ireland and Portugal. Hong Kong SAR has risen to fourth position.

The four countries with the highest percentage of female staff are Finland, New Zealand, the Russian Federation and Thailand.

Environment



3.3 Connectivity (weight of 20%)

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 six measures:

- C1: (4%) - Proportion of international students in tertiary education, 2011.
- C2: (4%) - Proportion of articles co-authored with international collaborators, 2008-2012. The data are a weighted average for each country where the weights are the proportion of output from each higher education institution.
- C3: (2%) - Number of open access full text files on the web, published 2008-2012, average for institutions.
- C4: (2%) - External links that university web domains receive from third parties, average for institutions. The data for C3 and C4, supplied by the Spanish research group *Cybermetrics Lab*, includes all tertiary institutions ranked in the top 10,000 in the world.
- C5: (4%) - Responses from business executives asked to rate the extent to which 'knowledge transfer is highly developed between companies and universities' in their country, in a survey run by *IMD World Development Centre*, Switzerland, 2013.
- C6: (4%) - Percentage of university research publications that are co-authored with industry researchers, 2008-2010.

Changes in this module are larger than elsewhere owing to the introduction of two new variables and changes in the way internet traffic is measured. The top five nations in rank order are now Switzerland, Sweden, the United Kingdom, Denmark and Singapore.

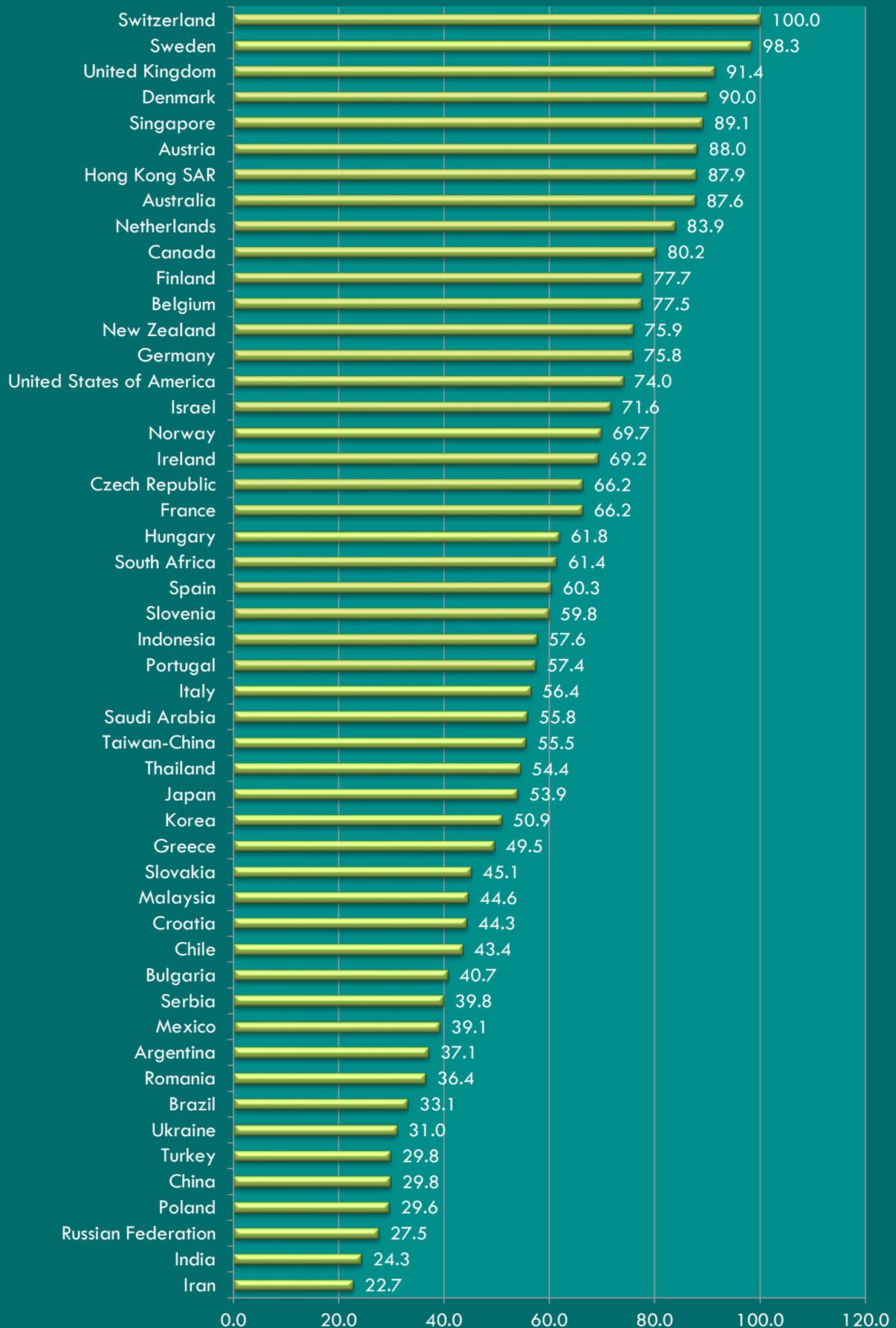
Turning to the new variables, the top 10 countries for knowledge transfer in the IMD survey of business executives are, in rank order, Israel, Switzerland, Sweden, the United States, Denmark, Finland, Germany, Canada, the Netherlands and the United Kingdom. The lowest ranked countries are in Eastern Europe, including the Russian Federation. The country with the greatest percentage of its research papers published jointly with industry is Sweden; then follow Denmark, the Netherlands, Austria, Japan, Finland, Korea, Norway, the United Kingdom and Canada. The correlation between the survey results and the percentage of co-authored papers is 0.60, indicating that collaborative research is an important component of knowledge transfer. The country with the highest proportion of articles jointly authored with international collaborators is Switzerland.

