U21 Ranking of National Higher Education Systems 2012

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U21 Ranking of National Higher Education Systems

A project sponsored by *Universitas 21*

Ross Williams
Gaetan de Rassenfosse
Paul Jensen
Simon Marginson

University of Melbourne
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The project is based at the
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University of Melbourne

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Preface

This project was approved at the May 2011Presidents' Meeting of *Universitas 21*. The results presented here represent an initial attempt to rate national systems of higher education. We have elected to include a relatively large number of countries (48 in total) covering different stages of economic development. This has widened the value of the exercise, although it has made the data collection more complicated. We hope that publication of the rankings will encourage improvements in data, both for included countries and to enable us to extend the range of countries in future updates.

The Steering Group for the project is:

Dr Ying Cheng, Graduate School of Education, Shanghai Jiao Tong University
Professor David Greenaway, Vice-Chancellor, University of Nottingham
Professor Don Fisher, Department of Educational Studies, University of British Columbia
Professor Simon Marginson, Centre for the Study of Higher Education, University of Melbourne
Professor Ross Williams, Melbourne Institute, University of Melbourne

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We thank Jane Usherwood, U21 Secretary General, Lavinia Gott, U21 Deputy Secretary General, Dr Gemma Marakas, U21 Research and Projects Co-ordinator and Clare Noakes, U21 Administrator.

Executive Summary

A nation's economic development depends crucially on the presence of an educated and skilled workforce and on technological improvements that raise productivity. The higher education sector contributes to both these needs: it educates and trains; it undertakes pure and applied research. Furthermore, in a globalised world, a quality higher education system that is well-connected internationally facilitates the introduction of new ideas, and fosters trade and other links with foreign countries, through the movement of students and researchers across national frontiers.

Given the importance of higher education, a nation needs a comprehensive set of indicators in order to evaluate the quality and worth of its higher education system. A good higher education system is well-resourced and operates in a favourable regulatory environment. Domestic and international connectivity are also important. The success of the system is measured by output variables such as research performance, participation rates and employment. We use such indicators to derive a ranking of national higher education systems. The measures are grouped under four main headings: Resources, Environment, Connectivity and Output.

The resource measures we use relate to government expenditure, total expenditure, and R&D expenditure in tertiary institutions. The environment variable comprises the gender balance in students and academic staff, a data quality variable and a quantitative index of the policy and regulatory environment based on survey results. We surveyed the following attributes of national systems of higher education: degree of monitoring (and its transparency), freedom of employment conditions and in the choice of the CEO, and diversity of funding. Our survey results are combined with those from the World Economic Forum. Data limitations restrict the connectivity variables to numbers of international students and articles written jointly with international collaborators.

Nine output measures are included and cover research output and its impact, the presence of world-class universities, participation rates and the qualifications of the workforce. The appropriateness of training is measured by relative unemployment rates. The measures are constructed for 48 countries at various stages of development.

The overall ranking is given on pages 6 and 7. The top ten countries, in rank order, are the United States, Sweden, Canada, Finland, Denmark, Switzerland, Norway, Australia, the Netherlands and the United Kingdom.

There is a strong relationship between resources and output: of the top eight countries in output, only the UK and Australia are not in the top eight for resources. There is some evidence of groupings of neighbouring countries. The four Nordic countries are all in the top seven; four east Asian countries (Hong Kong SAR, Japan, Taiwan and Korea) are clustered together at ranks 18 to 22; Eastern European countries (Ukraine, Czech Republic, Poland, Slovenia) are together in the middle range; and the Latin American countries (Chile, Argentina, Brazil and Mexico) cluster together. It would seem that while many countries may feel they cannot hope to match the higher education system in the United States, they do want to match that of their neighbours.

U21 Ranking 2012

Rank	Country	Score
1	United States	100.0
2	Sweden	83.6
3	Canada	82.8
4	Finland	82.0
5	Denmark	81.0
6	Switzerland	80.3
7	Norway	78.0
8	Australia	77.8
9	Netherlands	77.4
10	United Kingdom	76.8
11	Singapore	75.4
12	Austria	73.8
13	Belgium	73.7
14	New Zealand	72.5
15	France	70.6
16	Ireland	69.5
17	Germany	69.4
18	Hong Kong SAR	68.9
19	Israel	67.4
20	Japan	66.1
21	Taiwan	62.0
22	Korea	60.2
23	Portugal	60.1
24	Spain	59.9

The success of the system is measured by output variables such as research performance, participation rates and employment. The measures are grouped under four main headings:

National Higher Education Systems

Rank	Country	Score
25	Ukraine	58.6
26	Czech Republic	57.9
27	Poland	56.2
28	Slovenia	55.8
29	Greece	54.7
30	Italy	54.0
31	Bulgaria	52.5
32	Russian Federation	52.4
33	Romania	51.3
34	Hungary	50.8
35	Slovakia	50.6
36	Malaysia	50.5
37	Chile	48.9
38	Argentina	48.6
39	China	48.3
40	Brazil	47.2
41	Thailand	46.6
42	Iran	45.8
43	Mexico	45.3
44	Croatia	44.9
45	Turkey	44.4
46	South Africa	43.4
47	Indonesia	37.5
48	India	34.4

Resources, Environment, Connectivity and Output. All the variables and the weighting are explained in this report. The measures are constructed for 48 countries at various stages of development.

1. Introduction

A nation's economic development depends crucially on the presence of an educated and skilled workforce and on technological improvements that raise productivity. The higher education sector contributes to both these needs: it educates and trains; it undertakes pure and applied research. Thus a quality higher education system with high rates of participation is a necessary requirement for improvements in living standards and the broad distribution of those improvements. Furthermore, in a globalised world, a quality higher education system that is well-connected internationally facilitates the introduction of new ideas, and fosters trade and other links with foreign countries, through the movement of students and researchers across national frontiers.

