# U21 RANKING OF NATIONAL HIGHER EDUCATION SYSTEMS 2017


MELBOURNE INSTITUTE
of Applied Economic and Social Research

UNIVERSITAS 21

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## A project sponsored by *Universitas 21*

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# Contents

# Executive Summary

A quality system of higher education should be congruent with national aims and personal desires and aptitudes. This requires a diverse system of higher education which cannot be evaluated solely on the basis of the performance of research-intensive universities. This report presents the results for the sixth annual *Universitas 21* ranking of national systems of higher education and explains the methodology. Fifty national systems of higher education, from all continents, are evaluated on the basis of 25 attributes. Variables are standardised for population size. Countries are ranked overall and in each of four areas: Resources, Environment, Connectivity and Output.

Resources, whether public or private, are a necessary condition for 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. A consensus is emerging that the preferred environment is one where institutions are allowed considerable autonomy tempered by external monitoring and competition. The Environment module measures the extent to which national systems meet these criteria.

The Output measures encompass attributes such as participation rates, research performance, the existence of some world class universities, and employability of graduates. There is a world-wide trend for governments to encourage institutions of higher education to strengthen relationships with business and the rest of the community. International links are also important for the transmission of knowledge. Six such linkage measures are included in our Connectivity module.

The highest ranked countries for Resources are Sweden, Denmark, Canada, Singapore, Switzerland and the United States. The Environment for higher education is ranked best in the United States, New Zealand, Australia, Singapore, the United Kingdom and Hong Kong SAR. Switzerland is a clear leader in Connectivity followed by the United Kingdom, Austria, Denmark, the Netherlands and Sweden. For the Output module, the United States is ranked first, followed by the United Kingdom; then follow a group of five countries: Australia, Canada, Denmark, Sweden and Switzerland. Comparing changes in Output rankings since the 2013 ranking, the six largest improvers have been China, Malaysia, Russia, Saudi Arabia, Singapore and South Africa.

The results for each module are combined into an overall ranking using weights of 40 per cent for Resources and 20 per cent for each of the other three modules. The top five countries in the overall ranking are, in rank order, the United States, Switzerland, the United Kingdom, Denmark and Sweden.

An important aim of our work is to permit countries to benchmark performance against other countries at similar stages of development. In order to facilitate these comparisons, we present estimates of a country's performance relative to its level of GDP per capita. The top six countries are now, in alphabetical order, Denmark, Finland, New Zealand, Serbia, South Africa and the United Kingdom.

A subsidiary ranking of performance in research, teaching and engagement for 30 countries incorporates measures of the literacy and numeracy competencies of tertiary students and recent graduates. The highest competency scores are achieved in Finland, the Netherlands, Austria and Sweden.

# U21 RANKING 2017

| Rank | 2016 | Country | Score | 2016 |
|---|---|---|---|---|
| 1 | 1 | United States | **100** | 100 |
| 2 | 2 | Switzerland | **86.9** | 87.2 |
| 3 | 4 | United Kingdom | **85.5** | 84.3 |
| 4 | 3 | Denmark | **83.5** | 84.8 |
| 5 | 5 | Sweden | **83.4** | 82.2 |
| 6 | 8 | Singapore | **80.8** | 80.6 |
| 7 | 9 | Canada | **80.2** | 79.6 |
| 8 | 7 | Netherlands | **80.0** | 81.6 |
| 9 | 6 | Finland | **79.9** | 82.0 |
| 10 | 10 | Australia | **79.6** | 77.6 |
| 11 | 13 | Austria | **75.0** | 74.7 |
| 12 | 11 | Belgium | **74.2** | 75.7 |
| 13 | 12 | Norway | **73.9** | 75.3 |
| 14 | 15 | Hong Kong SAR | **73.7** | 70.9 |
| 15 | 14 | New Zealand | **72.1** | 70.9 |
| 16 | 16 | Germany | **68.8** | 70.3 |
| 16 | 18 | Israel | **68.8** | 67.6 |
| 18 | 17 | France | **67.5** | 68.3 |
| 19 | 19 | Ireland | **66.7** | 65.2 |
| 20 | 20 | Japan | **63.2** | 64.2 |
| 21 | 21 | Taiwan-China | **60.7** | 62.4 |
| 22 | 23 | Korea | **59.0** | 59.7 |
| 23 | 24 | Spain | **57.3** | 58.3 |
| 24 | 22 | Czech Republic | **56.9** | 60.0 |
| 25 | 27 | Malaysia | **56.7** | 54.4 |

| Rank | 2016 | Country | Score | 2016 |
|---|---|---|---|---|
| 25 | 28 | Saudi Arabia | **56.7** | 53.8 |
| 27 | 25 | Portugal | **55.8** | 56.6 |
| 28 | 29 | Italy | **54.5** | 53.8 |
| 28 | 26 | Slovenia | **54.5** | 56.0 |
| 30 | 30 | China | **52.7** | 51.8 |
| 31 | 31 | Hungary | **50.8** | 51.6 |
| 32 | 32 | Poland | **50.0** | 50.8 |
| 33 | 34 | Russia | **49.9** | 49.1 |
| 34 | 33 | Chile | **49.4** | 49.7 |
| 35 | 36 | Greece | **47.7** | 47.0 |
| 35 | 42 | Ukraine | **47.7** | 42.1 |
| 37 | 37 | South Africa | **46.6** | 45.6 |
| 38 | 35 | Slovakia | **45.9** | 47.8 |
| 39 | 39 | Serbia | **44.1** | 43.9 |
| 40 | 45 | Turkey | **44.0** | 40.7 |
| 41 | 40 | Argentina | **43.5** | 43.7 |
| 42 | 38 | Brazil | **43.1** | 45.1 |
| 43 | 46 | Croatia | **42.5** | 40.5 |
| 44 | 41 | Romania | **41.6** | 42.4 |
| 45 | 48 | Bulgaria | **40.2** | 39.2 |
| 46 | 43 | Mexico | **40.0** | 41.3 |
| 47 | 44 | Thailand | **39.7** | 40.7 |
| 48 | 47 | Iran | **38.4** | 39.7 |
| 49 | 49 | India | **36.7** | 38.0 |
| 50 | 50 | Indonesia | **33.3** | 36.9 |

# 1. Introduction

This report presents the results for the sixth annual ranking of national systems of higher education undertaken under the auspices of the *Universitas 21* (U21) group of universities. The national ranking of systems complements the many international rankings of universities. The rankings of institutions are essentially rankings of research-intensive universities and as such are encouraging a bias in systems of higher education towards that type of institution. A good system of higher education will encompass a range of institutions. The need for a diverse system is cogently argued by the former tertiary education co-ordinator at the World Bank, Jamil Salmi (2017, p.237):

*At the end of the day, the best tertiary educations systems are not those that boast the largest number of highly ranked universities. Governments should worry less about increasing the number of world-class universities and dedicate more efforts to the construction of world-class systems that encompass a wide range of good quality and well-articulated tertiary education institutions with distinctive missions, able to meet collectively the great variety of individual, community and national needs that characterise dynamic economies and healthy societies.*

We use 25 measures of performance grouped into four modules: Resources, Environment, Connectivity and Output. The first two are input measures and the second pair measure outcomes. For each variable, 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. A description of each variable is given in the relevant section and sources are given in Appendix 1. Our methodology is set out in detail in Williams, de Rassenfosse, Jensen and Marginson (2013).

Resources, whether public or private, are a necessary condition for 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. A consensus is emerging that the preferred environment is one where institutions are allowed considerable autonomy tempered by external monitoring and competition. The Environment module contains measures of these characteristics.

Turning to outcomes, our output measures encompass attributes such as participation rates, research performance, the existence of some world class universities, and employability of graduates. There is a world-wide trend for governments to encourage institutions of higher education to strengthen relationships with business and the rest of the community. The Connectivity module includes variables which span this wider concept (see de Rassenfosse and Williams (2015)).

Our work extends well beyond ranking. Countries can benchmark performance over a range of attributes, noting strengths in some areas, weaknesses in others. To permit countries to benchmark performance against other countries at similar stages of development, we also present estimates of a country's performance relative to its level of GDP per capita. In a new initiative we present national rankings for the three main activities of tertiary institutions: research, teaching and connectivity/ engagement.