The data changes in the web-based measures have not had a great effect on the ranking of countries within these two variables but they have affected the spread of values, most noticeably the gap between the USA and other countries has been greatly reduced for the impact variable C4. The top five countries for the average number of open access full text files per institution (C3) are Hong Kong SAR, Saudi Arabia, Taiwan-China, Indonesia and Croatia. For the impact measure (C4), websites of United States institutions are on average accessed the most, followed by Australia, Hong Kong SAR, Canada and the United Kingdom.

Singapore, Australia and the United Kingdom have the highest proportion of international students.

Compared with the 2013 rankings, the countries with the greatest improvements in ranking (more than 10 places) are Taiwan-China, Korea, Israel and Japan. The countries that have fallen the most places (more than 10) are Ukraine, the Russian Federation, Slovakia and Romania.

Connectivity



3.4 Output (weight of 40%)

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. The variables are given below. The 40 per cent total weight is allocated in the ratio one-third to O1 and the remaining two-thirds are spread equally over the other eight variables.

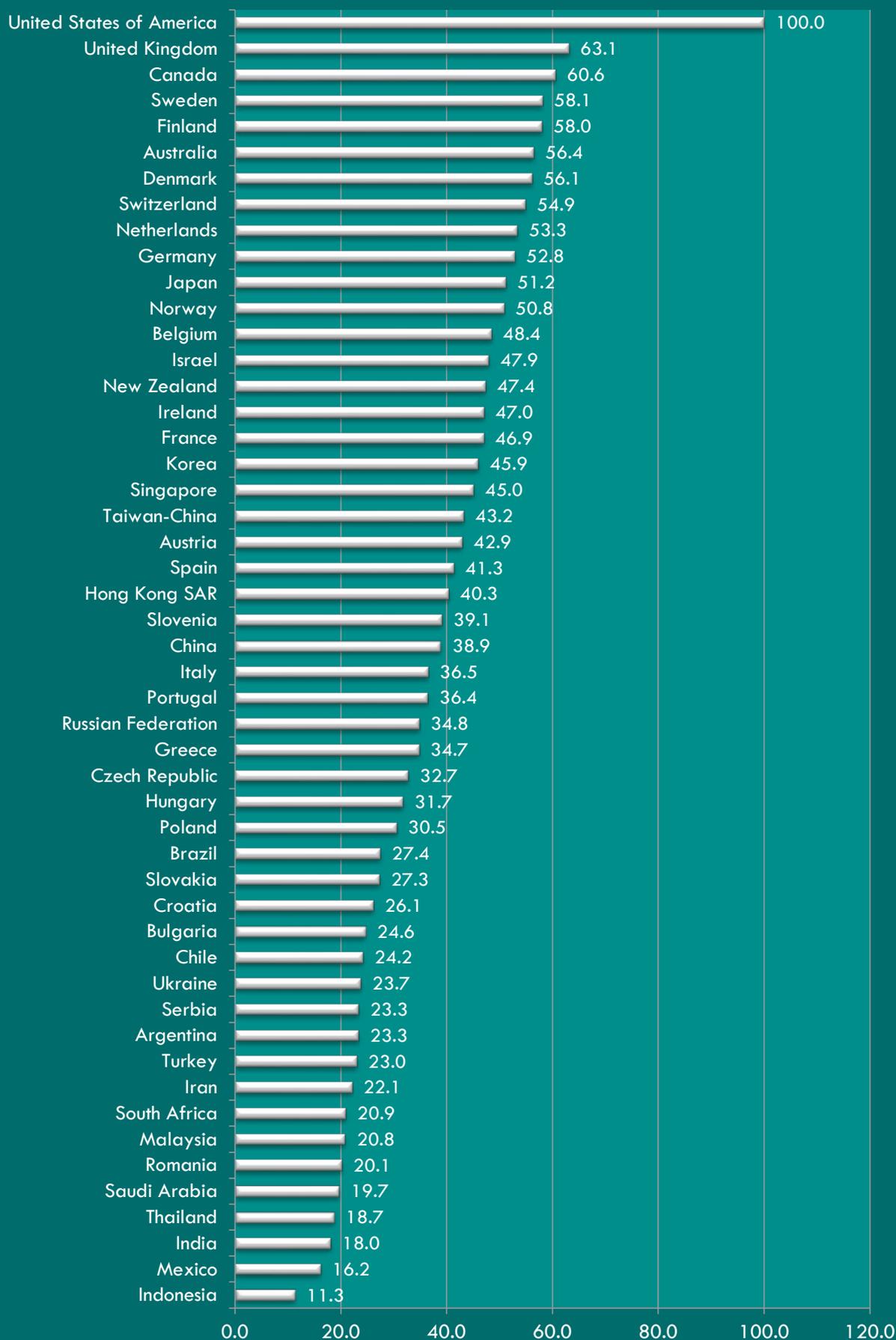
- O1: (13⅓%) - Total articles produced by higher education institutions, 2007-2011.
- O2: (3⅓%) - Total articles produced by higher education institutions per head of population, 2007-2011.
- O3: (3⅓%) - An impact measure calculated from the *SCImago* database, 2007-2011. The measure is a weighted average of the Karolinska Institute normalised impact factor for each higher education institution, where the weights are each institution's share of national publications from higher education institutions.
- O4: (3⅓%) - 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 2013 Shanghai Jiao Tong index divided by country population. The weights used are the scores out of 100 for each university.