Given the importance of higher education, a nation needs a comprehensive set of indicators in order to evaluate the quality and worth of its higher education system. A report by Martin and Sauvageot (2011, p. 9) of the International Institute for Educational Planning, a UNESCO affiliate, comments as follows:

> "Many countries are currently exploring the best means of designing indicator systems for their higher education sectors. They perceive the need for an indicator system to improve communication on the progress of their higher education systems to the public at large and funding organisations, as well as to monitor the implementation of their public higher education policies."

A consensus is emerging within the sector as to what are desirable characteristics. The consensus has come about principally because of studies that look at the characteristics of successful systems (for example Salmi, 2007, 2009), with success being defined in terms of the number and characteristics of a nation's graduates and the research performance of both the higher education sector and the nation.

While there are a number of international rankings of universities, commencing with the seminal Shanghai Jiao Tong index in 2003, less effort has been put into quantitative rankings of national systems of higher education. A notable exception is the policy brief for The Lisbon Council, in which Edereer, Schuller and Willms (2008) develop and implement a university systems ranking for 17 selected OECD countries. The international rankings of universities emphasise the peaks of research excellence. They throw no light, however, on issues such as how well a nation's higher education system educate all its students, possessing different interests, abilities and backgrounds. Even for universities, Salmi (2011, p. 335) notes that "what happens in the institution alone is not sufficient to understand and appreciate the full dynamics of their relative success or failure".

We now turn to a range of measures that can be used to compare and rank national systems of higher education.

2. The Menu of Measures

Salmi (2011, p.338), from a list of desirable features, concludes that "the governance framework and the availability of financial resources are definitely essential because they condition the degree of autonomy of research universities. These factors influence the universities' ability to mobilize funding for recruiting and keeping top academics and for providing them with the appropriate teaching and research infrastructure…"

We follow Salmi and include measures of financial resources as well as what we label as the 'Environment'. National investment in higher education is measured by public and private expenditure on teaching and research. These expenditures and the manner in which they are distributed between institutions and used within institutions are crucial determinants of the contribution of the sector to the economy. The 'Environment' encompasses the governmental regulatory regime, the degree of diversity in types of institutions and funding, and the openness of the system to minorities. We add a third type of desirable attribute, the 'Connectiveness' of the higher education system with the rest of society and internationally. As a measure of the efficacy of the system we use a range of output measures such as research performance, participation rates and graduate levels.

To summarise, we evaluate the standing of national higher education systems by providing rankings in four broad areas. These are:

- Resources
- Environment
- Connectivity
- Output

The rankings are then combined to provide an overall ranking.

In evaluating the quality of a national higher education system we control for national size in most measures. The diversity of higher education systems across countries, not withstanding convergence over time, means that for many variables data are most readily available for the whole of the tertiary sector, covering the ISCED classifications 5A, 5B and 6[1]. This is the definition used by international agencies from which we draw much of our data. However, data for variables such as research output often relate solely to universities or comparable institutions. The definitions and coverage of variables we use to measure performance within each of the four broad areas are set out below. Sources are given on page 27. In some cases data for a few countries are from earlier years than those given below.

1 The ISCED classification relates to programs: ISCED 6 to advanced research programs such as the PhD; ISCED 5A to degree programs of at least three years; ISCED 5B to more practical programs of at least two years. Institutions are typically classified in terms of the highest level of program offered.

2.1 Resources

Higher education institutions obtain funding for teaching and research from government, persons and corporations. Governments at different levels (federal and provincial) typically provide core funding for teaching in public institutions. Government funding will thus tend to be higher in countries with fewer private institutions. We measure total funding in both relative terms, as a percentage of GDP, and in absolute terms, namely funding per student, taking account of differences in purchasing power of money in different countries.

Expenditure on research and development (R&D) is an important determinant of economic growth. We therefore include as a measure of the strength of a nation's higher education system, expenditure on R&D in tertiary institutions both as a percentage of GDP and per head of population, after allowing for differences in purchasing power between countries. Thus our five measures of resources are:

R1: Government expenditure on tertiary education institutions as a percentage of GDP, 2008.

R2: Total expenditure on tertiary education institutions as a percentage of GDP, 2008.

R3: Annual expenditure per student (full-time equivalent) by tertiary education institutions in USD purchasing power prices, 2008.

R4: Expenditure in tertiary education institutions for research and development as a percentage of GDP, 2009.

R5: Expenditure in tertiary education institutions for research and development per head of population at USD purchasing power prices, 2009.

2.2 Environment

Resources are a necessary condition for excellence in higher education but they are not sufficient. The regulatory environment is important for ensuring that resources are used efficiently. Excessive regulation of employment conditions will limit the contributions of academics and the capacity to attract and retain globally-competitive talent. Restraints on competition may hinder innovation in teaching methods. A narrow choice of alternative forms of higher education is likely to lower participation rates. A national system benefits from having a critical mass of both private and public institutions (see Martin and Sauvageot (2011) and Salmi (2007)). Lack of opportunities for women or those from low socio-economic classes means that talent is not fully utilised.

Jamil Salmi, Philip Altbach and others have observed that the best performing national higher education systems are ones in which governments set the broad parameters and monitor performance but allow institutions to operate independently from direct government interference. In order to capture the characteristics of such a model we use quantitative data supplemented by a questionnaire that is designed to measure the autonomy of systems of higher education, complemented by measures of quality control.

The most obvious measure of equity is the percentage of low socio-economic groups in the student population. We have been unable to find a measure that is robust across countries. Other measures are listed below.