# 2. Changes in Data and Methodology from the 2016 Rankings

The 2017 ranking incorporates a new measure of the diversity of institutions. It now comprises two equally-weighted components. The new measure recognises more fully that a good system of higher education provides a range of institutions to meet differing student and national needs. The first component measures the mix of public and private institutions. We argue that a mixed system promotes competition and innovation. In previous rankings, the public–private mix was measured on a three-point scale based on the percentage of students enrolled in private institutions: less than 10 per cent, between 10 and 50 per cent, and over 50 per cent. In the 2017 ranking the three-point scale is replaced by a continuous variable: the percentage of students in private universities, capped at 50 per cent. The new measure overcomes the quite different scores that could be obtained with very little difference in the institutional mix. For example, a country with nine per cent of tertiary students in private institutions would score very much lower than a country with 11 per cent. While there is no optimal public–private mix, the larger the private enrolments the less need for autonomy in public institutions – another measure we use in the rankings. Thus the private enrolment measure and the measure of autonomy of public institutions need to be considered jointly, which is done in our Environment module.

The second component of the new diversity index is the percentage of tertiary enrolments that are at level 5 in the ISCED classification. The ISCED 2011 classification contains five levels for tertiary education: short-cycle tertiary (level 5), Bachelors (level 6), Masters (level 7) and PhD (level 8). Level 5 includes higher technical education, community colleges and advanced vocational training. The inclusion of this component recognises that for many students, level 5 courses are more appropriate than university study. These courses are particularly important for developing countries, where they are likely to be as important for economic growth as frontier research at universities.

In the Connectivity module, Webometrics have changed the OPENNESS measure which is now labelled TRANSPARENCY and is a google citations measure. To smooth the change we average over the two years.

There has been no change in the weights we use. The quality of data continues to improve each year and in some cases, which we highlight, new data explains shifts in a country's rank.

In this year's ranking we include measures of the three types of activity undertaken by tertiary institutions, sometimes referred to as the triple helix: research, teaching and connectivity. This cuts across our four-module approach. This new section is made possible by the collection and publication of national competency scores by the OECD, albeit for only 30 of our 50 countries.

# 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 all our 50 countries, the measure of resources per student in part serves as a proxy. In order to measure the contribution of tertiary education to a nation's research effort we include measures of expenditure on R&D in tertiary institutions. In summary, our five measures of resources and their weights are:

R1: (5%) Government expenditure on tertiary education institutions as a percentage of GDP, 2013.
R2: (5%) Total expenditure on tertiary education institutions as a percentage of GDP, 2013.
R3: (5%) Annual expenditure per student (full-time equivalent) by tertiary education institutions in USD purchasing power parity, 2013.
R4: (2.5%) Expenditure in tertiary education institutions for research and development as a percentage of GDP, 2014.
R5: (2.5%) Expenditure in tertiary education institutions for research and development per head of population at USD purchasing power parity, 2014.

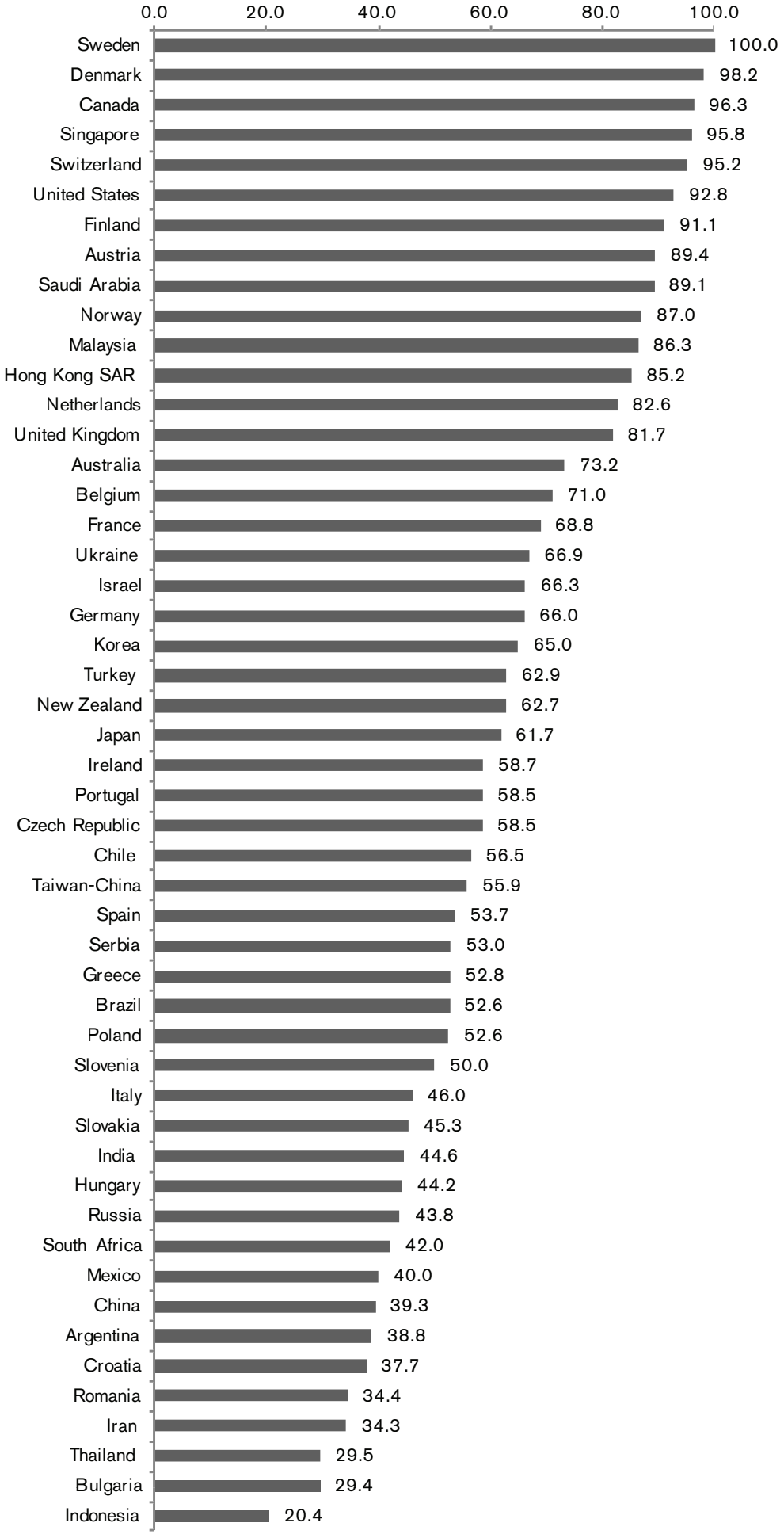
The median level of government expenditure on higher education as a share of GDP is 1.02 per cent, a fall from 1.19 per cent in last year's rankings. This decline in relative government expenditure has been offset by an increase in private expenditure: the median value of total expenditure has remained constant at 1.47 per cent of GDP. Research expenditure by institutions has also remained constant at 0.35 per cent of GDP.

The highest ranked countries for resources in the 2017 rankings are Sweden, Denmark, Canada, Singapore, Switzerland and the USA, in that order. Compared with the 2016 rankings the largest improvers are Ukraine, Turkey and Chile. Ukraine has improved eight places to 18th owing to the availability of more reliable data for government expenditure. Turkey has risen by seven places to 22nd, owing to an increase in both public and private expenditure. Chile has risen five places to 28th with public expenditure rising from 0.59 per cent of GDP to 0.97 per cent, albeit offset by a fall in private expenditure.

Countries with greatest falls in rank are Argentina, Iran, the Czech Republic and New Zealand. Argentina has fallen eight places to 44th following relative reductions in both government and private expenditure. Iran and the Czech Republic have fallen as a result of declines in government expenditure: Iran six places to 47th; the Czech Republic five places to 27th. In the case of New Zealand, the reduction in government funding as a share of GDP causes the ranking to fall five places to 23rd, back to the level in the 2015 rankings.

Government expenditure on higher education as a share of GDP is highest in Saudi Arabia (2.4%), Finland and Ukraine (1.8%), and Austria and Denmark (1.7%). Total expenditure on higher education as a percentage of GDP is highest in the USA, Canada and Saudi Arabia, Chile and Malaysia, Ukraine and Korea, in that order. Resources per student, which includes research expenditure, are highest in Singapore, the United States, Hong Kong SAR, the United Kingdom and Switzerland. Denmark, Sweden and Switzerland continue to rank highest for research expenditure in tertiary institutions. Research expenditure as a share of GDP in Malaysia has nearly doubled over the past two years and the country's ranking on this component has risen to 11th.

# RESOURCES 2017



# 3.2 Environment (weight of 20%)

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 also needs to be appropriate diversity, competition between institutions and external monitoring of performance. The degree to which national systems possess these characteristics is measured by the results of three survey findings complemented by four quantitative measures.