- O5: (3⅓%) - The research excellence of a nation's best universities calculated by averaging the 2013 Shanghai Jiao Tong index scores for the nation's three best universities.
- O6: (3⅓%) - Enrolments in tertiary education as a percentage of the eligible population, defined as the five-year age group following on from secondary education, 2011.
- O7: (3⅓%) - Percentage of the population aged 25-64 with a tertiary qualification, 2011.
- O8: (3⅓%) - Number of researchers (full-time equivalent) in the nation per head of population, 2011.
- O9: (3⅓%) - 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, 2011.

The top five countries in the Output module remain the same as in 2013. In rank order they are the United States, the United Kingdom, Canada, Sweden and Finland. Five countries have improved their rank by three places: Belgium, Croatia, Ireland, Japan and Serbia. The Russian Federation has risen four places but this is due to improved data on participation rates and unemployment rates. Argentina and Romania have fallen four places and Ukraine three places.

The number of articles produced per head of population is highest in Sweden followed by Australia, Switzerland, Denmark and Finland, in that order. Average citations to articles are highest in Switzerland, followed by the Netherlands, the United States, Denmark, the United Kingdom and Australia. Saudi Arabia improved by five places on citations whereas Iran fell by four places.

Compared with those who completed only the final year of schooling, unemployment rates for those with a tertiary qualification improved in Australia, Croatia and the Russian Federation, but deteriorated in Argentina, Saudi Arabia, Switzerland and Turkey. The best unemployment position was in Hungary, followed by Germany, Slovakia, the Czech Republic and Ireland. The nations with the most educated workforces were the Russian Federation, Canada, Japan, Israel, the United States and Korea.