E1: Proportion of female students in tertiary education, 2009 data.

E2: Proportion of academic staff in tertiary institutions who are female, 2009 data.

E3: A rating for data quality. A nation that has poor data on its higher education system can hardly be said to provide adequate monitoring. For each quantitative series, the value is 1 if the data are available for the exact definition of the variable, 0.5 if some data are available which relate to the variable but some informed adjustment is required; 0 otherwise.

E4: Qualitative measure of the policy and regulatory environment. This variable has three components:

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

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

E 4.3: An index based on a survey we conducted among *Universitas 21* institutions.

The questions cover

- Degree of monitoring (and its transparency) of tertiary institutions
- Freedom of employment conditions
- Choice of CEO

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

2.3 Connectivity

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

Measures of domestic connectivity would include the proportion of science and engineering articles co-authored with industry, and higher education expenditure accounted for by private entities other than households. Unfortunately data in these areas exist only for a limited number of countries and we were unable to include the measures.

We are thus limited to international measures of connectivity, although even here data are not widely available on one desirable measure, namely, the proportion of foreign students in advanced research programs.

The two measures for which we have data are:

C1: Proportion of international students in tertiary education, 2009.

C2: Proportion of articles co-authored with international collaborators, 2005-2009. The data are a weighted average for each country where the weights are the proportion of output from each higher education institution.

2.4 Output

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

O1: Total articles produced by higher education institutions, 2005-2009.

O2: Total articles produced by higher education institutions per head of population, 2005-2009. We use the SCImago data, based on the Scopus database, that calculates research output from over 3,000 research institutions classified as Government, Health, Higher Education, Private Companies and Other. The entries on higher education institutions, which we use, comprise around two-thirds of the entries. An alternative to O2 would be to use a productivity measure and divide output by the number of staff employed in higher education. This was not used because of our concerns about the availability and international comparability of data on staff numbers.

O3: An impact measure calculated from the SCImago database, 2005-2009. The measure is a weighted average of the Karolinska Institute normalized impact factor for each higher education institution, where the weights are each institution's share of national publications from higher education institutions.

O4: A measure of the depth of good universities in a country. For this measure we use a weighted average of the number of institutions listed in the top 500 according to the 2011 Shanghai Jiao Tong index divided by country population. The measure can be thought of as a rough indicator of the probability of a person in a country attending a university ranked among the top 500 in the world. The weights used are the scores out of 100 for each university. In the Shanghai ranking, universities ranked below the top 100 are banded in groups: 100-150, 151-200, 201-300, 301-400 and 401-500; within each band we use the average score.

O5: A measure of the research excellence of a nation's best universities. The quality of a nation's best universities sets national standards and facilitates knowledge transfer at the frontier of new research. For this measure we again use the 2011 Shanghai Jiao Tong index and average the scores for each nation's three best universities, with a zero weight for institutions not in the top 500.

O6: Enrolments in tertiary education as a percentage of the eligible population, defined as the five-year age group following on from secondary education, 2009.

O7: Percentage of the population aged over 24 with a tertiary qualification, 2009.

O8: Number of researchers (full-time equivalent) in the nation per head of population, 2009.

O9: Unemployment rates among tertiary educated aged 25-64 years compared with unemployment rates for those with only upper secondary or post-secondary non-tertiary education, 2009. The measure is calculated as the ratio of the latter to the former in order for larger values to indicate the value of higher education and to accommodate cases where unemployment is higher for tertiary than secondary.