The measures we use and their weights are:

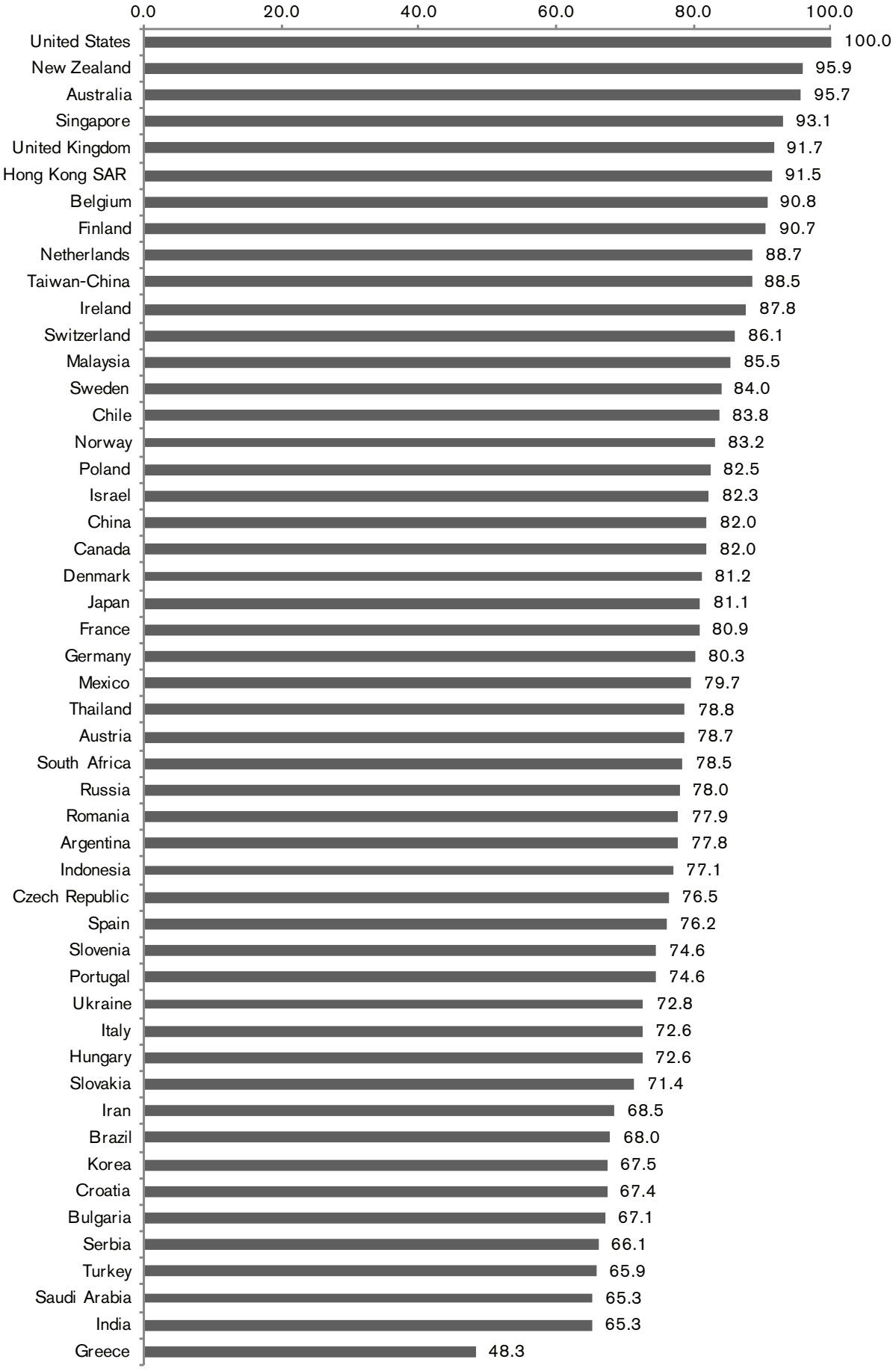
- E1: (1%) Proportion of female students in tertiary education, 2014.
- E2: (2%) Proportion of academic staff who are female in tertiary institutions, 2014.
- E3: (2%) A rating for data quality. For each quantitative series, the value is 2 if the data are available for the exact definition of the variable; 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:
  - E4.1 (2%) Diversity of the system comprising two components of equal weight: the percentage of tertiary students enrolled in private institutions (capped at 50 per cent) and the percentage of students enrolled in ISCED level 5 courses.
  - E4.2 (4%) Survey results for the policy and regulatory environment (see Appendix 2).
  - E4.3 (4%) Survey results for the financial autonomy of public universities (see Appendix 2)
- 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 top-ranked countries in the Environment module are the United States, New Zealand, Australia, Singapore, the United Kingdom and Hong Kong-SAR. The new wider definition of diversity has led to some marked changes in rank: Canada has risen 14 places to 20th whereas the Czech Republic has fallen 13 places to 33rd. Israel has risen 14 places to 18th owing to both the new measure of diversity and an improvement in the response of business as measured by the WEF survey (E5). Romania has fallen to 30th owing to both the new measure of diversity and a fall in the WEF survey score.

For the qualitative index (E4), the top-ranked countries are the United States, Australia, Hong Kong-SAR, New Zealand, Taiwan-China and the United Kingdom.

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 Russia. Business, as measured by the WEF survey, ranks the national education systems most highly in Switzerland, Singapore, Finland, Belgium and Ireland.

# ENVIRONMENT 2017



# 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.

We use six measures:

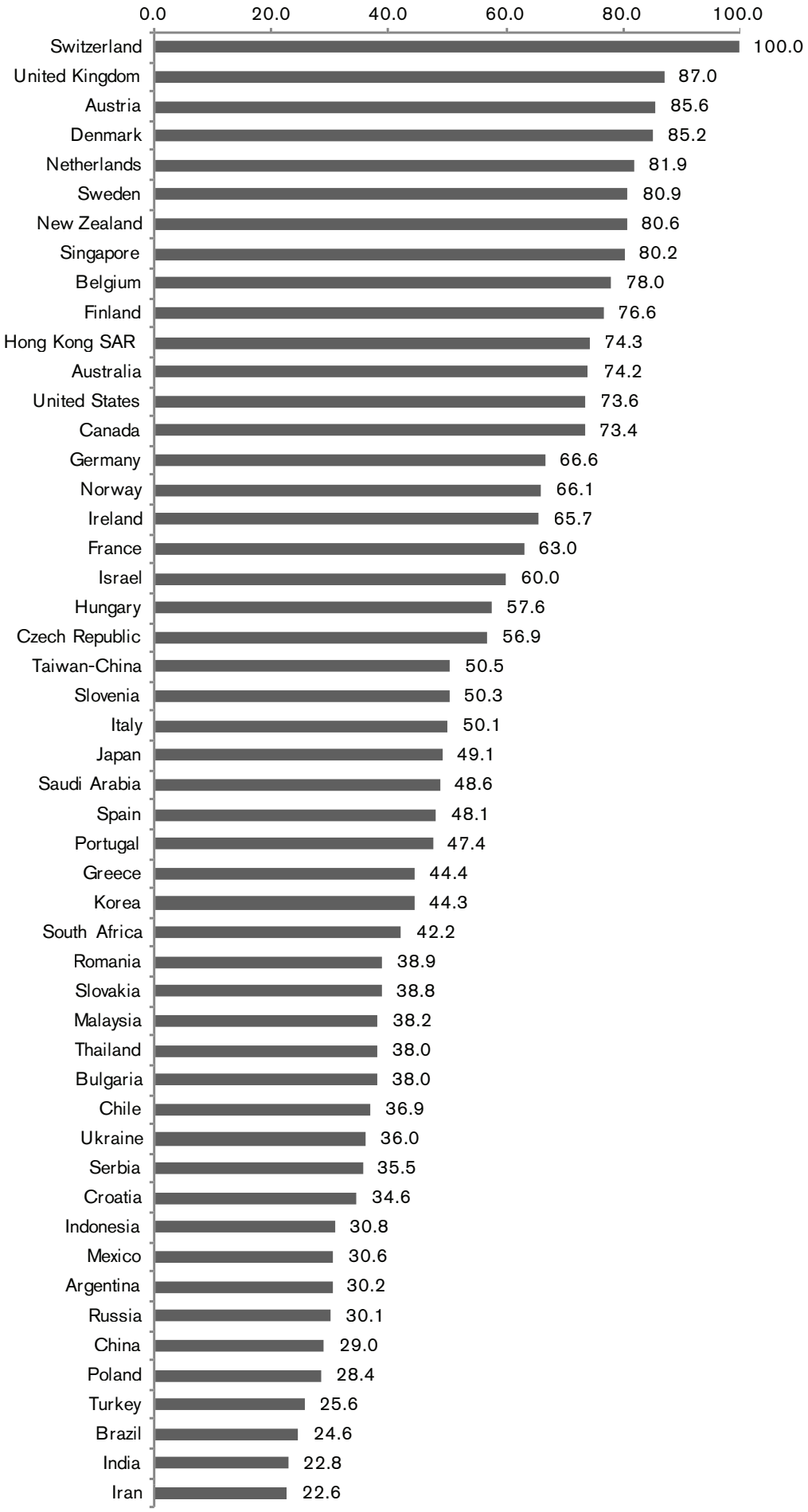
- C1: (4%) Proportion of international students in tertiary education, 2014.
- C2: (4%) Proportion of articles co-authored with international collaborators, 2014 (coverage is all institutions that publish at least 100 papers).
- C3: (2%) Webometrics Web TRANSPARENCY measure: sum of values from 4,200 universities divided by country's population, July 2016 edition.
- C4: (2%) Webometrics VISIBILITY index (external links that university web domains receive from third parties). Sum of data for 10,000 tertiary institutions divided by country's population, July 2016 edition.
- C5: (4%) Responses to question 'Knowledge transfer is highly developed between companies and universities', asked of business executives in the annual survey by IMD World Development Centre, Switzerland, 2016.
- C6: (4%) Percentage of university research publications that are co-authored with industry researchers, 2012–14.