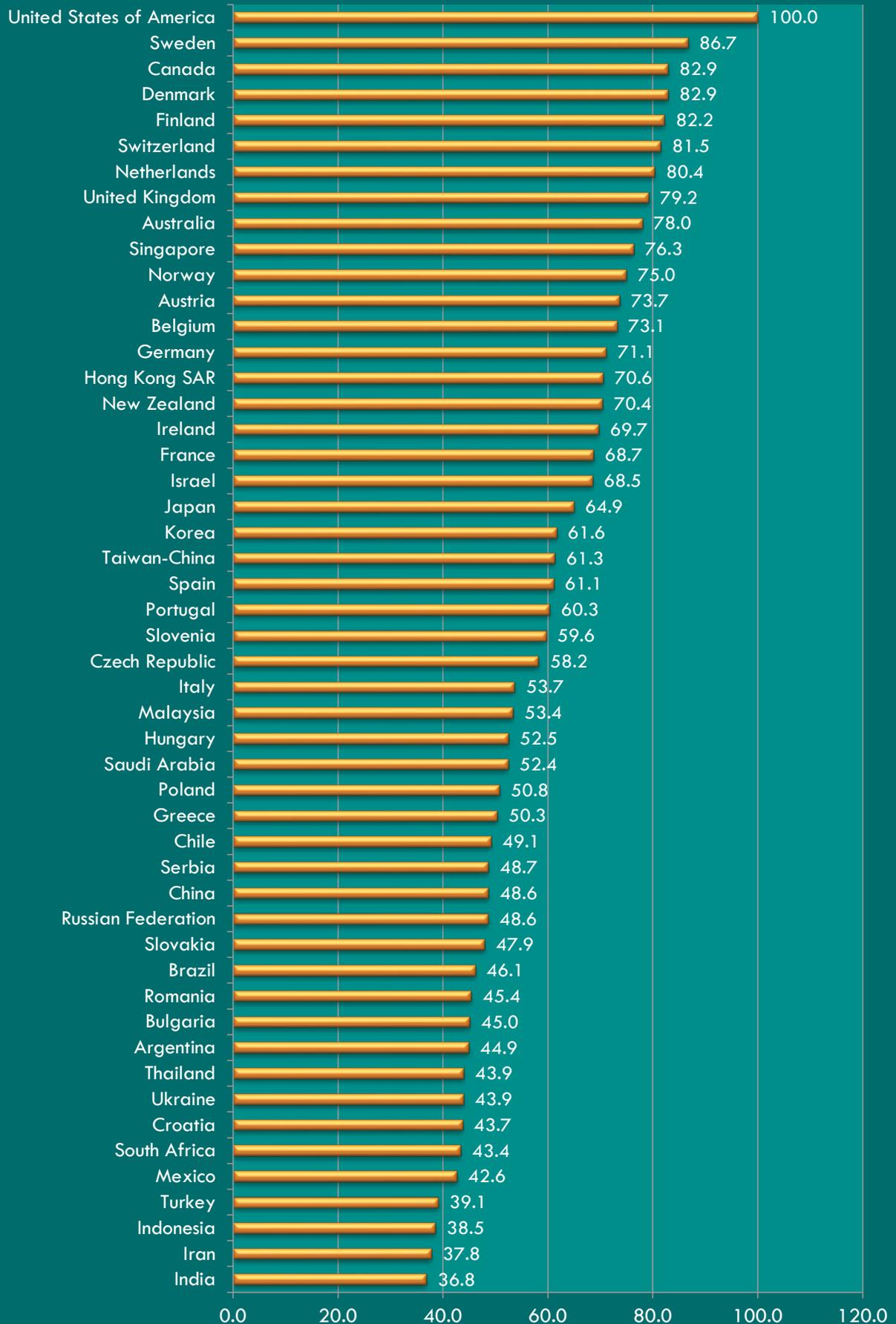
Output



3.5. Overall Ranking

Using a weight of 40 per cent on Output and 20 per cent on each of the other three modules, the top 10 countries are the same as in 2013 but the order has changed a little. It is now the United States, Sweden, Canada and Denmark, Finland, Switzerland, the Netherlands, the United Kingdom, Australia and Singapore. The United Kingdom has risen two places. The relative nature of the rankings is exemplified by Switzerland which has fallen three places even though its score remained constant. The largest changes in rankings since last year are an improvement of eight places by China, a rise of five places for Hungary, and a fall of seven places for Ukraine.

Overall Ranking



4. Methodology of Adjusting for Levels of Economic Development

In order to adjust for national levels of income we regress each variable, in original form, on a function of GDP per capita using data for all 50 countries. The GDP we use is for 2011 in US dollars measured in Purchasing Power Parity (PPP). We start with a quadratic equation but delete the squared term if it is not statistically significant. In practice, linear relationships explained most of the variations. The fitted equation gives the expected value of a variable for a nation's level of income. The difference between the actual and expected value is then expressed as a percentage of the expected value. The result can be positive or negative depending on whether a country performs above or below the expected value. For those variables where there was no significant variation with income levels we simply use percentage deviation from the average for all countries. Where data are missing we assume that the variable takes the expected value for that level of GDP per capita (which gives a deviation value of zero).