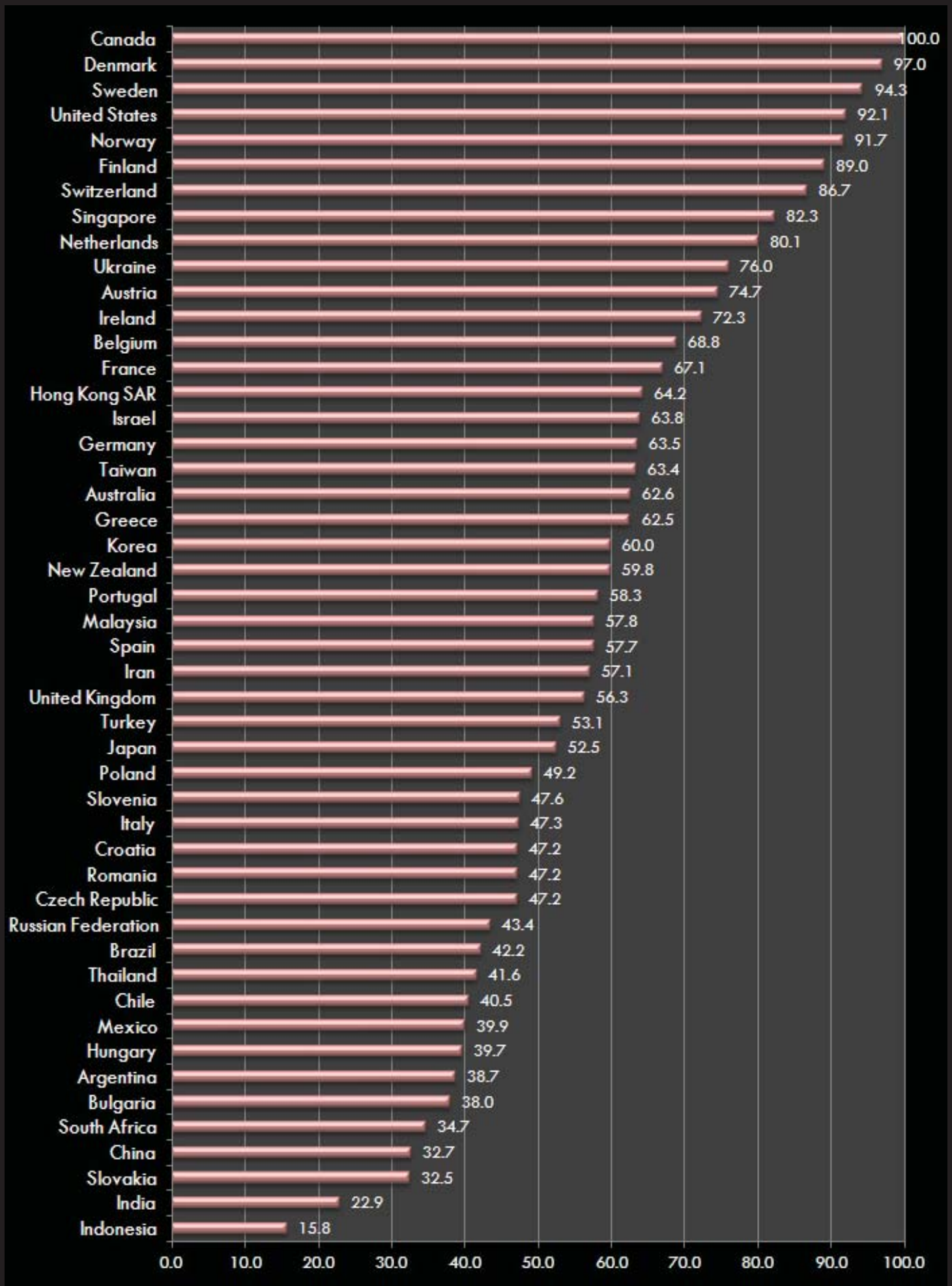
3. Country ratings

Initially we chose the top 50 countries in the National Science Foundation (NSF) rankings of research output in 2006-7. To these countries we added Hong Kong, which was not included separately in the NSF data, and the two G20 countries (Indonesia and Saudi Arabia) that did not make the cut. Subsequently five countries (Egypt, Pakistan, Saudi Arabia, Serbia and Tunisia) were dropped owing to the limited availability of data. The final list of 48 countries is:

Europe	Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, United Kingdom
Asia/Oceania	Australia, China, Hong Kong SAR, India, Indonesia, Japan, Korea, Malaysia, New Zealand, Singapore, Taiwan, Thailand
Latin America	Argentina, Brazil, Chile, Mexico
North America	Canada, United States
Africa/Middle East	Iran, Israel, Turkey, South Africa

For each variable, the highest scoring country is given a score of 100 and all other countries are expressed as a percentage of the highest score. Results are presented for each measure and for the four categories (resources, environment, connectivity and output). An overall ranking is then presented. Unless otherwise specified, in calculating overall rankings for the four categories we put missing data at the lower quartile score.

