

U21 Ranking of National Higher Education Systems

A project sponsored by *Universitas 21*

Ross Williams, University of Melbourne
Anne Leahy, University of Melbourne
Gaétan de Rassenfosse, EPFL, Switzerland
Paul Jensen, University of Melbourne

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Melbourne Institute of Applied Economic and Social Research
University of Melbourne

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The Steering Group for the project is:

Associate Professor Ying Cheng, Graduate School of Education, Shanghai Jiao Tong University

Professor Sir David Greenaway, Vice-Chancellor, University of Nottingham

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

Professor Simon Marginson, Institute of Education, University College London

Professor Ross Williams, Melbourne Institute, University of Melbourne

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U21 Ranking of National Higher Education Systems 2015

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Executive Summary

The report presents results for the 2015 *Universitas 21* annual ranking of national systems of higher education and explains the methodology used to obtain the results. The essential logic behind the development of national rankings is that it is the higher education system as a whole, not just research intensive universities, that matters for the economic and cultural development of a nation.

Fifty national systems of higher education, from all continents, are evaluated on the basis of 25 attributes. The attributes are grouped into four modules: Resources, Environment, Connectivity and Output. Resources are a necessary condition for excellence but they are not sufficient: they may be used inefficiently. Resources need to be complemented by a favourable regulatory environment which gives considerable independence to institutions, while monitoring quality and fostering competition. Institutions need to be well-connected to external stakeholders within the country to maximise their contribution to the nation; external connections are important in facilitating the flow of new ideas.

The actual selection of variables is constrained by the availability of data. The Resources module covers government expenditure on higher education, total expenditure, and R&D expenditure in tertiary institutions. The Environment module comprises a qualitative index of the policy environment, business views of the education system, the gender balance of students and academic staff, and a data quality variable. This year a measure of the financial autonomy of institutions, based on a survey we conducted, has been added to the qualitative index. The Connectivity module includes numbers of international students, research articles written with international collaborators, measures of interaction with business and industry, 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 indirectly by relative unemployment rates for different levels of education. Variables are standardised for population size.

Rankings are provided for each module as well as an overall ranking. For the latter, Output is weighted at 40 per cent and the other modules are weighted at 20 per cent. The highest ranked countries for Resources are Denmark and Canada; Singapore is third, having risen six places since the 2014 rankings, followed by Sweden, Switzerland, Finland and the United States. The Czech Republic shows the greatest improvement over last year's rankings. The environment for higher education is judged to be best in the United States, Hong Kong SAR, Finland and the Netherlands. The four leaders in Connectivity are all countries with relatively small populations: Switzerland, Austria, Sweden and Denmark; the United Kingdom is ranked fifth. The top three countries in the Output ranking are the United States, the United Kingdom and Canada; Denmark is fourth and Sweden and Switzerland are equal fifth. Saudi Arabia shows the largest increase, rising 11 places to 35.

Aggregating to obtain an overall ranking, the top ten countries are the United States, Switzerland, Denmark, Finland, Sweden, Canada, the Netherlands, the United Kingdom, Singapore and Australia. Comparing the rankings with those of two years ago, the larger movements are correlated with changes in economic circumstances: China, South Africa, Chile and Hungary improving; Ukraine, Serbia, Bulgaria, Greece, Spain and Turkey falling.

We calculate a second overall ranking by looking at how countries rate compared with what is the expected performance at their level of GDP per capita. This is done by fitting regression lines to each data series. Using this adjustment a number of lower income countries rise up markedly in the rankings: South Africa to 10th, China to 16th and India to 18th.

U21 Ranking 2015

Rank	2014	Country	Score	2014
1	1	United States of America	100.0	100.0
2	6	Switzerland	87.1	81.5
3	3	Denmark	85.3	82.9
4	5	Finland	85.2	82.2
5	2	Sweden	84.7	86.7
6	3	Canada	82.8	82.9
7	7	Netherlands	81.6	80.4
8	8	United Kingdom	80.6	79.2
9	10	Singapore	80.3	76.3
10	9	Australia	77.1	78.0
11	13	Belgium	76.0	73.1
12	11	Norway	75.3	75.0
13	12	Austria	74.6	73.7
14	14	Germany	72.1	71.1
15	15	Hong Kong SAR	70.3	70.6
16	16	New Zealand	69.6	70.4
17	18	France	69.3	68.7
18	17	Ireland	68.8	69.7
19	19	Israel	66.4	68.5
20	20	Japan	65.6	64.9
21	22	Taiwan-China	63.6	61.3
22	21	Korea	60.5	61.6
23	26	Czech Republic	59.9	58.2
24	23	Spain	59.3	61.1
25	24	Portugal	58.4	60.3

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

National Higher Education Systems

Rank	2014	Country	Score	2014
26	25	Slovenia	57.0	59.6
27	28	Malaysia	55.4	53.4
28	30	Saudi Arabia	54.7	52.4
29	27	Italy	54.3	53.7
30	29	Hungary	53.4	52.5
31	33	Chile	50.9	49.1
32	31	Poland	50.7	50.8
33	35	Russian Federation	50.4	48.6
34	35	China	48.5	48.6
35	32	Greece	48.0	50.3
36	37	Slovakia	47.4	47.9
37	34	Serbia	45.9	48.7
38	41	Argentina	45.1	44.9
39	45	South Africa	45.0	43.4
40	38	Brazil	44.6	46.1
41	42	Ukraine	43.8	43.9
42	39	Romania	43.6	45.4
43	40	Bulgaria	42.1	45.0
44	46	Mexico	41.7	42.6
45	44	Croatia	41.6	43.7
46	42	Thailand	40.0	43.9
47	49	Iran	39.3	37.8
48	48	Indonesia	38.8	38.5
49	47	Turkey	38.1	39.1
50	50	India	37.8	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 fourth annual ranking of national systems of higher education undertaken under the auspices of the *Universitas 21* (U21) network of universities. Some 50 countries are ranked overall and in each of four areas: Resources, Environment, Connectivity and Output. Our national rankings complement the plethora of rankings of institutions. The essential logic behind the development of national rankings is that it is the higher education system as a whole, not just 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. Our Output measures encompass attributes such as participation rates, research performance, the existence of some world class universities, and employability of graduates. Our Connectivity measures pick up the extent of external engagement, both nationally and internationally.

Resources, whether public or private, are a necessary condition of a well-functioning system of higher education but they are not sufficient: a well-designed policy environment is needed to ensure that resources are used well. The mission of the higher education system as a whole must include criteria that are above the responsibilities of individual institutions. These include national policy on the types of institutions permitted, movement of students between different types of institutions, governance structures and quality monitoring. National evaluations encompass both institutional diversity and governmental policy settings. A consensus is emerging that the preferred environment is one where institutions are allowed considerable autonomy tempered by external monitoring and competition. Our measures pick this up. In the 2015 rankings we extend our coverage of the environment in which higher education operates by including a measure of the extent to which public universities enjoy financial autonomy.

An important aim of our work is to permit countries to benchmark performance against other countries at similar stages of development. Our results permit, for example, comparisons of performance within Eastern European countries and within selected Latin American countries; East Asian countries can be compared with those in Western Europe. In order to facilitate comparisons between countries at similar levels of development, we present estimates of a country's performance at its level of GDP per capita; these estimates complement our main (unadjusted) measures of performance.