For the few variables (R4, O4, O5 and C6) with zero or near-zero values associated with low income levels, regression estimates are unreliable for countries with low GDP per capita. In these cases we obtained estimates for low income countries by deviating actual values from the mean values for comparable countries. These countries were then excluded from the regressions.

In aggregating over variables we used deviations from the regression line as a percentage of the average of the actual and predicted values. A simple average ignores the fact that the predicted values below the line are capped at 100 per cent, whereas there is no limit above the line. Our method ensures symmetry in that values which are half what is expected at a given level of GDP per capita have the same influence as values that are double those expected. It means, however, that the numerical scores for each module (and for the overall ranking) need careful interpretation: they are only an indicative measure of the extent to which the country is exceeding, or falling short of, the values expected at its level of income.

We use the same dependent variables and weights as described in section 3 with two exceptions. The exceptions are research expenditure (R4 and R5) and publication output (O1 and O2), where we had variables expressed in two different forms. This becomes unnecessary when we control for differences in income levels. We delete R5 and move the weight to R4, so that each of the Resources measures has a weight of five per cent in the overall ranking. We use as a single publication measure the number of articles divided by GDP with a weight equal to that of the other seven Output measures, namely five per cent in the overall ranking.

5. Results After Adjusting for Levels of Economic Development

5.1 Resources (weight of 20%)

The list of countries that devote more resources to higher education than is expected at their level of GDP per capita is headed by Malaysia, which is 52 per cent above the expected value. Then in order come: Serbia, Saudi Arabia, Denmark and Finland. We observe that the effect of controlling for the level of economic development is that low-income countries rise in the rankings and high income countries fall. The largest improvement is by China which rises 36 places to 10th.

Turning to the four variables that make up the Resources module, government expenditure as a percentage of GDP (R1) shows only a very marginal increase with levels of national income, so that the ranking is similar to that described in section 3.1. An exception is India which rises from 17th to eighth when we allow for differences in income levels. Allowing for per capita GDP levels brings large changes to the ranking of expenditure per student. Brazil rises from 21st to first and spends more than one and a half times per student than is expected at comparable income levels. Note, however, that the Brazilian data relate only to public institutions. Malaysia is second and India third. The United States remains relatively highly ranked at seventh. Expenditure on research and development is now highest in Turkey followed by Serbia and Saudi Arabia, but the Nordic countries still rank highly with Denmark fourth and Finland fifth.

5.2 Environment (weight of 20%)

For all but one of the variables in this module the values did not vary significantly with GDP per capita, so we just take deviations from the mean of each variable. (The exception was the WEF survey, E4.2.) For this reason the rankings are similar to those obtained when we did not adjust for income levels. The top three countries are New Zealand, the Netherlands and Poland.

5.3 Connectivity (weight of 20%)

Countries with GDP per capita in the lower quartile range score well on Connectivity when income levels are allowed for. This is not surprising. Interaction with the domestic and international economy plays an important role in nation building. South Africa is ranked first overall and first in international students (C1) and the percentage of publications jointly authored with industry researchers (C6). Thailand is ranked second overall and is third in the percentage of articles with industry researchers (C6). Hungary is ranked third overall and is second to South Africa in research papers with industry. After Hungary come a number of high income countries. In rank order they are Sweden, the United Kingdom and Switzerland. Indonesia is ranked seventh overall and first in articles co-authored with international collaborators (C2) and knowledge transfer to business (C6).

5.4 Output (weight of 40%)

The top five countries for Output, relative to their income levels, are Serbia, China, Finland, the United Kingdom and Israel. Turning to the components, when GDP per capita is taken into account, Indian tertiary institutions rank first for articles per unit of GDP, followed by Serbia and China. The highest ranking country for the average impact of articles is South Africa, followed by India, Thailand, the United Kingdom and Denmark. The South African figure is 50 per cent above what is expected at the country's income level. Relative to income levels, the quality of the top universities (O4) is highest in China, followed by Serbia, Israel, New Zealand and Switzerland. The quality of the university system as measured by total Shanghai Jiao Tong scores per head of population (O5) is highest in China, followed by Brazil, the United Kingdom, the United States and South Africa. All five of these countries score more than double that expected at their income levels.