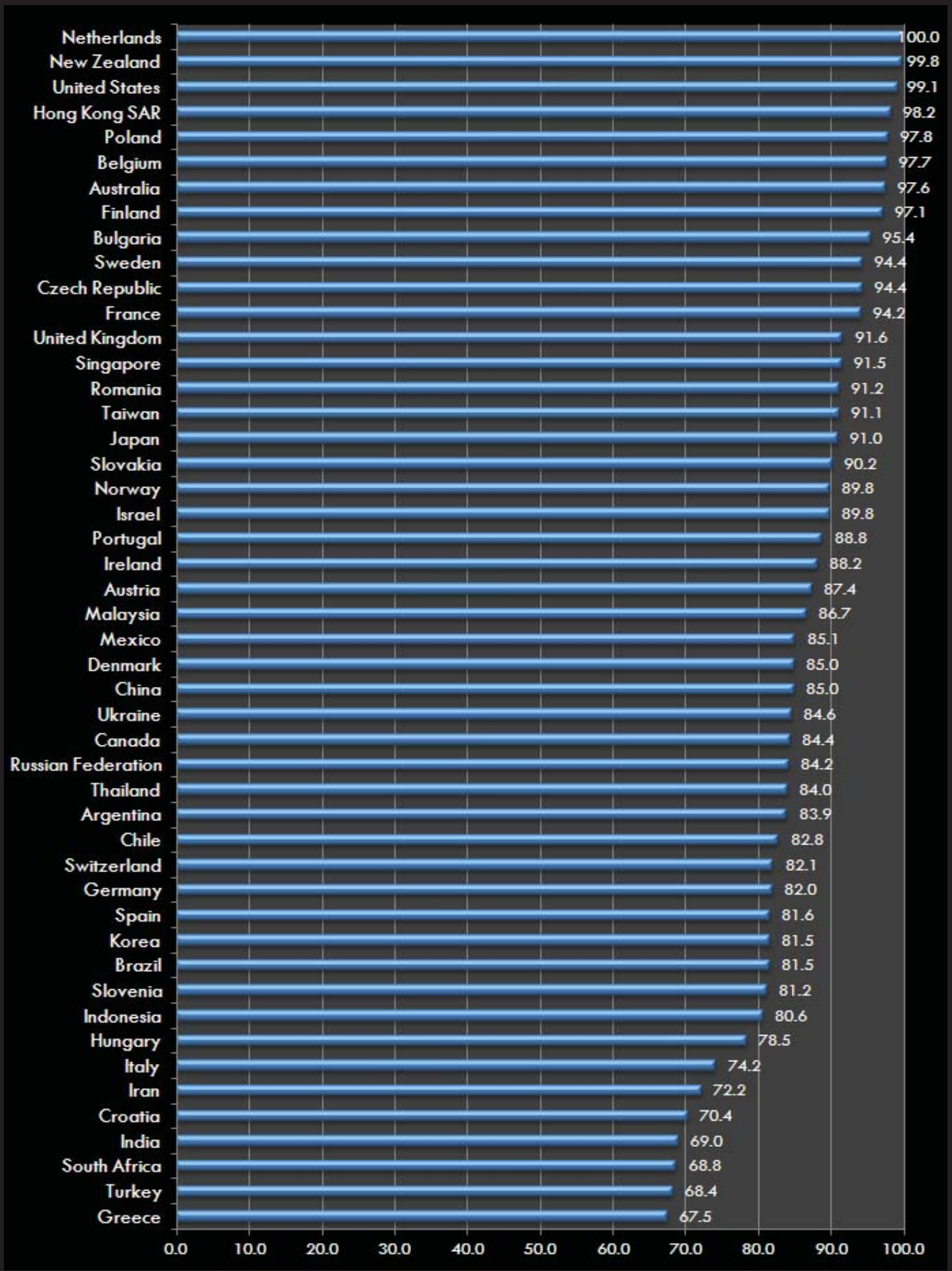
Resources


Canada 100.0
Denmark 97.0
Sweden 94.3
United States 92.1
Norway 91.7
Finland 89.0
Switzerland 86.7
Singapore 82.3
Netherlands 80.1
Ukraine 76.0
Austria 74.7
Ireland 72.3
Belgium 68.8
France 67.1
Hong Kong SAR 64.2
Israel 63.8
Germany 63.5
Taiwan 63.4
Australia 62.6
Greece 62.5
Korea 60.0
New Zealand 59.8
Portugal 58.3
Malaysia 57.8
Spain 57.7
Iran 57.1
United Kingdom 56.3
Turkey 53.1
Japan 52.5
Poland 49.2
Slovenia 47.6
Italy 47.3
Croatia 47.2
Romania 47.2
Czech Republic 47.2
Russian Federation 43.4
Brazil 42.2
Thailand 41.6
Chile 40.5
Mexico 39.9
Hungary 39.7
Argentina 38.7
Bulgaria 38.0
South Africa 34.7
China 32.7
Slovakia 32.5
India 22.9
Indonesia 15.8
0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0

3.1 Resources

While government funding of higher education is highest in three Nordic countries (Finland, Norway and Denmark), total funding as a percentage of GDP is highest in the United States and Canada. Private funding is especially important in the United States. Expenditure on R&D in tertiary institutions is highest in Denmark, Sweden and Switzerland. We arrive at an overall ranking for Resources by giving a double weight to the general expenditure measures, R1-R3, and a weight of 4 on public expenditure (R1) in those cases where data on private expenditure are not available. On this basis, Canada is first placed, followed by Denmark, Sweden, the United States and Norway, in that order.

Environment



3.2 Environment

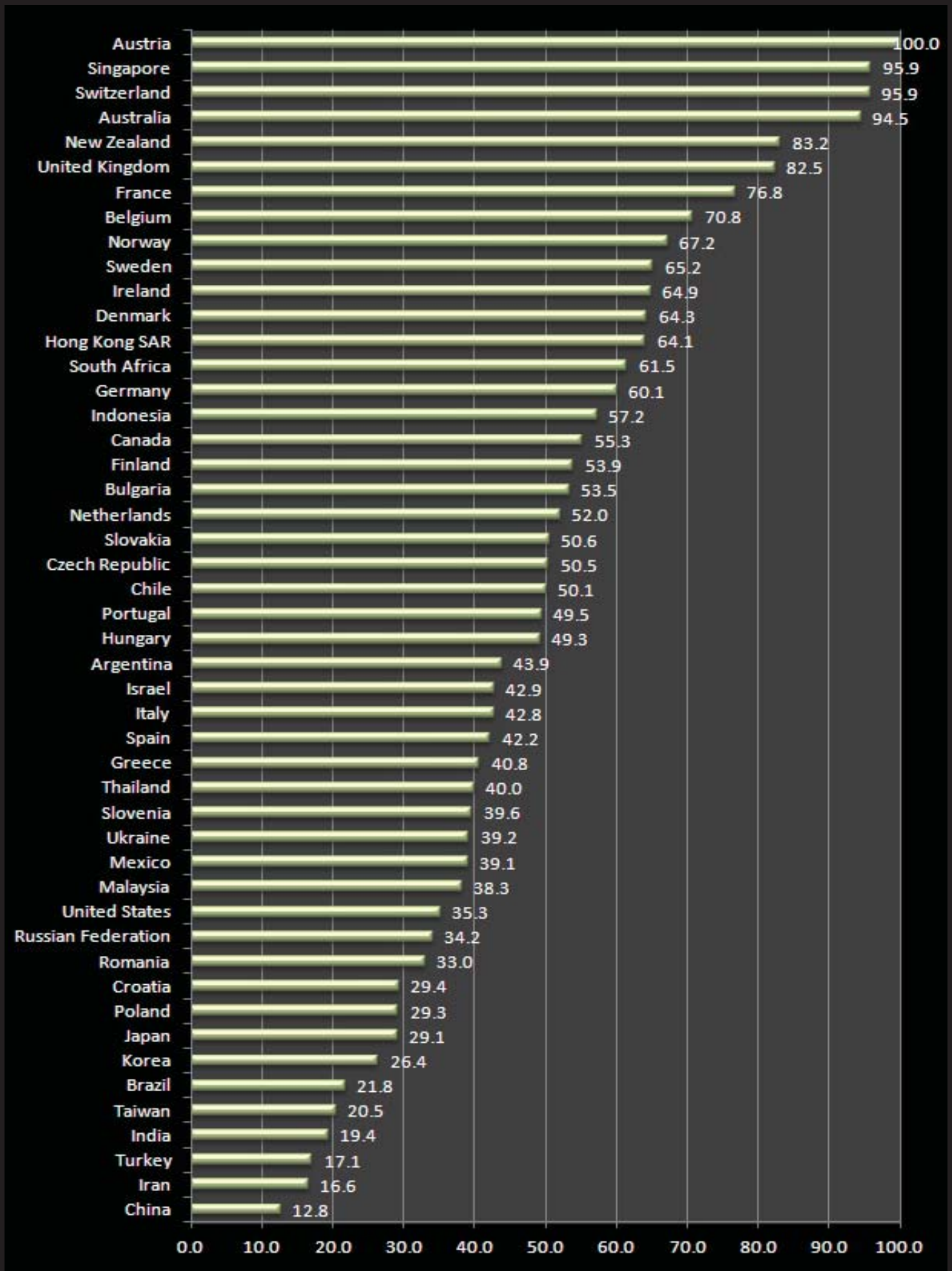
The score for female participation is put at the maximum level of 100 if the share is 50 percent or higher. In all but eight countries at least 50 percent of students were female. The lowest percentages were in India and Korea. On the other hand, in only five countries were at least 50 percent of staff female. The lowest percentages were in Iran and Japan.