Our methodology is set out in detail in Williams, de Rassenfosse, Jensen and Marginson (2013) and in the reports published on the U21 website (www.universitas21.com). There are 25 variables in total. A description of each variable is given in the relevant section below and sources are given in Appendix 1. The quality of data continues to improve but in the limited cases where no data are available we use the first quartile value. For each variable, the score for the best performing country is given a score of 100 and scores for all other countries are expressed as a percentage of this highest score.

2. Changes in methodology and data from the 2014 Rankings

A major change has been to add to the qualitative index of the policy and regulatory environment the results of a survey on the extent of financial autonomy in public universities. The questionnaire is attached as Appendix 3 and draws on the work of the European Universities Association in measuring university autonomy (www.university-autonomy.eu). The questionnaire covers the following: the degree of independence public universities have in allocating core public funding; the freedom to keep surpluses, to borrow and to levy fees; and the ability to pay loadings to academic staff. We also added a question on freedom over degree programs offered, which strengthens our overall measure by adding an indicator of academic autonomy. Autonomy in the public sector is less critical if there is a large private sector. For this reason, in the measure of the diversity of institutions, an extra weight is given to countries where over 50 per cent of university students are enrolled in independent private institutions. The presentation of the components of the Environment module has been streamlined by separating out the World Economic Forum (WEF) survey results into a separate variable and eliminating sub-components. In order to give an appropriate weight to the new survey (4 per cent) the weight on the WEF survey has been reduced from an effective 7.6 per cent to 5 per cent; the weight on female imbalance in the student population, a variable with little variation given the way it is calculated, has been reduced from 2 to 1 per cent.

There have been some changes in the nature of the Webometrics data used in the Connectivity module. Google Scholar has returned as the source of the Openness variable, as it was in the 2013 ranking. (In the 2014 ranking the variable was based on Google.) Both of the web-based measures are now deflated by population rather than by the number of institutions included. The latter method is sensitive to the cut-off level for number of institutions included: the inclusion of small institutions with very low web presence can lower the mean substantially.

The measures of research output and its impact have been made more up-to-date by using data for the most recent year instead of using a five-year average. This favours countries with rapidly increasing research output.

Some weight changes have been made to components of the Output module. The weighting of one third (within the module) on total publications has been reduced to one quarter, with a corresponding increase in the weight on the rating of the best three universities in a country. We note in passing that the compilers of the Global Innovation Index have followed us and in 2013 introduced the best three university scores as a measure of the availability of higher education institutions of quality (www.globalinnovationindex.org). The weights on the other Output components have been rounded down from $3\frac{1}{3}$ to 3 per cent and the reductions added on to the measure of average impact of research. The new weights are given in the Output section below. These changes in weights do not make a large difference to the rankings because of the relatively high correlations between the relevant variables.

The results adjusted for levels of GDP per capita have been affected by the large changes in the IMF purchasing power parity estimates that were first published in October 2014. The net effect has been to increase the per capita GDP figures for low-income countries relative to high-income countries. A few changes have been made to the methodology used in obtaining the GDP-adjusted results and these are discussed in section 4.

3. Measures and Results

3.1 Resources (weight of 20%)

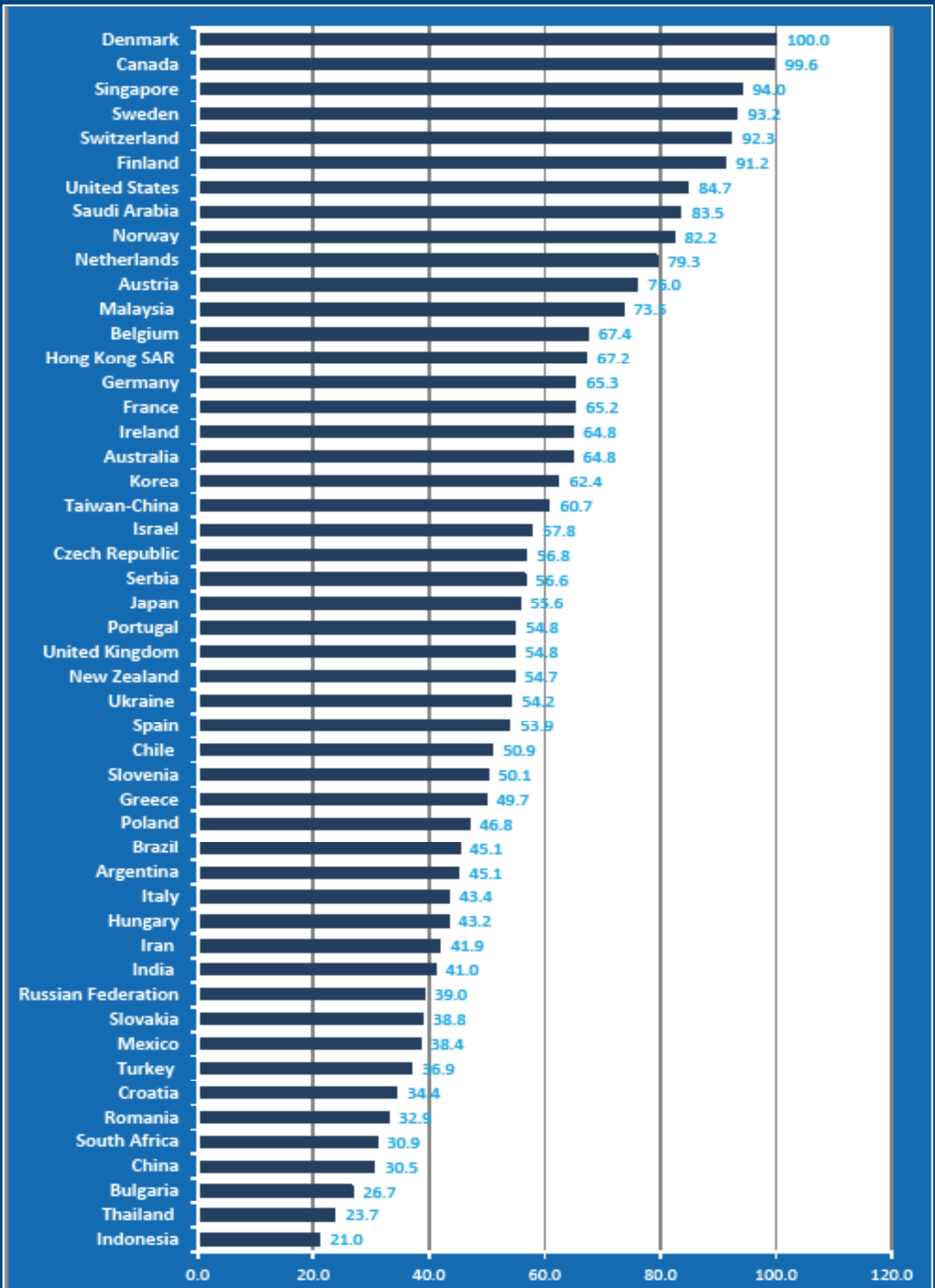
A necessary condition for a well-performing higher education system is that it is adequately resourced, whether by government or the private sector. One measure is expenditure by tertiary institutions as a share of GDP. But for low-income countries, especially those with a large student-age population, 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, the measure of resources per student in part serves as a proxy. The data for this variable are significantly better than in previous rankings (see sources in Appendix 1). For several countries approximations have been made for private expenditure using relative enrolment numbers and information on fees. 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 and their weights are:

- R1: (5%) Government expenditure on tertiary education institutions as a percentage of GDP, 2011.
- R2: (5%) Total expenditure on tertiary education institutions as a percentage of GDP, 2011.
- R3: (5%) Annual expenditure per student (full-time equivalent) by tertiary education institutions at USD purchasing power prices, 2011.
- R4: (2.5%) Expenditure in tertiary education institutions for research and development as a percentage of GDP, 2012.
- R5: (2.5%) Expenditure in tertiary education institutions for research and development per head of population at USD purchasing power prices, 2012.