Enrolment rates increase noticeably with income levels but, if this is allowed for, the best performing countries are Ukraine, South Africa, Korea and the United States. The percentage of the working age population with a tertiary qualification is highest in the Russian Federation, Ukraine, Israel, Japan and Canada, after taking account of income levels. Researchers per head of population are highest in Ukraine, China, Finland, the Russian Federation and Serbia. Employment conditions for the tertiary qualified compared with school leavers do not vary significantly with GDP per head, and the rankings are unaltered compared with those discussed in section 3.4.

5.5 Overall Ranking

The overall score is calculated by applying the weights to the results of each of the four modules. These scores are only indicative of absolute performance. The median score is -11 per cent, so that any country with a score above this is performing 'above average' for those countries we cover.

The top five countries are, in rank order, Sweden, Finland, Denmark, Serbia and New Zealand. The United Kingdom is sixth followed by Canada, Portugal, China and the Netherlands. All these countries are performing above the level that might be expected on the basis of their per capita income levels. The United States is ranked 15th overall, but performs above the level expected for its income.

As expected, the biggest changes occasioned by allowing for income levels occur at both extremes. Serbia, South Africa, India and China all rise by over 25 places in the rankings. Conversely, the four countries with the highest GDP per capita (Singapore, Norway, the United States and Hong Kong SAR) fall markedly in the rankings. The disparate nature of the four highest income countries, and the tendency for regression analysis to be less robust at the extremes, means that the results for these four rich countries are indicative only.

Measures Adjusted for Levels of Economic Development

Resources	% dev	Environment	% dev	Connectivity	% dev	Output	% dev
Malaysia	51.9	New Zealand	14.5	South Africa	55.2	Serbia	26.4
Serbia	38.2	Netherlands	11.6	Thailand	28.2	China	25.2
Saudi Arabia	36.3	Poland	11.6	Hungary	24.5	Finland	22.5
Denmark	32.9	Bulgaria	10.3	Sweden	24.1	United Kingdom	21.0
Finland	26.7	Belgium	10.2	United Kingdom	22.7	Israel	20.8
Canada	26.2	Romania	9.6	Switzerland	22.1	New Zealand	20.4
Sweden	24.2	Finland	9.4	Indonesia	20.5	Denmark	19.2
India	23.1	United States of America	8.4	Denmark	16.4	Sweden	17.2
Brazil	16.3	Hong Kong SAR	7.1	New Zealand	14.3	United States of America	12.3
China	14.7	Australia	6.9	Czech Republic	13.4	Canada	12.2
Portugal	11.9	Portugal	6.5	Australia	10.5	Australia	8.8
Ukraine	9.7	Czech Republic	5.9	Austria	9.7	Portugal	7.3
Netherlands	7.0	China	5.6	Belgium	3.0	Brazil	4.4
Switzerland	6.9	Chile	5.1	Netherlands	1.8	Belgium	4.2
Austria	3.5	Malaysia	4.9	Canada	1.6	Switzerland	3.5
United States of America	1.5	Sweden	4.4	Germany	1.6	Netherlands	2.5
Poland	0.4	Thailand	4.0	Finland	-0.1	Hungary	0.1
Norway	-0.1	Slovenia	3.9	Portugal	-0.6	Germany	-3.2
Mexico	-0.8	Serbia	3.6	Hong Kong SAR	-2.8	South Africa	-4.0
France	-1.3	France	3.4	Singapore	-5.0	India	-5.2
Greece	-4.4	United Kingdom	3.2	Mexico	-5.5	France	-5.4
Romania	-5.4	Indonesia	2.8	Romania	-9.2	Korea	-5.6
Belgium	-5.5	Israel	2.2	Bulgaria	-10.9	Croatia	-8.3
Turkey	-5.8	Russian Federation	1.6	Spain	-12.3	Japan	-8.7
Ireland	-5.8	Taiwan-China	1.5	Greece	-14.7	Ireland	-8.9
New Zealand	-6.0	Slovakia	1.0	Slovenia	-16.5	Russian Federation	-8.9
Argentina	-7.9	Austria	0.3	Italy	-17.4	Slovenia	-10.6
Israel	-8.0	Mexico	0.3	Israel	-17.8	Norway	-11.9
Taiwan-China	-9.2	Ireland	0.1	Ireland	-18.9	Spain	-12.8
Spain	-10.1	Japan	-1.0	France	-19.7	Austria	-16.8
Germany	-10.3	Singapore	-1.2	Malaysia	-22.4	Taiwan-China	-16.8
Russian Federation	-10.6	Norway	-1.2	United States of America	-24.6	Greece	-16.9
Singapore	-11.6	Argentina	-2.7	Argentina	-25.4	Poland	-19.7
Korea	-12.5	Brazil	-3.7	Serbia	-27.8	Chile	-25.6
Chile	-13.2	Spain	-3.9	Slovakia	-30.2	Iran	-27.1
Iran	-13.5	Korea	-6.7	Saudi Arabia	-30.4	Italy	-28.4
Hungary	-14.3	Germany	-7.0	Croatia	-31.9	Ukraine	-28.6
Australia	-15.0	Denmark	-7.5	India	-34.2	Turkey	-30.4
United Kingdom	-19.2	Ukraine	-7.5	Ukraine	-37.4	Singapore	-31.8
Czech Republic	-22.4	Canada	-8.0	Brazil	-37.8	Czech Republic	-32.9
Slovenia	-22.6	Hungary	-8.3	Norway	-38.6	Malaysia	-33.4
Thailand	-24.4	Switzerland	-11.8	China	-39.0	Hong Kong SAR	-36.1
Croatia	-24.9	Iran	-13.7	Chile	-41.0	Argentina	-40.0
Japan	-26.3	India	-13.9	Taiwan-China	-43.0	Bulgaria	-51.2
South Africa	-32.1	Italy	-14.4	Japan	-45.2	Thailand	-55.5
Italy	-34.1	Croatia	-16.7	Turkey	-50.6	Romania	-57.6
Hong Kong SAR	-34.5	South Africa	-17.4	Korea	-50.8	Mexico	-59.7
Slovakia	-43.2	Turkey	-18.3	Iran	-60.0	Saudi Arabia	-60.0
Bulgaria	-55.0	Greece	-25.9	Poland	-61.1	Slovakia	-62.5
Indonesia	-70.9	Saudi Arabia	-35.0	Russian Federation	-63.5	Indonesia	-86.5