The top five nations in rank order are Switzerland, the United Kingdom, Austria, Denmark and the Netherlands. The greatest fall is that of Indonesia: by nine places to 41st owing to a reduction in papers jointly written with international collaboration (C2). But, more broadly, joint international publications continue to increase in importance: the only other countries to show a (small) decline from values in last year's rankings are Russia and South Africa. For our 50 countries, the median percentage for joint international publications has risen to 43.7 per cent from 41.5 per cent last year: the top five countries are Saudi Arabia, (75 per cent), Hong Kong (66 per cent), Switzerland (64 per cent), Belgium (60 per cent) and Singapore (59 per cent), an unchanged ranking from last year. The five most highly ranked countries for the percentage of articles written with industry (C6) are, in rank order, Denmark, Austria, Sweden, the Netherlands and Japan. The share in Denmark is 8.3 per cent but it is above 7 per cent in all the top five ranked countries; the median share for all 50 countries is 3.8 per cent. The share of joint industry publications in Belgium has fallen by 1 percentage point compared with last year's rankings whereas the share in France has increased by nearly 1 percentage point.

The top five countries for knowledge transfer in the IMD survey of business executives (C5) are, in rank order, Switzerland, the United States, Israel, the Netherlands and Denmark. Canada has fallen from equal third last year to 14th in this year's rankings, whereas Sweden has risen from 17th to sixth. Indonesia has fallen 17 places to 40th; Korea from 19th to 27th.

Singapore, New Zealand, Australia and the United Kingdom again have the highest proportion of international students (C1). The United States is ranked a clear first for web impact (C4) followed by Switzerland, Canada, the United Kingdom and Taiwan-China. Switzerland and Sweden are ranked the highest for web transparency (C3).

# CONNECTIVITY 2017



# 3.4 Output (weight of 40%)

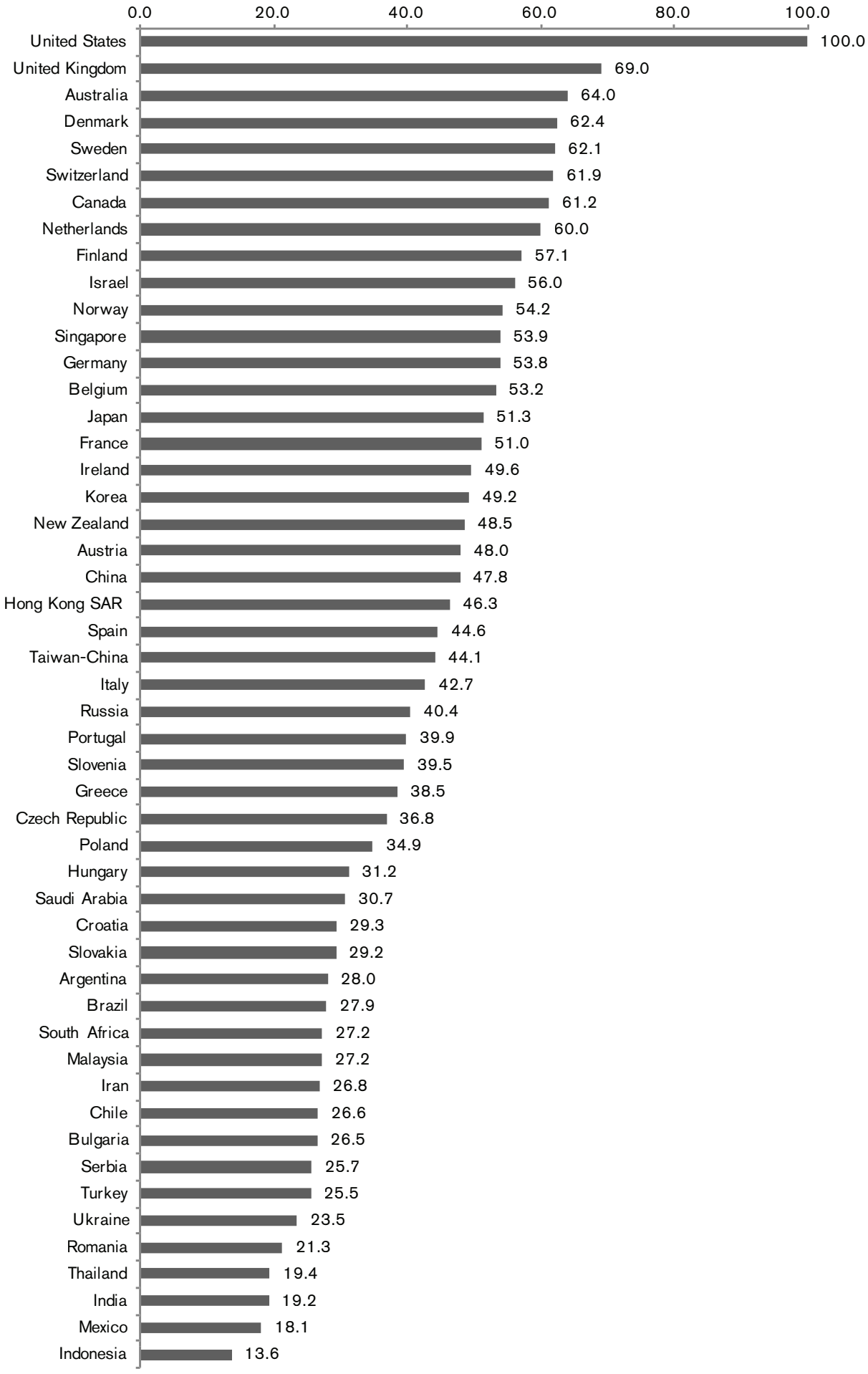
The measures used in this module encompass research output and its impact, student throughput, the national stock of graduates and researchers, the quality of a nation's best universities and employability of graduates. The variables are given below.

- O1: (10 per cent) Total articles produced by higher education institutions, 2014.
- O2: (3 per cent) Total articles produced by higher education institutions per head of population, 2014.
- O3: (5 per cent) Average impact of articles as measured by citations in 2014 to articles published in previous years using the Karolinska Institute normalized impact factor.
- O4: (3 per cent) 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 2016 Shanghai Jiao Tong scores, divided by country population.
- O5: (7 per cent) The excellence of a nation's best universities calculated by totalling the 2016 Shanghai Jiao Tong scores for the nation's three best universities.
- O6: (3 per cent) Enrolments in tertiary education as a percentage of the eligible population, defined as the five-year age group following on from secondary education, 2014.
- O7: (3 per cent) Percentage of the population aged 25–64 with a tertiary qualification, 2015.
- O8: (3 per cent) Number of researchers (full-time equivalent) in the nation per million of population, 2014.
- O9: (3 per cent) 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, 2015.

The top country in the output module is clearly the United States. The United Kingdom is second. Australia is third followed by near equal scores for Canada, Denmark, Sweden and Switzerland. These top seven countries retain the same ranks as in the 2016 rankings. Lower down in the rankings, Croatia has risen six places to 34th and Argentina has improved five places to 36th. Chile and Turkey have each fallen six places to 41st and 44th respectively.