The highest ranked countries for Resources in the 2015 rankings are Denmark and Canada. Singapore has risen six places to third and is followed in rank order by Sweden, Switzerland, Finland, and the United States. Compared with the 2014 ranking the largest improvement has occurred for the Czech Republic, up ten places to 22nd following increases in both government and private spending on higher education. The improvement in the ranking of Taiwan-China reflects improved data on research expenditure. Romania has fallen seven places in the ranking on Resources and three countries have fallen five places: New Zealand, Spain and the United Kingdom.

Canada has replaced the United States as the country with the largest total expenditure (public plus private) on higher education as a percentage of GDP. Resources per student, which includes research expenditure, are highest in Singapore, Canada and the United States. Denmark and Sweden continue to rank highest for research expenditure in tertiary institutions.

Resources



3.2 Environment (weight of 20%)

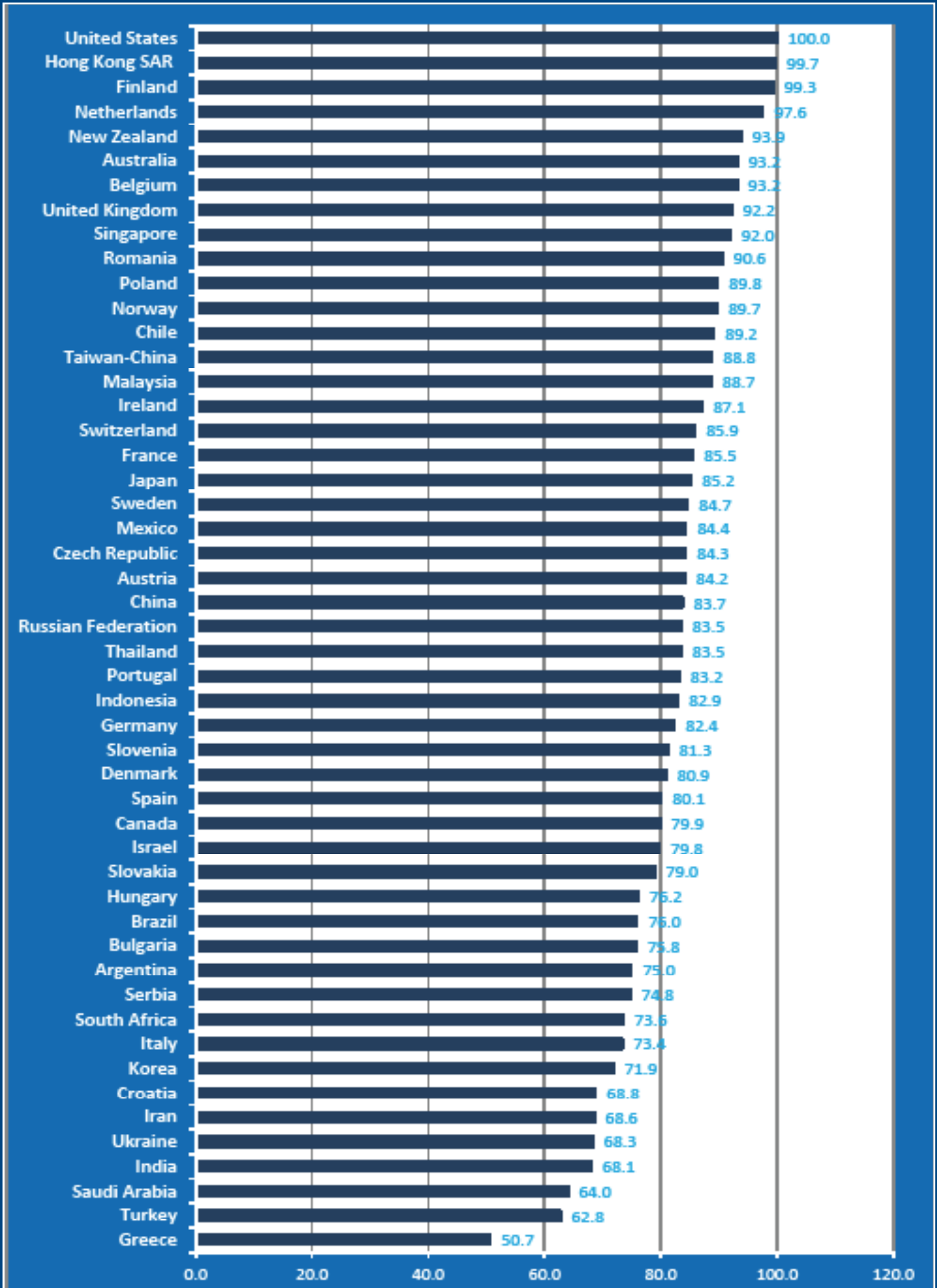
Resources are a necessary condition for excellence in tertiary education but they are not sufficient. A consensus is emerging that for a quality higher education system, institutions need considerable autonomy in areas such as budgets and degree offerings. But there needs to be appropriate external monitoring of performance. We use the results of two surveys to measure these concepts. Our measures are supplemented by the results of a survey carried out by the World Economic Forum (WEF) and four quantitative measures: female participation among both students and staff (capped at 50 per cent), a measure of diversity of institutions in the system, and the quality of data on higher education. Diversity encourages higher participation and promotes competition; data deficiencies are indicative of a lack of planning and evaluation of the higher education system. The measures we use and their weights are:

- E1: (1%) Proportion of female students in tertiary education, 2012.
- E2: (2%) Proportion of academic staff in tertiary institutions who are female, 2012.
- E3: (2%) A rating for data quality. For each quantitative series, the value is 2 if the data are available for the exact definition of the variable; 1 if some data are available which relate to the variable but some informed adjustment is required; and 0 otherwise.
- E4: (10%) Qualitative measure of the policy environment comprising:
 - (4%) survey results for the policy and regulatory environment (see Appendix 2).
 - (4%) for the new survey of financial autonomy (see Appendix 2).
 - (2%) a measure of diversity of the system defined as 1 if less than 90 per cent of university students are enrolled in any one of the three OECD categories: public, government dependent private, and independent private; 1.5 if more than 50 per cent of students are enrolled in independent private universities; and 0 otherwise.
- E5: (5%) Responses to WEF survey question (7-point scale): “how well does the educational system in your country meet the needs of a competitive economy?”.

The measure of the environment has been made more encompassing through the introduction of measures of the financial autonomy of public universities. This has produced some large changes compared with previous years for countries where there is a strong negative correlation between national monitoring and financial autonomy. For example, Switzerland, which scores much higher on financial independence than national monitoring, rises 18 places from the 2014 rankings to 17th; the reverse is true for Bulgaria, which falls 29 places in the Environment module to 38th. Interestingly, four countries where private universities dominate enrolments (Brazil, Indonesia, Japan and Korea) score relatively lowly on the financial autonomy of their public universities. Institutional financial autonomy of public universities is rated highest in Hong Kong SAR and the United Kingdom followed by the United States and Australia. No country scored over 90 per cent in this new survey.