% dev = percentage deviation from expected value at nation's level of GDP per capita

Overall Ranking Adjusted

Rank	Country	% dev
1	Sweden	17.4
2	Finland	16.2
3	Denmark	16.0
4	Serbia	13.3
5	New Zealand	12.7
6	United Kingdom	9.7
7	Canada	8.8
8	Portugal	6.5
9	China	6.3
10	Netherlands	5.1
11	Switzerland	4.8
12	Australia	4.0
13	Israel	3.6
14	Belgium	3.2
15	United States of America	2.0
16	Hungary	0.4
17	South Africa	-0.5
18	Brazil	-3.3
19	Austria	-4.0
20	Germany	-4.4
21	France	-5.7
22	Malaysia	-6.5
23	India	-7.1
24	Ireland	-8.5
25	Spain	-10.4

% dev = percentage deviation from expected value at nation's level of GDP per capita

for Levels of Economic Development

Rank	Country	% dev
26	Slovenia	-11.3
27	Norway	-12.8
28	Czech Republic	-13.8
29	Greece	-15.8
30	Korea	-16.2
31	Singapore	-16.3
32	Taiwan-China	-16.8
33	Poland	-17.7
34	Croatia	-18.0
34	Japan	-18.0
36	Russian Federation	-18.1
37	Ukraine	-18.5
38	Chile	-20.1
39	Hong Kong SAR	-20.5
40	Thailand	-20.7
41	Argentina	-23.2
42	Romania	-24.0
43	Italy	-24.5
44	Mexico	-25.1
45	Turkey	-27.1
46	Iran	-28.3
47	Saudi Arabia	-29.8
48	Bulgaria	-31.6
49	Slovakia	-39.5
50	Indonesia	-44.1

6. Concluding Remarks

Our data not only provide a snapshot of the performance of higher education in a range of countries spanning different levels of economic development, but the relationships between the various measures also enable light to be thrown on how to improve performance. There is a relatively strong relationship, for example, between expenditure and many of the Output measures. The strongest relationship is between expenditure by tertiary institutions on R&D and quality research output.

In our auxiliary rankings we have evaluated the national performance of systems of higher education compared with the average or expected values at a country's level of GDP per capita. This was done to meet the criticism that rankings use criteria that are most appropriate for developed countries. The other side to looking at how income levels influence the performance of higher education, is how tertiary education systems best contribute to GDP growth. Our work provides results which enable this issue to be explored at a more disaggregated level than usual. How important, for example, is connectivity both internationally and internally? How important is R&D expenditure in promoting long-term growth? The difficulty with trying to establish these empirical relationships is that the lags may be quite long.