Turning to the quality of data variable, the most serious data deficiency was the absence of information on total expenditure on tertiary education (public plus private) in nine countries.

In rating the national regulatory regime, the percentage scores on the questionnaire (and information obtained from other sources) were converted into a 10 point scale, with 4 being the lowest score obtained. One criterion used was the existence of national monitoring agencies, which lowered the scores for some federations where monitoring is left to subnational governments. The three components of the qualitative variable (diversity of institutions, E4.1, WEF scores, E4.2, and our survey findings, E4.3) are weighted as 4 (E4.1), 16 (E4.2) and 24 (E4.3), where 24 represents the maximum score that could be obtained for the questionnaire. By this composite qualitative measure, the country with the best regulatory environment is the Netherlands, followed by Hong Kong SAR, New Zealand, the United States, Belgium, Poland, Australia, and Japan. The least favourable regulatory environments are in Croatia, Turkey and Greece.

The overall ranking in the category Environment is obtained by using a weight of 70 percent for the qualitative variable and 10 percent for each of the three other variables. (For countries where data on female staff were unavailable we averaged over the other variables.) Not surprisingly, given the weighting system, the overall Environment ranking is very similar to that for the composite qualitative variable, with the Netherlands and New Zealand first, followed by the United States. Next come Hong Kong SAR, Poland, Belgium and Australia and Finland.