The top-ranked countries in the Environment module are the United States, Hong Kong SAR and Finland. The Netherlands is fourth. The next ranked countries are New Zealand, Australia, Belgium, the United Kingdom and Singapore. Only in four countries for which data are available does the percentage of female staff in tertiary institutions exceed 50 per cent: Finland, Malaysia, Thailand and the Russian Federation. Business, as measured by the WEF survey, ranks the national education systems most highly in Switzerland, Finland and Singapore.

Environment



3.3 Connectivity (weight of 20%)

Connectivity encompasses the two-way flow of information between the higher education sector and the rest of society. 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. Connectivity promotes technical change and economic growth. A more detailed discussion of connectivity and its measurement is contained in de Rassenfosse and Williams (2015). We use six measures:

- C1: (4%) Proportion of international students in tertiary education, 2012.
- C2: (4%) Proportion of articles co-authored with international collaborators, 2012.
- C3: (2%) Number of open access full text files on the web, per head of population, 2009–2013.
- C4: (2%) External links that university web domains receive from third parties, per head of population, 2009–2013.

The data for C3 and C4 include all tertiary institutions ranked in the top 10,000 in the world.

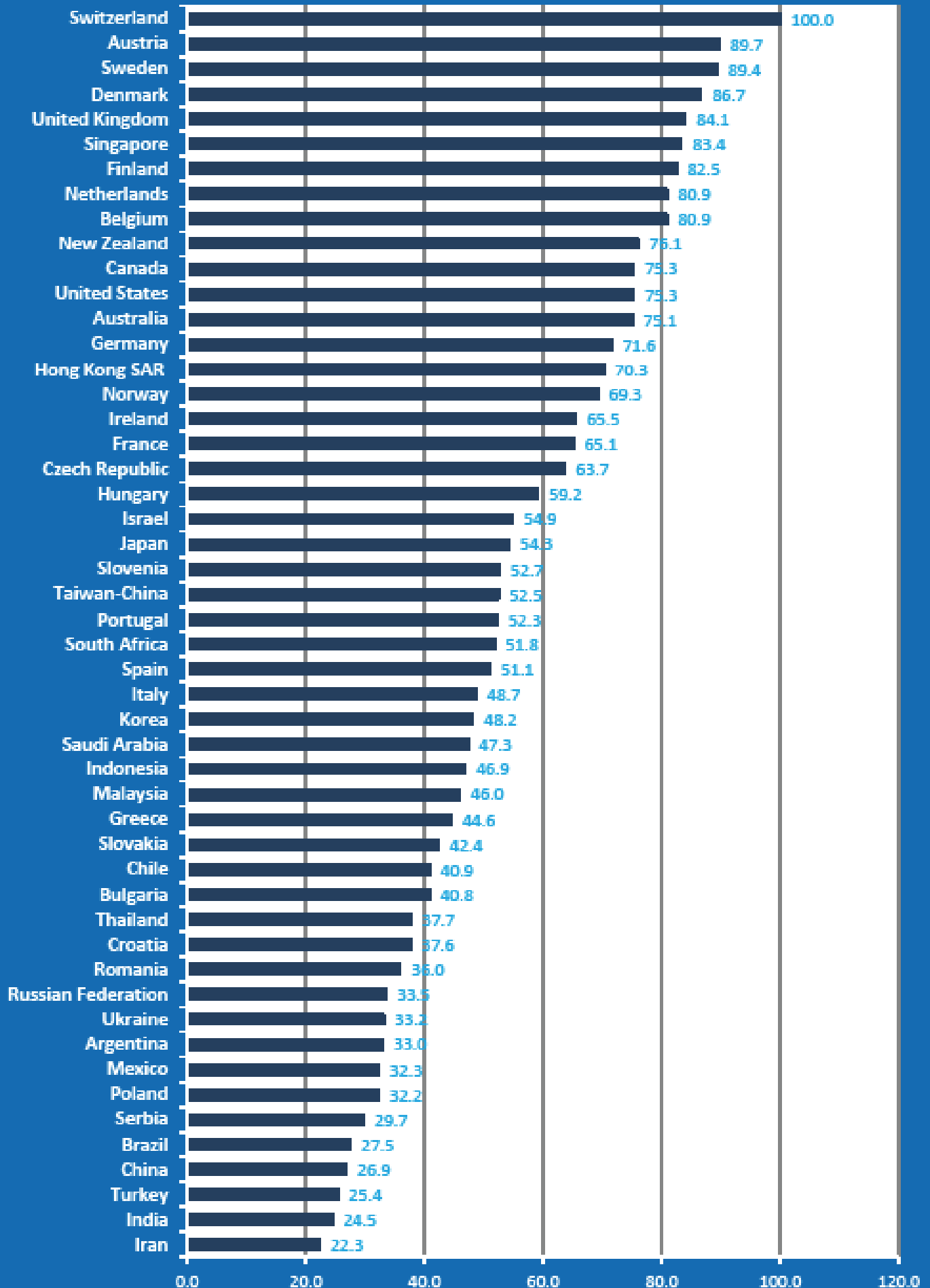
- C5: (4%) Responses to question 'Knowledge transfer is highly developed between companies and universities', asked of business executives in a survey by IMD World Development Centre, Switzerland, 2013.
- C6: (4%) Percentage of university research publications that are co-authored with industry researchers, 2009–2012.

The top six nations in rank order are Switzerland, Austria, Sweden, Denmark, the United Kingdom, and Singapore. These countries also formed the top six in the 2014 rankings but with some changes in order. The largest changes in rankings have occurred as a result of using more robust web measures: Japan has risen nine places to 22nd, while Thailand and Indonesia have fallen seven and six places respectively. The Czech Republic is ranked first for web presence and the United States is first for web impact. The improvement in the ranking of the Russian Federation from 48th to 40th is due to an improvement in the scores on most indicators of Connectivity.

Replacing three years of data with data for the most recent year has seen Saudi Arabia replace Switzerland as the country with the largest percentage of articles with an international co-author (70 per cent). Switzerland is now ranked third, with Hong Kong SAR keeping its second-ranked spot. The percentage of articles co-written with industry has increased in all countries with the mean rising from 3.5 to 4.6 per cent but improvements in the data base are likely to explain much of the increase. The share is over 8 per cent for the five top-ranked countries: Denmark, Sweden, Austria, Japan and the Netherlands, all of which were in the top five in the 2014 rankings. Belgium and Bulgaria show the largest increases.

The top four countries for knowledge transfer in the IMD survey of business executives are, in rank order, Switzerland, the United States, Finland and Singapore. Israel has slipped from first to fifth; Malaysia has risen from twelfth to sixth. The lowest ranked countries are in Eastern Europe. Singapore, Australia and the United Kingdom have the highest proportion of international students.