The median increase in publications is 8.8 per cent but much larger increases occurred in Russia (64 per cent), Indonesia (41 per cent) and South Africa (23 per cent). The Russian increase may, in part, reflect a greater journal coverage by Scopus. Publications per head of population remain highest in Australia followed by Sweden and Denmark, and then Finland and Switzerland. The top country for the average research impact of articles is Switzerland, but there is little difference in the scores for the top six countries: in alphabetical order the others are Denmark, the Netherlands, Singapore, the United Kingdom and the United States. Participation rates (O6) are highest in Greece, Korea, Spain, Finland, Canada and the United States. Canada has replaced Russia as the country with the most qualified workforce (55 per cent have a tertiary qualification); Russia is ranked second followed by Japan, Singapore and Israel. The national stock of researchers relative to population is highest in Israel, Denmark and Finland; next come Korea, Sweden and Singapore. Unemployment of the tertiary educated relative to school leavers (O9) is lowest in Hungary, South Africa, the United States and Poland. The largest improvement occurred in the United States; deterioration was greatest in Finland and Brazil. In five countries unemployment is higher for those with a tertiary qualification: Malaysia, Mexico, Taiwan-China, Thailand and Saudi Arabia.

# OUTPUT 2017


0.0
20.0
40.0
60.0
80.0
100.0
United States 100.0
United Kingdom 69.0
Australia 64.0
Denmark 62.4
Sweden 62.1
Switzerland 61.9
Canada 61.2
Netherlands 60.0
Finland 57.1
Israel 56.0
Norway 54.2
Singapore 53.9
Germany 53.8
Belgium 53.2
Japan 51.3
France 51.0
Ireland 49.6
Korea 49.2
New Zealand 48.5
Austria 48.0
China 47.8
Hong Kong SAR 46.3
Spain 44.6
Taiwan-China 44.1
Italy 42.7
Russia 40.4
Portugal 39.9
Slovenia 39.5
Greece 38.5
Czech Republic 36.8
Poland 34.9
Hungary 31.2
Saudi Arabia 30.7
Croatia 29.3
Slovakia 29.2
Argentina 28.0
Brazil 27.9
South Africa 27.2
Malaysia 27.2
Iran 26.8
Chile 26.6
Bulgaria 26.5
Serbia 25.7
Turkey 25.5
Ukraine 23.5
Romania 21.3
Thailand 19.4
India 19.2
Mexico 18.1
Indonesia 13.6

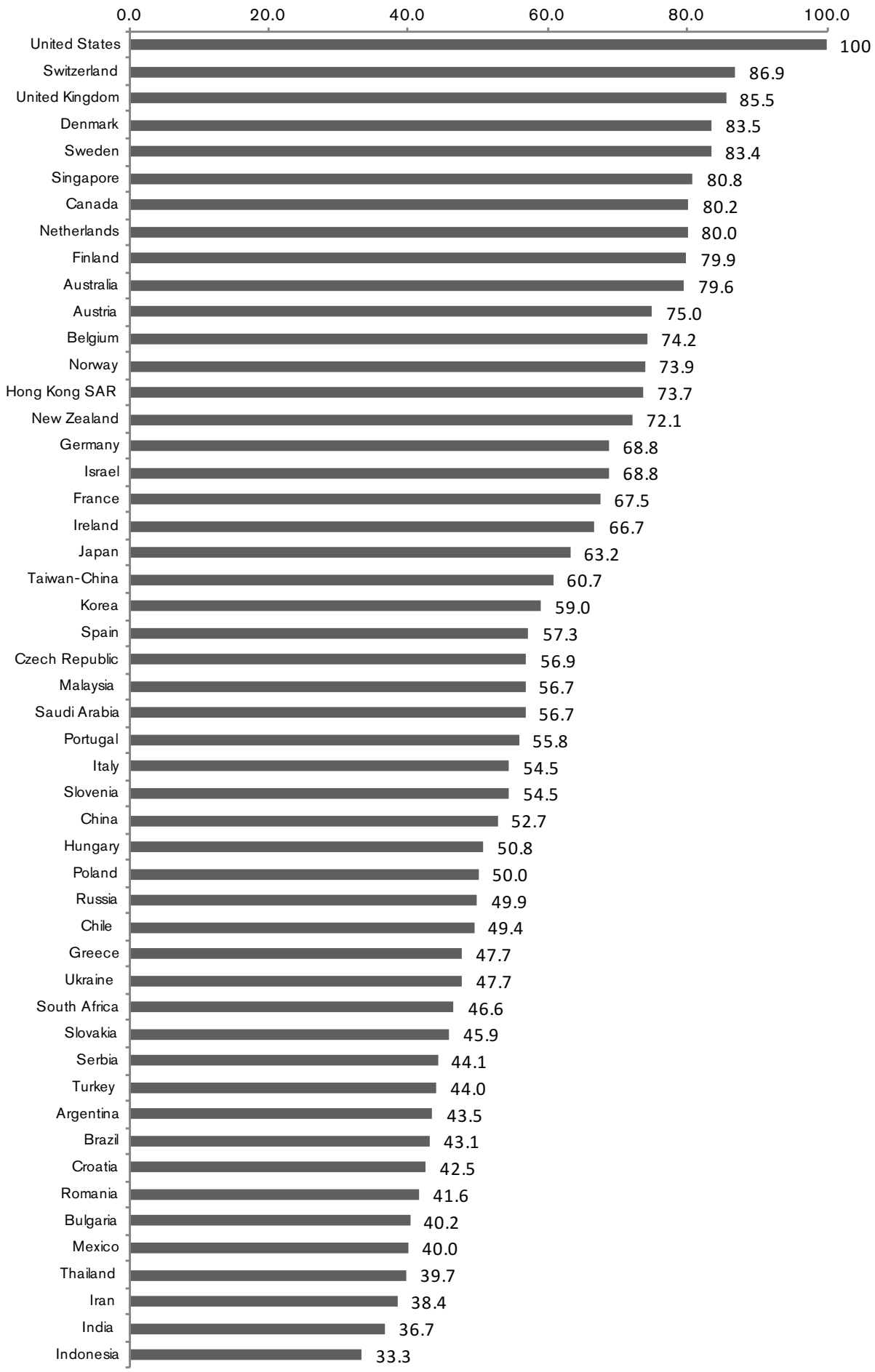
# 3.5 Overall Ranking

Using weights of 40 per cent on Output and 20 per cent on each of the other three modules, the top five countries, in order, are the United States, Switzerland, the United Kingdom, Denmark and Sweden. The only change from the 2016 rankings is that Denmark and the United Kingdom have swapped positions. The next five countries are Singapore (up two to sixth), Canada (up two to seventh), the Netherlands (down one to eighth), Finland (down three to ninth) and Australia unchanged at tenth.

Systems evolve slowly over time. Compared with the 2016 rankings, for 33 of our 50 countries the rank change was at most one. The largest changes have been Ukraine, up seven places to 35th, and Turkey, up five places to 40th. The largest fall in rank is Brazil: down four places to 42nd.

This information can be seen in a table on page seven and graph on page 19.

# U21 RANKING 2017



# 3.6 Trends

Annual changes in the performance of national systems of higher education are likely to be modest, at least in an upward direction. While a system can face significant deterioration in a short period of time due to factors such as political disturbances, major improvement will normally take a few years. It is therefore instructive to use our time-series of rankings to examine trends over several years. We do this by comparing the results for the Output module over the last five rankings: 2013 to 2017. However, the changes reflect a longer period because in the 2013 and 2014 rankings we used a five-year average for the three research measures (O1, O2, O3). The Output model is chosen because the variables included have remained the same, apart from that just mentioned, and the data quality has always been good. However, modest weight changes over the period exert some effect.

The countries showing the largest improvement have been Saudi Arabia (up 12 places) and Malaysia (up seven places). Both countries have in recent years devoted considerable additional resources to higher education. The other noticeable improvers have been Singapore, South Africa and Russia (all up six places) and China (up five places). Australia, Croatia and Denmark have all improved four places. Ukraine, not surprisingly given its political difficulties, shows the largest fall, down 10 places. New Zealand is down six places; Bulgaria and Romania down five. Six countries have fallen by four ranks: Canada, Finland, Germany, Slovenia, Taiwan-China, and Turkey. These changes, of course, reflect relative system performance, not absolute or necessarily institutional performance. This is well illustrated by the fall in New Zealand's rank which is due primarily to falls in the ranks for qualification of the workforce (O7) and number of researchers (O8). The increase in the percentage of the population aged 25–64 years with a tertiary qualification has not matched the increase of nine percentage points in the median value for our 50 countries.