In principle, in order to fully explore the interrelationships between education and economic development we should extend our coverage to include more low income countries. In practice, however, data deficiencies seriously limit such an extension, at least for the wide range of measures we employ. Nevertheless, much can be learned by low income countries from studying the attributes and performance of the lower and middle income countries included in our study.

Appendix & References

Appendix 1: Sources

R1 and R2: OECD, Education at a Glance, 2013, Table B2.3 and UNESCO, Institute for Statistics (www.uis.unesco.org)

R3: OECD, Education at a Glance, 2013, Table B1.1a, col 9; 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 and R5: UNESCO, Institute for Statistics and IMF, Data and Statistics

E1 and E2: UNESCO, Institute for Statistics

E4.1: OECD, Education at a Glance 2013, Table C1.5; UNESCO

E4.2: World Economic Forum, The Global Competitiveness Report 2013-2014, Table 5.03, p. 462.

E4.3: See Appendix 2.

C1: OECD, Education at a Glance 2013, Table C3.1; UNESCO

C2: SCImago data, Scopus data bank (www.scimagoir.com)

C3 and C4: Webometrics (www.webometrics.info), July 2013 version

C5: IMD World Competitiveness Yearbook 2013, World Competitiveness Center, Institute for Management Development, Lausanne, Switzerland.

C6: Source: Professor Robert Tijssen, Leiden University. See R. J.W. Tijssen, 'Co-authored research publications and strategic analysis of public-private collaboration', Research Evaluation, 21 (3), 2012, pp. 204-215.

O1, O2 and O3: SCImago data, Scopus data bank (www.scimagoir.com)

O4 and O5: Shanghai Jiao Tong University Rankings, 2013 (www.shanghairanking.com)

O6: OECD, Education at a Glance, 2013, Table C1.1a and UNESCO, Institute for Statistics

O7: OECD, Education at a Glance, 2013, Table A1.3, ILOSTAT data base (www.ilo.org), UNESCO, Institute for Statistics

O8: UNESCO, Institute for Statistics

O9: OECD, Education at a Glance, 2013, Table A5.4a; ILOSTAT data base (www.ilo.org), UNESCO Institute for Statistics

Appendix 2: 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.

E4.3: A rating of a country's regulatory and policy environment based on the degree of monitoring (and its transparency) of tertiary institutions, freedom of employment conditions, and choice of CEO.

Sources:

Survey of U21 members; T. Estermann, T. Nokkala, T and M. Steinel, University Autonomy in Europe II: The Scorecard, European University Association, Belgium, 2011; and J. Fielden, J. Global Trends in Education Governance, World Bank; Eurydice; and websites of national and 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).

References

More information on the U21 rankings can be found in the following:

Rauhvargers, A. 2013. 'Global University Rankings and their Impact: Report II', European University Association, Brussels.

Williams, R., de Rassenfosse, G., Jensen, P. and Marginson, S. 2013 'The Determinants of Quality National Higher Education Systems', *Journal of Higher Education Policy and Management*, 35(6): 599–611.

Williams, R. and de Rassenfosse, G., 'Pitfalls in Aggregating Performance Measures in Higher Education', *Studies in Higher Education* (forthcoming).

Universitas 21

The leading global network of research-intensive universities, working together to foster global citizenship and institutional innovation through research-inspired teaching and learning, student mobility, connecting our students and staff, and wider advocacy for internationalisation.

University of Amsterdam • University of Auckland • University of Birmingham
University of British Columbia • Pontificia Universidad Católica de Chile
University of Connecticut • University of Delhi • University College Dublin
University of Edinburgh • Fudan University • University of Glasgow
University of Hong Kong • University of Johannesburg • Korea University
Lund University • University of Maryland • McGill University
University of Melbourne • Tecnológico de Monterrey • UNSW Australia
University of Nottingham • The Ohio State University • University of Queensland
Shanghai Jiao Tong University • National University of Singapore
University of Virginia • Waseda University

Universitas 21
c/o Strathcona 109
University of Birmingham
Edgbaston
Birmingham
B15 2TT
UK

T +44 (0)121 415 8870
F +44 (0)121 415 8873
u21@contacts.bham.ac.uk
www.universitas21.com