Connectivity



3.4 Output (weight of 40%)

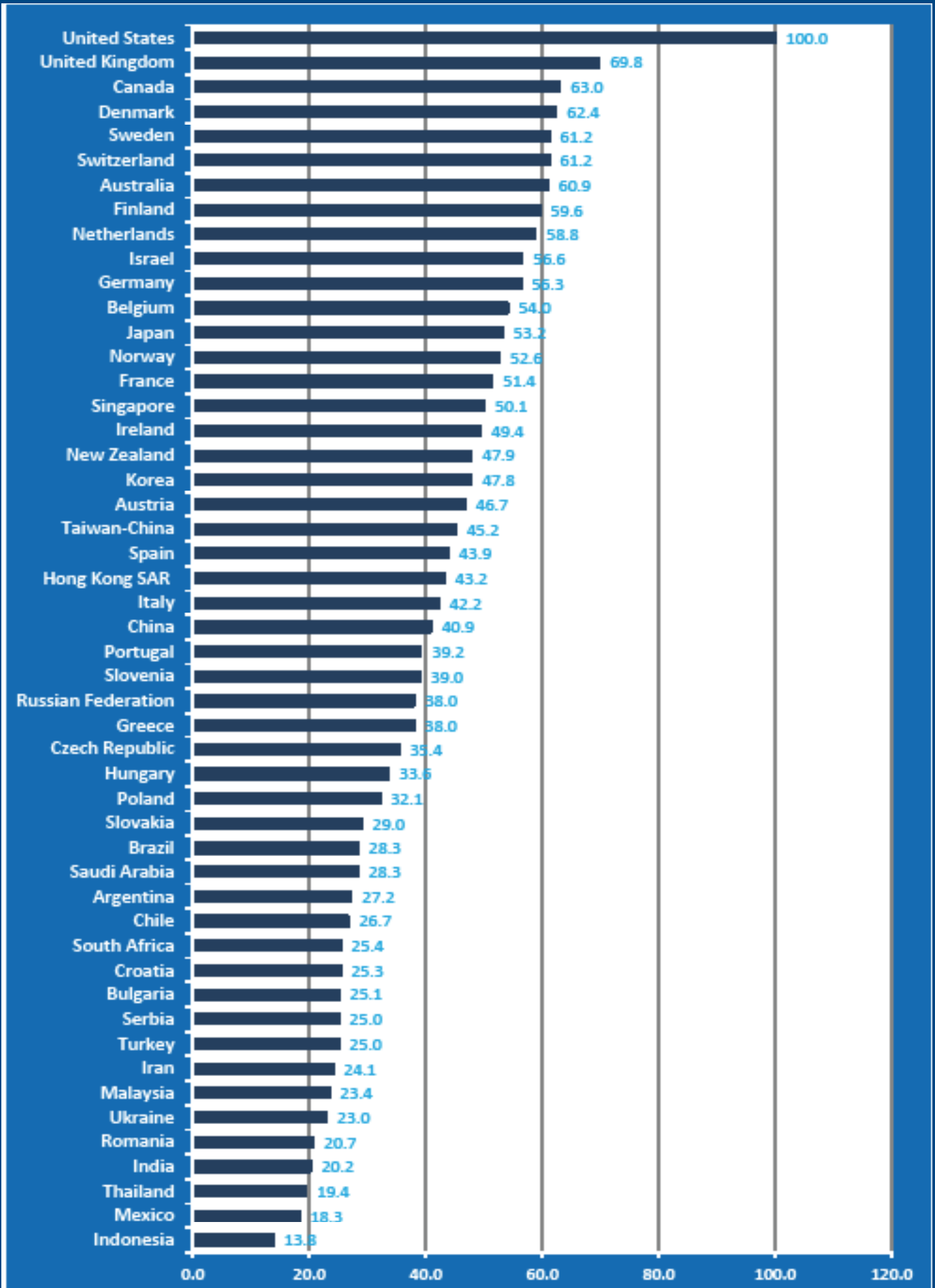
The measures used in this module encompass research output and impact, student throughput, the national stock of researchers, the quality of a nation's best universities, and employability of graduates. The variables are given below with the new weights (see section 2 for the changes).

- 1: (10%) Total articles produced by higher education institutions, 2012.
- 2: (3%) Total articles produced by higher education institutions per head of population, 2012.
- 3: (5%) Average impact of articles as measured by citations in 2012 to articles published in previous years using the Karolinska Institute normalized impact factor.
- 4: (3%) The depth of world class universities in a country. This is calculated as a weighted average of the number of institutions listed in the top 500 according to the 2014 Shanghai Jiao Tong rankings, divided by country population. The weights used are the scores out of 100 for each university.
- 5: (7%) The research excellence of a nation's best universities calculated by averaging the 2014 Shanghai Jiao Tong scores for the nation's three best universities.
- 6: (3%) Enrolments in tertiary education as a percentage of the eligible population, defined as the five-year age group following on from secondary education, 2012.
- 7: (3%) Percentage of the population aged 25–64 with a tertiary qualification, 2012.
- 8: (3%) Number of researchers (full-time equivalent) in the nation per head of population, 2012.
- 9: (3%) 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, 2012.

The top three countries in the Output module are the United States, the United Kingdom and Canada, the same as in the 2014 ranking. Denmark has risen three places to fourth and Sweden and Switzerland are equal fifth. Israel has improved four places and is now ranked tenth. Saudi Arabia shows the largest increase, rising 11 places to 35th, due to improvements in the number and quality of research output. South Africa rises five places to 38th.

The number of articles produced by Chinese tertiary institutions has now reached two-thirds of the United States total. Publications per head of population are highest in Denmark, Sweden, Australia and Switzerland: an unchanged top four. The more current measure of the average research impact of articles has led to changes in rankings, with the top three countries now Switzerland, the United States and the United Kingdom. The Russian Federation and Italy have improved their ranking but India has fallen. Participation rates (○6) are highest in Greece, Korea, the United States and Canada. Russia remains the country with the highest-qualified workforce, followed by Canada, Japan and Israel. The national stock of researchers relative to population is highest in Finland, followed by Denmark, Israel and Singapore. Relative unemployment of the tertiary educated (○9) is lowest in Hungary, Germany, Ireland and the Czech Republic.