# 4. Methodology of adjusting for levels of economic development

In our main rankings, the performance of a country is measured against world-best practice. But comparisons of performance should also be made with that of countries at similar levels of economic development. More precisely, how well does a country perform on each of our criteria relative to its level of per capita income? In order to adjust for national levels of income, we regress the values for each variable, in original units, on GDP per capita using data for all 50 countries. The GDP we use is for 2014 in US dollars measured in Purchasing Power Parity (PPP) terms. Both linear and quadratic relationships are used. Logarithmic models performed less well. Given the tenfold range in GDP per capita across our 50 countries, values for countries at the very top and bottom ends of the income range show some sensitivity to functional form. The values of all but one of our 19 variables in the Resources, Connectivity and Output modules increase significantly with GDP per head (the only exception is the unemployment variable, O9). The coefficient on the quadratic term was always negative, implying some tapering off of increases at high levels of GDP per capita.

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 will be positive or negative depending on whether a country performs above or below the expected value. In the few cases where data are missing we assume that the variable takes the expected value for that country's level of GDP per capita, that is, we assume a deviation value of zero. 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 capita and take a moving average of actual scores to derive more robust estimates of predicted values.

In aggregating over variables we first express 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. The average deviation for each module is a weighted sum of the deviations for each of the measures within the module. The 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 a measure 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 measures of Resources 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 (total) GDP, thus combining O1 and O2 (the weights are added).

# 5. Results after adjusting for levels of economic development

## 5.1 Resources

Expenditure levels are best described by a linear relationship with GDP except for research expenditure where a quadratic curve fits best. The highest-ranked country is Malaysia, which devotes nearly 50 per cent more to resources than what is expected given its income level. Resources devoted to higher education are over 30 per cent more than expected in Serbia, Turkey and Ukraine. Next in rank order are Sweden, Finland, Denmark, Canada, India and Saudi Arabia where scores are at least 20 per cent above those expected.

Compared with the non-adjusted rankings, the biggest improvers are Brazil (up 37 places to 12th), India (up 31 places to ninth), South Africa (up 30 places to 11th ) and China (up 24 places to 19th.) At the other end of the income range, Singapore falls from fourth to 33rd and the United States from sixth to 20th.

Turning to the four variables that are included in the Resources module, government expenditure and total expenditure on higher education show only slight increases as a share of GDP as income levels rise. For each ten thousand dollar increase in GDP per capita, government expenditure is estimated to increase by only 0.07 per cent of GDP and total expenditure by 0.08 per cent. It follows that rankings are similar to those discussed in section 3.1. The top eight countries for the level of government expenditure after adjusting for GDP per capita are Ukraine, Saudi Arabia, Finland, Malaysia, Austria, Denmark, India and Turkey.

The highest-ranked countries for total expenditure as a share of GDP are now Ukraine, Chile and Malaysia, but despite their high-income levels the United States and Canada remain ranked at fourth and fifth, respectively. Expenditure (which includes research expenditure) per student increases markedly with income levels: on average by around USD361 for each USD1,000 increase in GDP per capita (adjusted R2 = 0.730). The top six countries on an income-adjusted basis are, in order, Brazil (data for public institutions only), South Africa, Malaysia, the United Kingdom, India and the United States.

Research expenditure in higher education as a share of GDP increases with GDP per capita, but at a declining rate. The quadratic regression estimates imply that at GDP per capita of USD25,000 the expected expenditure on R&D is 0.32 per cent of GDP whereas the corresponding figure at GDP per capita of USD50,000 is 0.58. The top eight countries for research expenditure as a share of GDP are now Serbia, Denmark, South Africa, Malaysia, Turkey, Portugal, Sweden and Finland.

# 5.2 Environment

In principle, the creation of a favourable environment is independent of income levels so we do not carry out regression analysis. Instead, we use mean values for expected and calculate the percentage deviation from expected as was done in other modules. The rankings are necessarily very similar to those for the unadjusted data.

The scores for the top three countries (the United States, New Zealand and Australia) are around 20 per cent above expected values.

# 5.3 Connectivity

The connectivity measures are quite strongly positively related to levels of GDP per head, with the adjusted R2 values lying in the range 0.4 to 0.6. The top seven countries, in rank order, are South Africa, Ukraine, Serbia, the United Kingdom, New Zealand, Switzerland and Denmark.

The equation for international co-authorship (C2) implies that for each USD10,000 increase in GDP per capita the percentage of articles that have an international co-author increase by 5.3 percentage points. The top seven countries, in rank order, are Chile, Saudi Arabia, South Africa, Bulgaria, Belgium, Sweden and New Zealand.

Relationships with industry reveal different emphases on more informal links through knowledge transfer (C5) versus 'basis research links' as exhibited through joint publications (C6). Knowledge transfer is the more important in Israel, Malaysia and China: Israel is first on knowledge transfer but 32nd on joint publications; the corresponding rankings for Malaysia are third and 50th, and for China, seventh and 21st. Conversely, in Ukraine and Indonesia basic research links are more important: Ukraine is first on joint publications but 31st on knowledge transfer; Indonesia third on publications and 28th on knowledge transfer. India, on the other hand, is in the top five for both measures.

China and the United States are the highest ranked countries for Web impact (C4).

# 5.4 Output

All but one of the Output measures (unemployment, O9) show a significant increase with levels of GDP per capita but the increase flattens out at high-income levels. Two Output measures show a particularly strong relationship with GDP per capita (adjusted R2 > 0.6): impact as measured by citations (O3) and researchers per head of population (O8). The impact measure picks up not only the quality of research but its nature: applied research in developing countries is unlikely to be highly referenced despite its relevance for economic development.

The top five ranked countries for Output are Serbia, Portugal, Israel, China and the United Kingdom. For these countries Output is between 20 and 40 per cent above expected values for their levels of income. Turning to the components, the top six countries for publications relative to (total) GDP are Serbia, India, Portugal, Australia, Slovenia and Singapore. After adjusting for differences in income levels, the impact of publications (O3) is highest for India, South Africa, the United Kingdom, Italy and Denmark. China and the United States are ranked at the top for the quality of the best three universities; the next three ranked countries are well above their expected values: Brazil, Russia and the United Kingdom.

After allowing for income levels, Ukraine is ranked first on participation rates (O6), followed by Greece, Chile, Argentina and Turkey. Ukraine also comes first on tertiary qualifications of the workforce (O7), followed in rank order by Russia, Israel, Canada and Japan. Israel is first for researchers per head of population, next in rank are Serbia, Korea and Finland.

# 5.5 Overall Ranking

All but one of the Output measures (unemployment, O9) show a significant increase with levels of GDP per capita but the increase flattens out at high-income levels. Two Output measures show a particularly strong relationship with GDP per capita (adjusted R2 > 0.6): impact as measured by citations (O3) and researchers per head of population (O8). The impact measure picks up not only the quality of research but its nature: applied research in developing countries is unlikely to be highly referenced despite its relevance for economic development.

The top five ranked countries for Output are Serbia, Portugal, Israel, China and the United Kingdom. For these countries Output is between 20 and 40 per cent above expected values for their levels of income. Turning to the components, the top six countries for publications relative to (total) GDP are Serbia, India, Portugal, Australia, Slovenia and Singapore. After adjusting for differences in income levels, the impact of publications (O3) is highest for India, South Africa, the United Kingdom, Italy and Denmark. China and the United States are ranked at the top for the quality of the best three universities; the next three ranked countries are well above their expected values: Brazil, Russia and the United Kingdom.

After allowing for income levels, Ukraine is ranked first on participation rates (O6), followed by Greece, Chile, Argentina and Turkey. Ukraine also comes first on tertiary qualifications of the workforce (O7), followed in rank order by Russia, Israel, Canada and Japan. Israel is first for researchers per head of population, next in rank are Serbia, Korea and Finland.