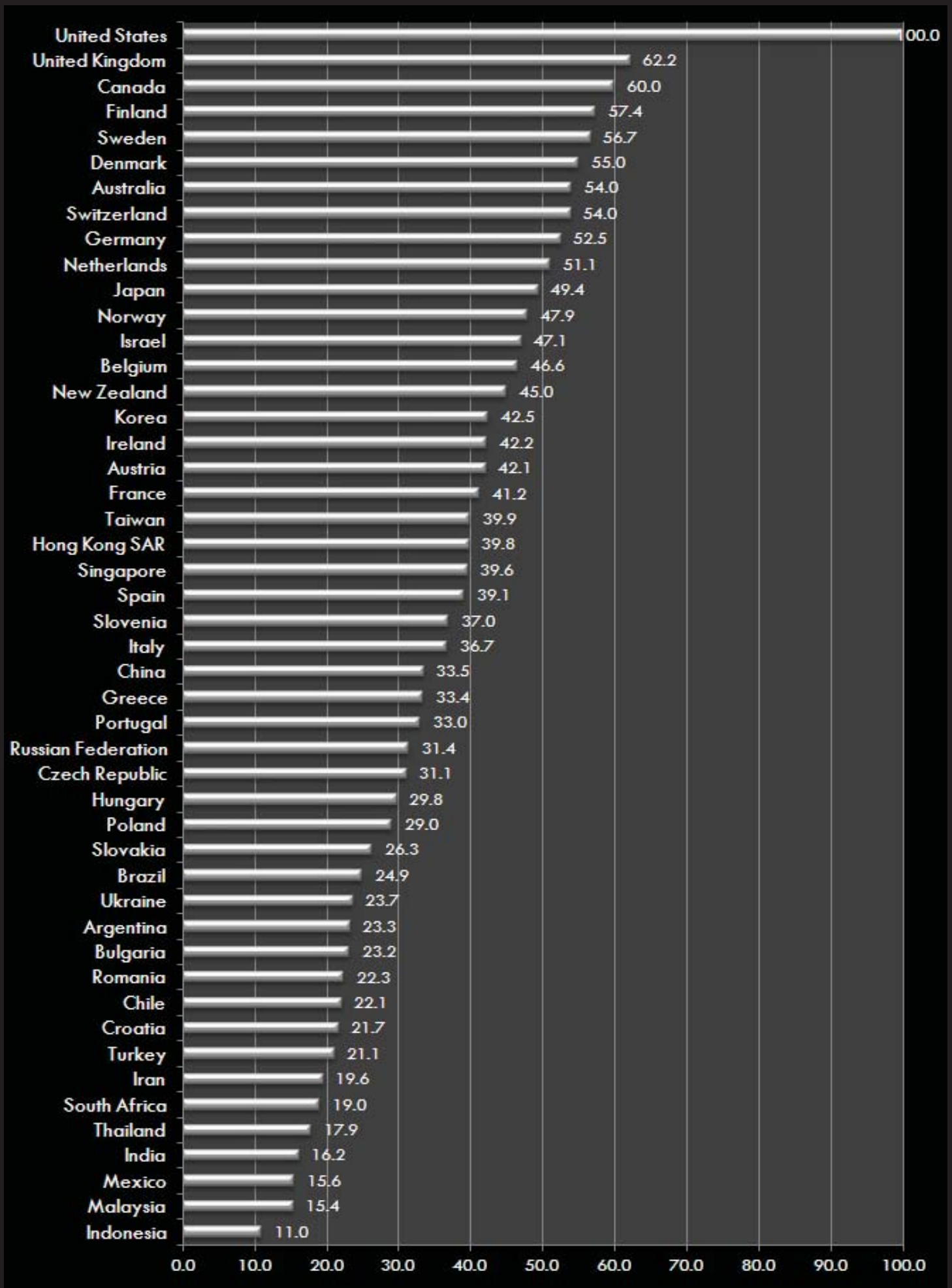
Connectivity



3.3 Connectivity

International student enrolments as a percentage of total enrolments are highest in Australia, Singapore and Austria. International enrolments are also relatively important in the United Kingdom, Switzerland and New Zealand. Researchers are most linked internationally, as measured by joint publications with a foreign author, in Indonesia and Switzerland. International collaboration is also high in Denmark, Belgium, Austria and Sweden. The United States, Korea and Japan are in the bottom quartile for research collaboration, in part reflecting the existence of a critical mass within the national research community. Averaging the two measures to obtain an overall measure of Connectivity, Austria is ranked first followed by Singapore, Switzerland and Australia.

Output


United States 100.0
United Kingdom 62.2
Canada 60.0
Finland 57.4
Sweden 56.7
Denmark 55.0
Australia 54.0
Switzerland 54.0
Germany 52.5
Netherlands 51.1
Japan 49.4
Norway 47.9
Israel 47.1
Belgium 46.6
New Zealand 45.0
Korea 42.5
Ireland 42.2
Austria 42.1
France 41.2
Taiwan 39.9
Hong Kong SAR 39.8
Singapore 39.6
Spain 39.1
Slovenia 37.0
Italy 36.7
China 33.5
Greece 33.4
Portugal 33.0
Russian Federation 31.4
Czech Republic 31.1
Hungary 29.8
Poland 29.0
Slovakia 26.3
Brazil 24.9
Ukraine 23.7
Argentina 23.3
Bulgaria 23.2
Romania 22.3
Chile 22.1
Croatia 21.7
Turkey 21.1
Iran 19.6
South Africa 19.0
Thailand 17.9
India 16.2
Mexico 15.6
Malaysia 15.4
Indonesia 11.0
0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0

3.4 Output

The United States dominates the total output of articles from higher education institutions. Chinese universities publish just over 40 percent of the United States total; Japan and the United Kingdom 25 percent. On a per capita basis Sweden produces the most journal articles. The next highest performers are Finland, Switzerland, Denmark, Australia, the Netherlands and Canada in that order. The nations whose research papers, on average, have the greatest impact are Switzerland, the Netherlands and the United States. These countries are followed by the United Kingdom and Denmark.

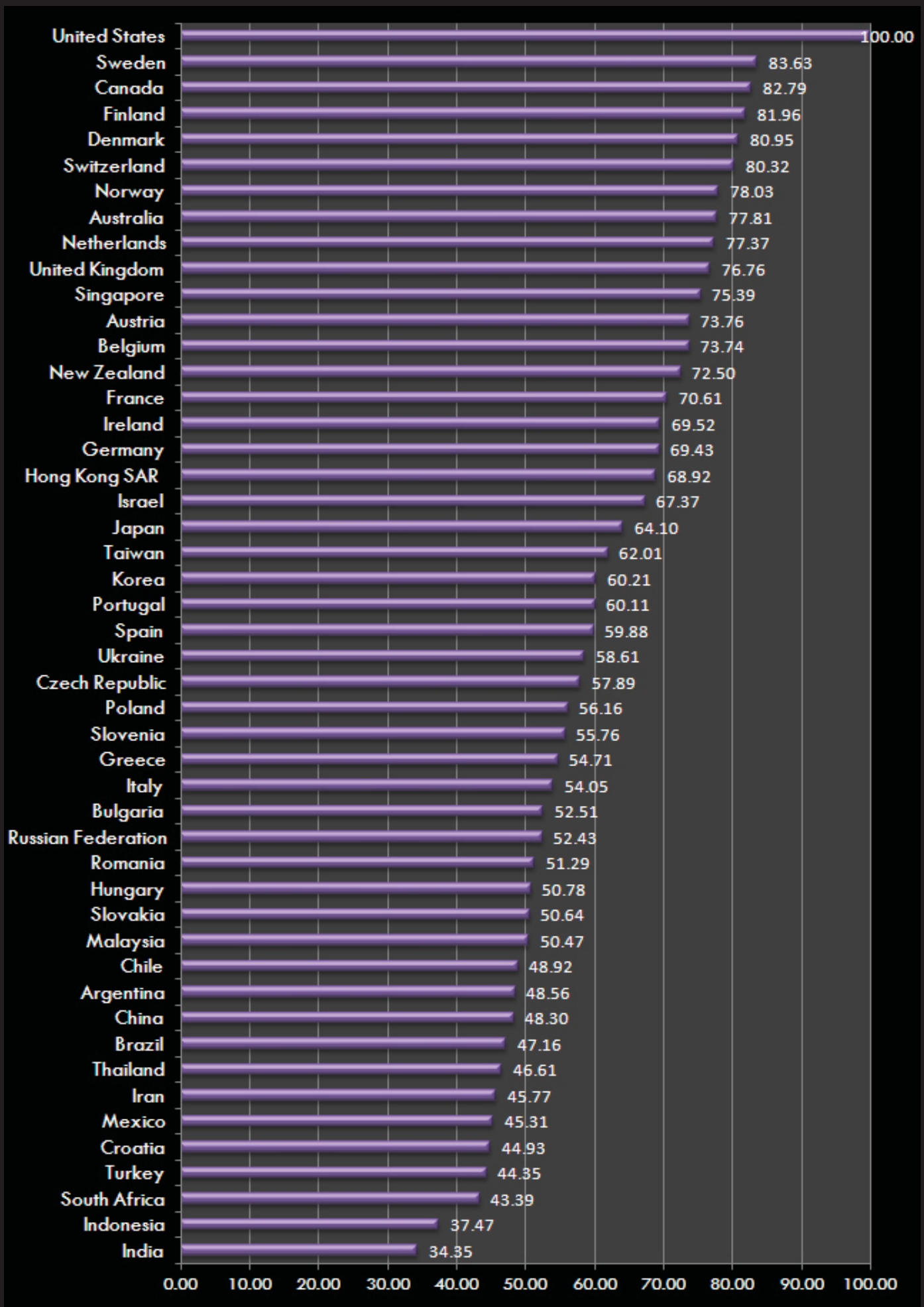
The United States and the United Kingdom have the world's top universities . But on a weighted per capita basis the depth of world class universities is best in Switzerland and Sweden, with Israel and Denmark next in rank order.