Output

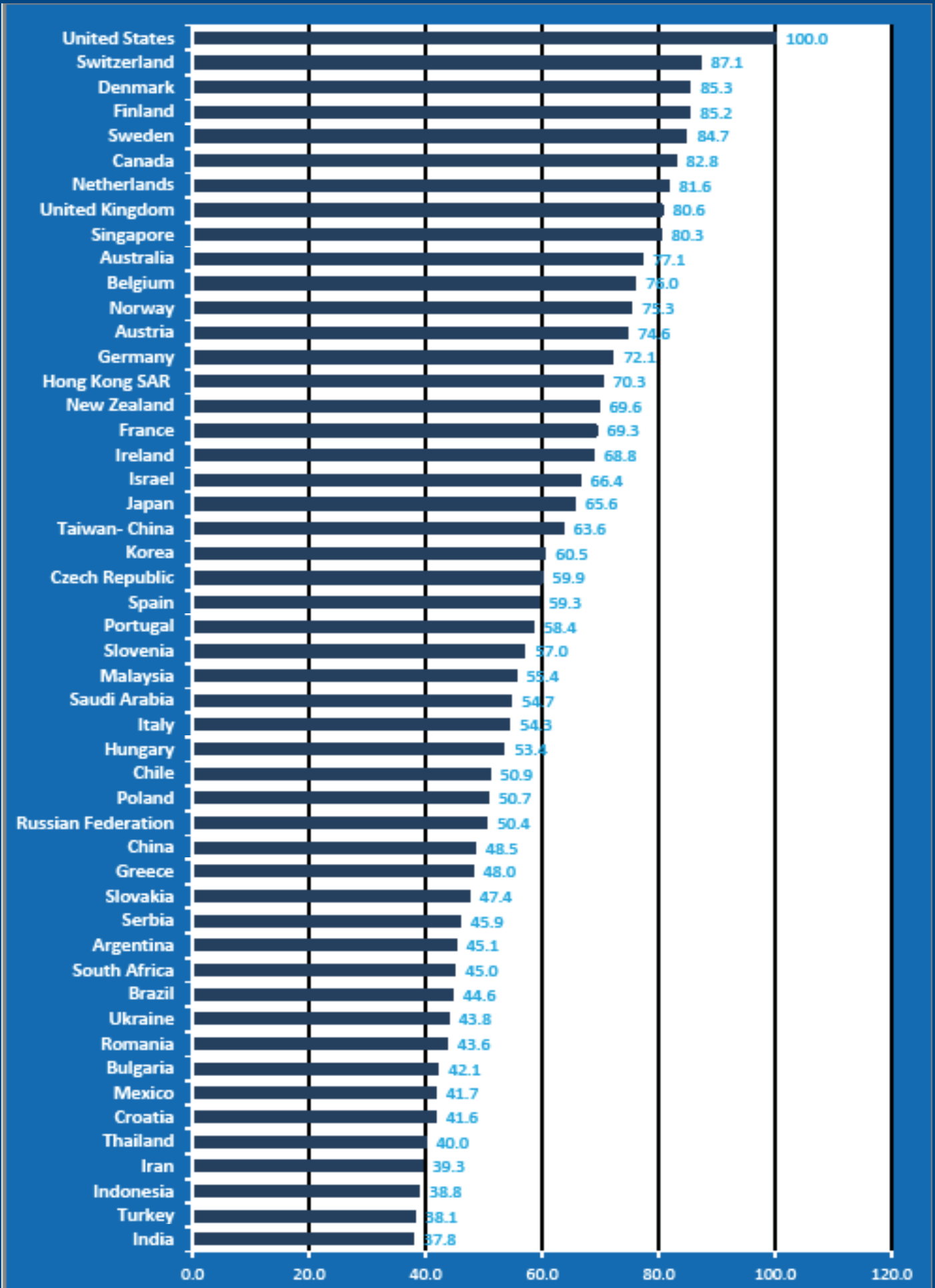


3.5 Overall Ranking

Using a weight of 40 per cent on Output and 20 per cent on each of the other three modules, the top ten countries are the same as in 2014 but the order has changed a little. Switzerland has remained first for Connectivity and improved its score in all of the other three modules to rise from sixth to second place after the United States. Denmark and Finland are close enough to be ranked as equal third, followed in rank order by Sweden, Canada, the Netherlands, the United Kingdom, Singapore and Australia. The largest change among all fifty countries is a rise of six places to 39th for South Africa. The Russian Federation has risen three places to 33rd, but Eastern European countries have fallen a little. Greece has fallen three places to 35th. The fall of four places for Thailand is partly explained by our use of a more robust measure of web-based connectivity.

This data can be seen in table format on pages 8 and 9.

Overall Ranking



4. Methodology of adjusting for levels of economic development

In order to adjust for national levels of income we regress the values for each variable, in original form, on a function of GDP per capita using data for all 50 countries. The GDP we use is for 2012 in US dollars, measured in Purchasing Power Parity (PPP) terms. 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 the two Output variables based on the Shanghai rankings (O4 and O5) the presence of zero values limits the use of regression, so instead we rank the countries by GDP per head and take a moving average of actual scores to derive a more robust estimate of predicted values. The regressions for the two web-based Connectivity measures (C3 and C4) include only countries with GDP per head above USD14,000; for countries below that level the expected value is the mean score for those 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).

In aggregating over variables we use deviations from the regression line as a percentage of the average of the actual and predicted values. To use the percentage deviations from the line would ignore 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 that are half what is expected at a given level of GDP per capita have the same influence as values that are double those expected. By construction, our calculated deviations lie in the range -200 per cent to +200 per cent. This method of measuring deviations needs to be borne in mind when interpreting the weighted average numerical scores for each module and for the overall ranking.

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 in each case 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 four Resources measures has a weight of 5 per cent in the overall ranking. In the Output module we use as a single publication measure the number of articles divided by GDP, thus combining O1 and O2. In the 2014 GDP-adjusted rankings we used equal weights on all eight measures of Output; in this year's rankings we use the weights employed in the non-adjusted Output rankings (section 3.4 above). More than usual care is therefore needed in comparing results over two years: they are influenced by the big changes in the IMF estimates of GDP in Purchasing Power Parity terms and in some changes in the Output weights.

5. Results after adjusting for levels of economic development

5.1 Resources

The top four countries devoting greater resources to higher education than is expected at their level of GDP per capita are Serbia, Ukraine, Malaysia and India. The scores for these countries range from 36 to 58 per cent above the expected values. The high values for Serbia and Ukraine are at least partly explained by the combination of 'sticky' expenditure on higher education and a fall in GDP per capita in 2012. The top four countries are followed in order by four high-income countries: Denmark, Canada, Finland and Sweden. The largest improvement compared with the non-adjusted rankings is by China, which rises 32 places to 15th.

Compared with the 2014 GDP-adjusted rankings, the largest change has been a rise of 27 places by the Czech Republic to 13th; South Africa and Iran have risen by 22 and 20 places respectively, and Romania has fallen 23 places.

Turning to the four variables that make up the Resources module, expenditure as a percentage of GDP (R1 and R2) shows only a very marginal increase with levels of national income, so that the ranking is similar to that described in section 2. An exception is India, which rises to fifth for government expenditure. On the other hand, expenditure per student varies markedly with income levels: for each USD1,000 increase in GDP per capita, expenditure per student rises on average by USD407 ($R^2 = 0.82$). Recall, however, that expenditure includes all activities, including research. Allowing for per capita GDP levels brings large changes to the ranking of expenditure per student. The top five countries that spend highly relative to GDP per head are India, Brazil, Malaysia, Serbia and Canada. (The Brazilian data relate only to public institutions.) The United States remains relatively highly ranked at seventh place. The top five countries for expenditure on research and development relative to income levels are Serbia, Denmark, South Africa, Turkey and Sweden.

5.2 Environment

The creation of a favourable environment does not depend on income levels, although it can be expected to improve future income levels. For this reason we do not use regression analysis for this module but instead deviate scores from mean values for each of the five components. (In practice only the WEF survey score increases with GDP per capita.) The adopted approach means that the rankings are similar to those obtained when we did not adjust for income levels. The scores for the top four countries (the United States, Hong Kong SAR, Finland and the Netherlands) are nearly 20 per cent above the average for all countries.

5.3 Connectivity

We have argued elsewhere (de Rassenfosse and Williams (2015)) that connectivity is especially important for developing countries. International connectivity facilitates the import of ideas and innovations, while domestic links promote adaptation to national needs. In the income-adjusted rankings South Africa is again ranked first overall for Connectivity and top five for all but the web-based measures. After South Africa, Indonesia is the next highest ranked developing country at 17th overall; top two for the measures of the interaction with business (C5 and C6) and fourth for joint publications with international authors (C2). However, high-income countries occupy more of the top spots than in the 2014 rankings, in part due to the compression of national income differentials in the new official estimates of GDP per capita. For this module the United Kingdom is ranked second, New Zealand third and Switzerland fourth.