# NATIONAL RANKINGS CONTROLLING FOR LEVEL OF ECONOMIC DEVELOPMENT, 2017

| Rank | Resources | %dev | Environment | %dev | Connectivity | %dev | Output | %dev |
|---|---|---|---|---|---|---|---|---|
| 1 | Malaysia | 47.6 | United States | 23.7 | South Africa | 52.2 | Serbia | 41.4 |
| 2 | Ukraine | 39.5 | New Zealand | 19.8 | Ukraine | 48.0 | Portugal | 32.3 |
| 3 | Serbia | 36.4 | Australia | 19.6 | Serbia | 35.5 | Israel | 27.6 |
| 4 | Turkey | 31.0 | Singapore | 16.5 | United Kingdom | 34.1 | China | 24.8 |
| 5 | Sweden | 25.5 | United Kingdom | 15.2 | New Zealand | 32.2 | United Kingdom | 23.0 |
| 6 | Finland | 24.7 | Hong Kong SAR | 15.0 | Switzerland | 26.1 | Sweden | 19.9 |
| 7 | Denmark | 22.9 | Belgium | 14.0 | Denmark | 21.7 | Greece | 19.1 |
| 8 | Canada | 22.1 | Finland | 13.7 | Austria | 21.0 | Australia | 18.8 |
| 9 | India | 20.9 | Netherlands | 11.8 | Hungary | 20.4 | South Africa | 18.6 |
| 10 | Saudi Arabia | 20.2 | Taiwan-China | 11.2 | Finland | 18.0 | Denmark | 18.6 |
| 11 | South Africa | 17.1 | Ireland | 10.6 | Czech Republic | 14.0 | Finland | 13.1 |
| 12 | Brazil | 16.2 | Switzerland | 7.6 | Belgium | 13.8 | Croatia | 12.6 |
| 13 | Austria | 14.2 | Malaysia | 7.6 | Netherlands | 12.6 | New Zealand | 11.7 |
| 14 | United Kingdom | 10.5 | Sweden | 6.2 | Canada | 11.6 | Canada | 7.6 |
| 15 | Portugal | 5.4 | Norway | 4.5 | Sweden | 11.3 | United States | 7.2 |
| 16 | Switzerland | 5.2 | Chile | 4.4 | Thailand | 6.9 | Netherlands | 7.0 |
| 17 | Israel | 4.4 | Israel | 4.2 | India | 6.6 | Switzerland | 6.6 |
| 18 | Netherlands | 4.2 | China | 3.8 | Australia | 5.0 | Singapore | 0.9 |
| 19 | China | 1.8 | Canada | 3.6 | Portugal | -5.1 | Belgium | -0.5 |
| 20 | United States | 0.2 | Poland | 3.4 | Greece | -5.2 | Slovenia | -0.5 |
| 21 | Czech Republic | -1.1 | Denmark | 2.4 | Hong Kong SAR | -7.1 | India | -0.6 |
| 22 | France | -3.1 | France | 2.3 | Israel | -7.3 | Brazil | -1.0 |
| 23 | Belgium | -3.4 | Germany | 1.0 | Germany | -7.9 | Spain | -2.0 |
| 24 | Hong Kong SAR | -4.2 | Japan | 0.7 | Bulgaria | -9.5 | Iran | -2.1 |
| 25 | Poland | -5.6 | Austria | -0.9 | Slovenia | -9.9 | Malaysia | -7.8 |
| 26 | New Zealand | -6.9 | Thailand | -1.3 | United States | -11.6 | Korea | -8.4 |
| 27 | Greece | -8.1 | Mexico | -1.3 | France | -12.3 | Norway | -9.0 |
| 28 | Australia | -8.2 | Russia | -2.6 | Ireland | -14.4 | Poland | -9.2 |
| 29 | Korea | -8.9 | Indonesia | -3.0 | Singapore | -15.5 | France | -11.2 |
| 30 | Norway | -9.5 | Argentina | -3.1 | Romania | -16.1 | Italy | -15.6 |
| 31 | Chile | -11.9 | Czech Republic | -3.8 | Indonesia | -18.4 | Czech Republic | -17.9 |
| 32 | Japan | -13.8 | Romania | -4.0 | Italy | -18.9 | Austria | -18.1 |
| 33 | Singapore | -14.5 | Spain | -4.4 | China | -20.1 | Germany | -18.3 |
| 34 | Germany | -15.3 | South Africa | -5.6 | Spain | -20.4 | Ireland | -20.9 |
| 35 | Spain | -16.2 | Slovenia | -6.6 | Norway | -30.6 | Hong Kong SAR | -22.5 |
| 36 | Slovenia | -18.8 | Portugal | -7.1 | Slovakia | -31.0 | Japan | -22.6 |
| 37 | Mexico | -19.7 | Ukraine | -9.1 | Taiwan-China | -36.7 | Taiwan-China | -28.1 |
| 38 | Slovakia | -22.4 | Italy | -9.4 | Malaysia | -41.8 | Argentina | -28.1 |
| 39 | Hungary | -24.1 | Hungary | -10.9 | Japan | -42.1 | Chile | -28.2 |
| 40 | Croatia | -26.1 | Slovakia | -12.6 | Croatia | -43.8 | Turkey | -31.0 |
| 41 | Iran | -26.3 | Iran | -14.7 | Brazil | -49.1 | Russia | -36.8 |
| 42 | Argentina | -26.7 | Korea | -16.8 | Korea | -49.6 | Ukraine | -55.1 |
| 43 | Italy | -33.6 | Brazil | -17.8 | Poland | -50.8 | Hungary | -55.8 |
| 44 | Ireland | -33.6 | Croatia | -18.5 | Chile | -52.6 | Slovakia | -60.7 |
| 45 | Taiwan-China | -34.1 | Bulgaria | -19.0 | Saudi Arabia | -57.4 | Romania | -68.5 |
| 46 | Russian Federation | -36.0 | Serbia | -19.9 | Mexico | -57.9 | Mexico | -71.2 |
| 47 | Thailand | -36.5 | Turkey | -20.5 | Russia | -57.9 | Bulgaria | -77.3 |
| 48 | Romania | -47.8 | Saudi Arabia | -20.6 | Turkey | -62.8 | Saudi Arabia | -79.4 |
| 49 | Bulgaria | -55.7 | India | -21.4 | Argentina | -66.0 | Thailand | -84.1 |
| 50 | Indonesia | -69.7 | Greece | -56.7 | Iran | -72.6 | Indonesia | -126.2 |

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

# OVERALL RANKING CONTROLLING FOR LEVEL OF ECONOMIC DEVELOPMENT 2017

| Rank | Country | % dev |
|---|---|---|
| 1 | Serbia | 26.9 |
| 2 | United Kingdom | 21.2 |
| 3 | South Africa | 20.2 |
| 4 | Denmark | 16.8 |
| 5 | Sweden | 16.6 |
| 6 | Finland | 16.5 |
| 7 | New Zealand | 13.7 |
| 8 | Portugal | 11.6 |
| 9 | Israel | 11.3 |
| 10 | Australia | 10.8 |
| 11 | Canada | 10.5 |
| 12 | Switzerland | 10.4 |
| 13 | Netherlands | 8.5 |
| 14 | China | 7.0 |
| 15 | United States | 5.4 |
| 16 | Belgium | 4.7 |
| 17 | India | 1.0 |
| 18 | Austria | -0.4 |
| 19 | Malaysia | -0.4 |
| 20 | Singapore | -2.3 |
| 21 | Czech Republic | -5.4 |
| 22 | Ukraine | -6.3 |
| 23 | Greece | -6.3 |
| 24 | France | -7.1 |
| 25 | Slovenia | -7.3 |

| Rank | Country | % dev |
|---|---|---|
| 26 | Hong Kong SAR | -8.3 |
| 27 | Spain | -9.0 |
| 28 | Brazil | -10.6 |
| 29 | Norway | -10.7 |
| 30 | Germany | -11.8 |
| 31 | Croatia | -12.6 |
| 32 | Poland | -14.3 |
| 33 | Ireland | -15.8 |
| 34 | Korea | -18.4 |
| 35 | Italy | -18.6 |
| 36 | Japan | -20.1 |
| 37 | Turkey | -22.9 |
| 38 | Taiwan - China | -23.2 |
| 39 | Chile | -23.3 |
| 40 | Iran | -23.6 |
| 41 | Hungary | -25.3 |
| 42 | Argentina | -30.4 |
| 43 | Russia | -34.0 |
| 44 | Slovakia | -37.5 |
| 45 | Thailand | -39.8 |
| 46 | Romania | -41.0 |
| 47 | Saudi Arabia | -43.3 |
| 48 | Mexico | -44.3 |
| 49 | Bulgaria | -47.8 |
| 50 | Indonesia | -68.7 |

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

# 6. The Triple Helix: Research, Teaching and Connectivity

The Output measures defined in Section 3 include variables that reflect both research and teaching. But they do not include measures of the quality of graduates because until recently internationally comparable data were not available. This position has been rectified, at least for a sub-group of our countries, by the OECD's Programme for the Assessment of Adult Competencies (PIAAC). The measures we use are mean literary and numeracy scores of 20–24-year-olds who have a tertiary qualification or who are undertaking tertiary education. These data are available for 30 of our 50 countries and are combined with equal weights into a single ranking. The top five countries, in rank order, are Finland, the Netherlands, Austria, Sweden and Belgium (Flanders).