The extent of education and training is measured in two ways: the flow of those currently being trained (O6) and the stock of the adult population with a tertiary qualification (O7). As expected, developing countries perform better on the flow variable than the stock, but over time these will converge. The variation across countries is much less for the flow measure than for the stock measure. Korea has the highest percentage of young people enrolled in tertiary institutions but is ranked eighth on the percentage of the working population with a tertiary qualification, well behind the best performing country, Russia. Other countries with high participation rates are Finland, Greece, the United States, Canada and Slovenia. After Russia, countries with relatively large stocks of tertiary educated workers are Canada, Israel, the United States, Ukraine, Taiwan and Australia.

The stock of tertiary educated workers is a blunt measure of the performance of the tertiary sector. Is the distribution across disciplines appropriate? Do the qualifications meet the demands of a modern economy? One measure of the contribution to the economy is the number of researchers per head of population. This ratio is highest in Finland and Denmark, followed in rank order by Singapore, Norway, Japan, Sweden, Korea and the United States, but the United States figure is only 60 percent of that for Finland. Unemployment data provide a measure of the appropriateness of education and training. The best performing countries are the eastern European countries Slovakia, Czech Republic and Hungary. In three countries, Chile, Mexico and Indonesia, the unemployment rate was higher for those with tertiary education than those who completed only secondary school, perhaps indicative of a tertiary education sector that is not producing the needed mix of graduates.

The score for the broad category Output is obtained by averaging over the 9 output variables and giving a weight of 4 to total output (equivalent to a weight of one-third in the output variable). On this basis the United States ranks first, followed by the United Kingdom and Canada. The Nordic countries rank highly: Finland and Sweden are equal fourth, Denmark is sixth and Norway twelfth.

Overall ranking



3.5 Overall ranking

An overall ranking is obtained by weighting the four broad areas as follows:

Resources	25%
Environment	25%
Connectivity	10%
Output	40%

The weights reflect our judgement about importance, modified by the availability and quality of data. We would give a higher weight to connectivity, for example, if we had data on joint activity between higher education institutions and the rest of society.

The top six countries on our ranking of national higher education systems are the United States, Sweden, Canada, Finland, Denmark and Switzerland. The United States would still be ranked first even if we did not include the total output variable (O1), so the result is not solely a size effect.

There is some evidence of groupings of neighbouring countries. The four Nordic countries are all in the top seven; four east Asian countries (Hong Kong SAR, Japan, Taiwan and Korea) are clustered together at ranks 18 to 22; Eastern European countries (Ukraine, Czech Republic, Poland, Slovenia) are together in the middle range; the Latin American countries (Chile, Argentina, Brazil and Mexico) cluster together. It would seem that while many countries may feel they cannot hope to match the higher education system in the United States, they do want to match that of their neighbours.

In later work we intend to explore in more detail the relationship between outputs and what might be called the input and state variables (Resources and Environment) but some relationships stand out. Of the top eight countries in output, only the United Kingdom and Australia are not in the top eight for resources. The United Kingdom ranks low on resources (below the median) but is second on output, indicating high productivity. The same is true but to a lesser extent for Australia and Germany.

Concluding remarks

We have taken a snapshot of higher education systems at a point in time. A more detailed empirical analysis of what works in higher education requires tracing over time how systems develop with changes in inputs and the state variables. We have been selective in our choice of countries (we chose around 50 from a database of 200 countries) so that those at the bottom of our rankings could be expected to be well above the median on a ranking of all countries. Many of the countries omitted are lower income countries in Africa and Latin America. Even in the medium term these countries cannot expect their systems to reach the levels of our top ranked countries. But a necessary condition for building up a strong higher education sector is to establish a favourable environment, to connect with other national systems in research and training and then to fund appropriately.

More work is required on how to rate higher education systems in countries with very large populations. What, for example, is the optimum number of research intensive universities for China and India? Does China need to match on a population basis the number of world class universities in the Nordic countries? Each of the four Nordic countries has roughly one world-class university (defined as included in the Shanghai top 500) per million of inhabitants. To match this on a population basis, China would need over 1,300 such institutions! Economies of scale exist for systems as they do for institutions.

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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@contacts.bham.ac.uk
www.universitas21.com

Designed by Clare Noakes
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