5.4 Output

The top five countries for Output relative to their income levels are Serbia, Portugal, Israel, the United Kingdom and China. Turning to the components, Serbia, India and Portugal are the top three for publications relative to (total) GDP. South Africa, India and the United Kingdom do best for the average impact of publications per head after adjusting for income levels: ranging from 32 per cent above the expected value for the United Kingdom to nearly 60 per cent above for South Africa and India. Relative to income levels, the quality of the best three national universities (O5) is highest in China and the United States; next in order are Brazil, South Africa and the United Kingdom.

Enrolment rates increase noticeably with income levels and when this is allowed for the highest rates are in Ukraine, Greece, Korea, the United States, Norway and Canada. Interestingly, Ukraine also ranks first for the percentage of the workforce with a tertiary qualification and the number of researchers per head, but ranks very lowly on all the other Output measures. The Russian Federation and Israel have the next highest qualified workforce relative to income levels. After Ukraine, the number of researchers per head of population is highest in China, Israel, Portugal and Finland. 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: 20 per cent for each of Resources, Environment and Connectivity and 40 per cent for Output. These scores are only indicative of absolute performance. The median score is -7.5 per cent, so that any country with a score above this is performing better than the average for those countries we cover.

The top five countries are, in rank order, Serbia, the United Kingdom, Denmark, Sweden and Finland. These were all ranked in the top six last year. The three Nordic countries are also in the top five when no adjustment is made for income levels: their high rank across years and methodologies is quite a remarkable result which shows the high standing of their higher education systems.

Looking at countries with income levels below USD20,000 (PPP), China ranks next after Serbia, followed by India and Brazil.

Measures Adjusted for Levels of Economic Development

Rank	Resources	% dev	Environment	% dev	Connectivity	% dev	Output	% dev
1	Serbia	57.8	United States	19.8	South Africa	40.0	Serbia	45.9
2	Ukraine	38.7	Hong Kong SAR	19.6	United Kingdom	31.1	Portugal	32.2
3	Malaysia	38.4	Finland	19.3	New Zealand	28.3	Israel	32.2
4	India	35.7	Netherlands	17.8	Switzerland	25.8	United Kingdom	31.6
5	Denmark	31.5	New Zealand	13.7	Austria	23.2	China	24.8
6	Canada	31.0	Australia	13.2	Sweden	22.4	Denmark	21.6
7	Finland	26.7	Belgium	13.0	Czech Republic	21.7	Sweden	20.0
8	Sweden	24.5	United Kingdom	12.0	Hungary	21.1	South Africa	15.6
9	Saudi Arabia	17.6	Singapore	11.6	Denmark	18.2	Australia	14.5
10	Brazil	16.9	Romania	9.3	Belgium	14.2	Canada	13.0
11	Switzerland	7.9	Norway	9.2	Finland	13.0	Finland	11.4
12	Portugal	7.0	Poland	8.1	Canada	9.5	New Zealand	11.1
13	Czech Republic	5.0	Chile	7.6	Netherlands	5.9	United States	9.9
14	Netherlands	4.1	Malaysia	7.3	Australia	5.0	Switzerland	8.9
15	China	2.9	Taiwan-China	5.7	Portugal	4.3	Brazil	8.0
16	Iran	2.3	Ireland	4.3	Bulgaria	2.6	Netherlands	5.7
17	Austria	1.8	France	3.2	Indonesia	-1.8	Belgium	5.4
18	Poland	-1.5	Switzerland	3.0	Thailand	-2.5	Hungary	5.0
19	Belgium	-3.3	Sweden	2.5	Germany	-3.5	India	4.0
20	Israel	-3.8	Austria	2.0	Ukraine	-5.2	Greece	1.8
21	United States	-3.8	Czech Republic	2.0	Romania	-12.4	Slovenia	-3.4
22	France	-4.5	China	1.7	Slovenia	-12.9	Singapore	-4.6
23	South Africa	-5.2	Japan	1.6	Greece	-13.3	Spain	-5.7
24	Korea	-6.9	Portugal	1.2	Singapore	-14.4	Korea	-7.0
25	Singapore	-8.8	Indonesia	1.1	Hong Kong SAR	-14.5	Poland	-7.7
26	Spain	-9.8	Thailand	0.7	United States	-14.7	Norway	-9.4
27	Germany	-10.2	Russian Federation	0.6	France	-15.6	France	-10.7
28	Greece	-10.3	Mexico	0.0	Ireland	-17.0	Iran	-11.2
29	New Zealand	-10.5	Germany	-0.5	Spain	-17.4	Germany	-11.7
30	Hungary	-11.3	Slovenia	-1.2	India	-18.5	Ireland	-18.0
31	Slovenia	-12.0	Denmark	-2.0	Serbia	-21.0	Japan	-18.0
32	Mexico	-13.3	Israel	-3.3	Malaysia	-21.8	Chile	-18.5
33	Turkey	-13.5	Spain	-3.3	Slovakia	-28.9	Czech Republic	-18.7
34	Australia	-13.7	Canada	-3.9	Norway	-32.6	Malaysia	-19.4
35	Norway	-13.8	Slovakia	-6.3	Italy	-33.0	Taiwan-China	-20.1
36	United Kingdom	-14.5	Hungary	-8.3	Israel	-33.5	Italy	-22.8
37	Ireland	-14.8	Bulgaria	-9.3	Brazil	-33.7	Austria	-23.6
38	Chile	-16.5	Brazil	-9.9	Japan	-37.6	Hong Kong SAR	-25.2
39	Argentina	-16.7	Serbia	-10.8	China	-37.6	Turkey	-31.4
40	Taiwan-China	-16.8	Argentina	-11.0	Taiwan-China	-40.3	Argentina	-38.8
41	Japan	-17.2	Italy	-12.2	Korea	-44.1	Croatia	-45.2
42	Hong Kong SAR	-20.1	Korea	-13.9	Chile	-44.8	Russia	-46.0
43	Croatia	-26.6	South Africa	-14.7	Poland	-46.4	Ukraine	-49.4
44	Slovakia	-28.7	Iran	-18.9	Russia	-49.0	Mexico	-63.2
45	Romania	-30.4	Ukraine	-20.1	Croatia	-50.1	Romania	-63.5
46	Italy	-35.8	India	-20.2	Mexico	-55.2	Slovakia	-68.5
47	Russia	-36.8	Croatia	-20.3	Turkey	-60.3	Bulgaria	-70.6
48	Thailand	-51.2	Saudi Arabia	-26.8	Saudi Arabia	-67.2	Saudi Arabia	-82.3
49	Bulgaria	-53.8	Turkey	-30.0	Argentina	-71.4	Thailand	-82.7
50	Indonesia	-55.8	Greece	-55.7	Iran	-77.5	Indonesia	-125.6

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

Overall Ranking Adjusted

Rank	Country	% dev
1	Serbia	23.5
2	United Kingdom	18.4
3	Denmark	18.2
4	Sweden	17.9
5	Finland	16.4
6	Portugal	15.3
7	Canada	12.5
8	Switzerland	10.9
9	New Zealand	10.7
10	South Africa	10.2
11	Netherlands	7.8
12	Belgium	6.9
13	Australia	6.7
14	Israel	4.7
15	United States of America	4.2
16	China	3.4
17	Hungary	2.3
18	India	1.0
19	Czech Republic	-1.8
20	Brazil	-2.2
21	Malaysia	-2.9
22	Austria	-4.0
23	Singapore	-4.2
24	Slovenia	-6.6
25	France	-7.4