The PIACC data can then be combined with our other measures to derive rankings for Teaching. From the measures used in Section 3, we take total expenditure per student (R3) and the tertiary enrolment rate (O6). The data are combined using rank values with a weight of 0.5 on the competency score and 0.25 on each of the other two measures. Ranks are used because the competency scores show much less variation than do the other two variables (for further explanation see Williams and de Rassenfosse, 2016). By combining competency scores with participation rates we offset any advantage accruing to countries with a more selective higher education sector.

A Research measure is derived by picking out the research-dominated variables in our Output module: publications per head (O2), impact of research as measured by citations (O3), and the two Shanghai ranking measures (O4 and O5). These are combined into a single ranking using the same weights as in Section 3. The Connectivity measure used in this section is the same as in Section 3.

Three Nordic countries (Denmark, Finland and Sweden) and the Netherlands stand out as the strongest overall performers with ranks in the top ten for each component of the triple helix. The Teaching rank is worse than for Research and Connectivity in Israel and Italy but especially in the United Kingdom where participation rates are relatively low. Countries where the rank for teaching is noticeably higher than that for the two other activities include Japan, Korea and Norway. Two countries have the same rank for all three activities: France and Greece.

Research performance is more highly correlated with Connectivity than with Teaching: the rank correlation coefficients are 0.87 and 0.70, respectively. Nevertheless, most countries that lead in research also score reasonably highly on teaching, which adds a little to the debate on whether concentration on research weakens the quality of teaching. The highest correlation is between Research and Connectivity (0.87).

# RANKS FOR RESEARCH, TEACHING AND CONNECTIVITY: 30 COUNTRIES

| Country | Research | Teaching | Connectivity | Literacy and Numeracy* |
|---|---|---|---|---|
| Australia | 5 | 13 | 10 | 18 |
| Austria | 14 | 3 | 2 | 3 |
| Belgium (Flanders) | 10 | 7 | 8 | 5 |
| Canada | 7 | 9 | 12 | 17 |
| Chile | 28 | 28 | 26 | 29 |
| Czech Republic | 24 | 17 | 18 | 10 |
| Denmark | 4 | 6 | 3 | 9 |
| Finland | 8 | 1 | 9 | 1 |
| France | 16 | 16 | 16 | 12 |
| Germany | 13 | 10 | 13 | 6 |
| Greece | 23 | 23 | 23 | 25 |
| Indonesia (Jakarta) | 30 | 30 | 27 | 30 |
| Ireland | 17 | 23 | 15 | 22 |
| Israel | 12 | 26 | 17 | 27 |
| Italy | 18 | 29 | 20 | 26 |
| Japan | 19 | 12 | 21 | 7 |
| Korea | 21 | 14 | 24 | 15 |
| Netherlands | 6 | 2 | 4 | 2 |
| New Zealand | 15 | 15 | 6 | 16 |
| Norway | 9 | 4 | 14 | 8 |
| Poland | 26 | 20 | 29 | 14 |
| Russia | 25 | 25 | 28 | 24 |
| Singapore | 11 | 8 | 7 | 11 |
| Slovakia | 27 | 22 | 25 | 13 |
| Slovenia | 22 | 18 | 19 | 19 |
| Spain | 20 | 19 | 22 | 23 |
| Sweden | 3 | 5 | 5 | 4 |
| Turkey | 29 | 26 | 30 | 28 |
| United Kingdom (England) | 2 | 20 | 1 | 21 |
| United States | 1 | 11 | 11 | 20 |

* Data for Chile, Greece, Israel, Indonesia, New Zealand, Singapore, Slovenia and Turkey are for 2015. For the other countries data are for 2012.

# 7. Concluding Remarks

The paper has considered a range of measures for evaluating the quality of national systems of higher education. In our core ranking, we measure performance under four headings: Resources, Environment, Connectivity and Output. In this ranking the highest ranked nations are high-income countries. While the best systems provide aspirational levels of performance it is neither feasible nor desirable for low-income countries to match this performance. It is for this reason that we develop an auxiliary ranking in which we adjust performance for levels of GDP per capita. Even then we still use the same variables and weights. To go further would require these to be dependent on income levels. In order to maintain economic growth, high-income countries need to be engaged in high-level basic research, whereas for low-income countries the adoption of existing research findings is more important. Thus for low-income countries, more weight might be given to technical training and links with industry, and less weight to scientific publications. Our detailed results enable such re-calculation, although benchmarking of each data series against countries at similar levels of development provides a simpler approach.

Most of our measures evaluate national performance using current values of variables, whereas the true worth of research, teaching and connectivity can only be evaluated over time. There is no simple answer to this problem. If stock measures are used, such as the competencies of all tertiary educated people in the workforce, we are then measuring the performance of the system of higher education over several decades. This is less of an issue if the system has been relatively stable over a long period of time.

Both our Connectivity variables and those included in the Output module can be considered as outcomes of a nation's system of higher education. Similarly, our Resources and Environment modules together represent inputs. On the input side there does seem to be a trade-off between government funding and autonomy of institutions: not surprisingly, more government funding is accompanied by less autonomy. For example, the Nordic countries and the United States both have systems of higher education that perform well but there is both greater government regulation and greater government funding in the Nordic countries. This trade-off is reflected in our data. In our Environment module, where weights are given to autonomy, the highest ranked countries are the United States, and the United Kingdom and Commonwealth countries, whereas the Nordic countries rank highest in the Resources module where government expenditure is weighted heavily. The moral is that there is no ideal system, only some systems that are better than others. What does stand out are the characteristics of a bad system: one in which governments exercise much control over institutions but provide little funding.

# Appendix 1. Sources

R1 and R2: OECD, *Education at a Glance, 2016, Table B2.3 and UNESCO, Institute for Statistics* (**www.uis.unesco.org**)

R3: OECD, *Education at a Glance, 2016,* Table B1.1a; 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: OECD, *Education at a Glance 2016; UNESCO;* surveys as described in Appendix 2

E5: World Economic Forum, *The Global Competitiveness Report 2016-17,* Table 5.03.

C1: OECD, *Education at a Glance 2016,* Table C4.1; UNESCO

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

C3 and C4: Webometrics (**www.webometrics.info**), July 2015 version.

C5: *IMD World Competitiveness Report 2016,* Table 4.3.23, World Competitiveness Center, Institute for Management Development, Lausanne, Switzerland.

C6: CWTS, Leiden University

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

O4 and O5: Shanghai Jiao Tong University Rankings, 2016 (**www.shanghairanking.com**)

O6: UNESCO, Institute for Statistics

O7: OEDC, *Education at a Glance, 2016,* Table A1.2 ILOSTAT data base (**www.ilo.org**), UNESCO, Institute for Statistics

O8: UNESCO, *Institute for Statistics*

O9: OECD, *Education at a Glance,* 2016, Table A5.4 and ILOSTAT data base (**www.ilo.org**)

# Appendix 2: The Survey Components of E4: Qualitative measure of the environment

The qualitative measures of the environment are based on responses to questionaries. Replies were obtained from U21 representatives, government agencies and educational research institutes. The survey for E4.2 was originally carried out in 2012; the survey for E4.3 was undertaken in 2015. The responses have been updated as appropriate.

E4.2: The eight survey questions cover the following areas:

- Are there agencies that monitor standards of public tertiary institutions?
- If agencies exist are their findings made public?
- Are there agencies that monitor standards of private tertiary institutions?
- If agencies exist are their findings made public?
- The degree to which academics in public tertiary institutions are not government employees.
- Are academics in public research universities free to move to another university without government approval?
- Degree of freedom institutions have in choosing the CEO of a public research university.
- Degree of freedom to appoint foreign academics to ongoing positions?

E4.3: This was a survey primarily of the financial autonomy of publicly funded institutions. The categories of responses draw on those used by the European University Association (EUA) given on the EUA Autonomy in Europe website (**www.university-autonomy.eu**).

The six survey questions cover the following areas:

- To what extent is core public funding untied?
- Can institutions make market-adjustment allowances for academic staff in high demand?
- To what extent are institutions permitted to keep cash surpluses?
- What ability do institutions have to borrow money?
- To what extent can public institutions levy tuition fees for national (domestic) students?
- What freedom do institutions have over Bachelor degree programs offered?

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