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

for Levels of Economic Development

Rank	Country	% dev
26	Germany	-7.5
27	Spain	-8.4
28	Poland	-11.1
29	Norway	-11.2
30	Ireland	-12.4
31	Hong Kong SAR	-13.1
32	Greece	-15.2
33	Korea	-15.8
34	Ukraine	-17.1
35	Japan	-17.8
36	Taiwan-China	-18.0
37	Chile	-18.2
38	Iran	-23.3
39	Italy	-25.3
40	Romania	-32.1
41	Turkey	-33.3
42	Argentina	-35.4
42	Russian Federation	-35.4
44	Croatia	-37.5
45	Mexico	-39.0
46	Slovakia	-40.2
47	Bulgaria	-40.4
48	Thailand	-43.7
49	Saudi Arabia	-48.2
50	Indonesia	-61.6

6. Concluding Remarks

Looking back on four years of national higher education system rankings, there is considerable stability in the scores even though there have been some changes in weights, and variables have been added. Comparing the (unadjusted for income) 2015 ranking with the 2013 ranking (the first to cover fifty countries), 36 countries moved by two or fewer places. The larger movements by and large correspond to what we know about economic developments, which suggests they are real changes and not just reflecting changes in methodology or data. The greatest changes are an improvement by China of eight places, an improvement by South Africa of seven places and a fall by Ukraine of seven places. Chile and Hungary improved by four places; Bulgaria and Serbia fell five places and Greece, Spain and Turkey fell by four places.

Another feature of our data, not unexpectedly, is the high correlation between the four modules (the correlation coefficients are all over 0.9). This means that modest changes in weights do not have a great effect on the overall ranking. Interestingly, the highest correlation (0.987) is between the Connectivity and Resources scores. While causality can run both ways, the results suggest that it pays the higher education sector to be engaged with those who fund it – perhaps not a surprising conclusion! At the more micro level, the strongest relationship is between expenditure by tertiary institutions on R&D and the quality of research output.

In principle a series of annual rankings can throw light on the question of whether or not there is country convergence, that is, are the countries with weaker higher education systems catching up? If we use the standard deviation of the scores as a measure, there is no evidence of any significant convergence of performance.

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 of looking at how income levels influence the performance of higher education is to look at how tertiary education systems can best contribute to GDP growth. Our work provides results that enable this issue to be explored at a more disaggregated level than usual. For example, how important 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 addition, such work would be strengthened by the inclusion of more low-income countries. While there have been some noticeable improvements in the quality of the data for our fifty included countries, the inclusion of additional countries must await better data.

Appendix & References

Appendix 1: Sources

- R1 & R2: OECD, Education at a Glance, 2014, Table B2.3 and UNESCO, Institute for Statistics (www.uis.unesco.org)
- R3: OECD, Education at a Glance, 2014, 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 & R5: UNESCO, Institute for Statistics and IMF, Data and Statistics
- E1 & E2: UNESCO, Institute for Statistics
- E4: OECD, Education at a Glance 2014, Table C1.5; UNESCO; surveys as described in Appendix 2
- E5: World Economic Forum, The Global Competitiveness Report 2014–15, Table 5.03, p. 462
- C1: OECD, Education at a Glance 2014, Table C3.1; UNESCO
- C2: SCImago data, Scopus data bank (www.scimagoir.com)
- C3 & C4: Webometrics (www.webometrics.info), July 2014 version
- C5: IMD World Competitiveness Yearbook 2014, World Competitiveness Center, Institute for Management Development, Lausanne, Switzerland
- C6: Professor Robert Tijssen and Alfredo Yegros-Yegros, CWTS, Leiden University
- O1, O2 & O3: SCImago data, Scopus data bank (www.scimagoir.com)
- O4 & O5: Shanghai Jiao Tong University Rankings, 2014 (www.shanghairanking.com)
- O6: OECD, Education at a Glance, 2014, Table C1.1a and UNESCO, Institute for Statistics
- O7: OECD, Education at a Glance, 2014, Table A1.3, ILOSTAT data base (www.ilo.org), UNESCO, Institute for Statistics
- O8: UNESCO, Institute for Statistics
- O9: OECD, Education at a Glance, 2014, Table A5.4a; ILOSTAT data base (www.ilo.org), UNESCO Institute for Statistics

Appendix 2: The survey components of E4: qualitative measure of the environment

The initial U21 ranking included a rating of each country's regulatory and policy environment based on: the degree of monitoring (and its transparency) of tertiary institutions, freedom of employment conditions, and who chooses the CEO. Only a few updates to this survey have been subsequently made. Details may be found in Williams et al (2013) and at www.universitas21.com.

In the 2015 rankings the coverage has been extended through the inclusion of the results of a second survey mainly concerned with the degree of financial independence of public universities in each country. The survey questions, with weights, are given below; the categories of responses draw on those used by the European University Association (EUA). Responses for the 16 countries with universities that are members of U21 were provided by institutions in those countries, supplemented by other respondents; data for most other European universities were obtained from the EUA Autonomy in Europe website (www.university-autonomy.eu). Responses for the remaining countries were obtained from university representatives, government agencies and published surveys. The weights are closely aligned to those used by the EUA.

Appendix 3: Questionnaire on financial autonomy of publicly funded universities

Maximum Score of 32

1. Type of core public funding (10 points)
 - Detailed line-item budget with no or very limited ability to move across items (0)
 - Block grant is split into broad categories with no or limited possibilities to move funds between categories (6)
 - Block grant with no or minimal restrictions on internal allocation (10)
2. Do institutions have the ability to make market-adjustment allowances for academic staff in fields with high market demand? (4)
 - No (0)
 - Yes (4)
3. To what extent are institutions permitted to keep cash surpluses? (4)
 - Surplus cannot be kept (0)
 - Surplus can be kept subject to restrictions, such as a maximum amount or approval by an external authority (3)
 - Surplus can be kept with no or minor restrictions (4)
4. What ability do institutions have to borrow money? (4)
 - Institutions cannot borrow money (0)
 - Institutions can borrow money subject to restrictions, such as a maximum amount or approval by an external authority (3)
 - Institutions can borrow money without restriction (4)
5. To what extent can public institutions levy tuition fees for national (domestic) students at the Bachelor degree level? (5)
 - Tuition fees are not permitted (0)
 - Tuition fees are set by an external authority (1)
 - Institutions are free to set tuition fees subject to some restrictions, such as a ceiling, set by an external authority (2)
 - Institutions are completely free to set the level of tuition fees (5)
6. What freedom do institutions have over Bachelor degree programs offered? (5)
 - Institutions must obtain external approval for all new degree programs (0)
 - There is freedom over degree programs offered except for major changes that require substantial government funding (4)
 - There is complete freedom over degree programs offered (5)

Two additional questions related to whether performance measures were used in allocating funds for (i) teaching and (ii) block grants for research. These are not included in the ranking measure.

Further Information on the U21 Rankings

de Rassenfosse, G. and Williams, R. 2015 'Rules of Engagement: Measuring Connectivity in National Systems of Higher Education', Higher Education (Springer). DOI 10.1007/s10734-015-9881-y

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

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Williams, R. and de Rassenfosse, G., 2014 'Pitfalls in Aggregating Performance Measures in Higher Education', Studies in Higher Education. DOI 10.1080/03075079.2014.914912

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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@universitas21.com
www.universitas21.com