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Cross Ranking 2018

Comparing World Higher Education Systems and Institutions

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Prague 2019

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Summary

The importance of world university rankings is without doubt still growing. This is mainly due to globalisation and economic integration that have been taking place over the last decades, as well as to the gradually increasing interconnection of the EU countries. Higher education institutions (HEIs) are not only one of major accelerators of such developments but, at the same time, globalisation, integration and interconnection are retroactively influencing them, and gradually changing their characteristics.

Despite a number of imperfections and weaknesses, the existing most significant world university rankings are still the only serious attempt so far how to identify, assess and measure the quality of higher education institutions at international level. Moreover, their methodologies and data collection techniques have been gradually improving, and as they have been updated every year they also provide important and valuable comparisons of development over time.

Not only the number of published world university rankings but also their influence on the development of higher education systems and on the behaviour of individual institutions has been constantly increasing. Therefore, it is not sufficient just to follow the results of institutions in different rankings. It is necessary to take into account the information on the dynamics both general and of individual tendencies and trends, and also to examine particular impact and influence of rankings not only on individual institutions but also on higher education systems and government policies. Even more, it means that the very dynamic and innovative development of the rapidly changing global quality assessment of universities has to be monitored and assessed very carefully. Our meta-analysis attempts to be a step in this direction.

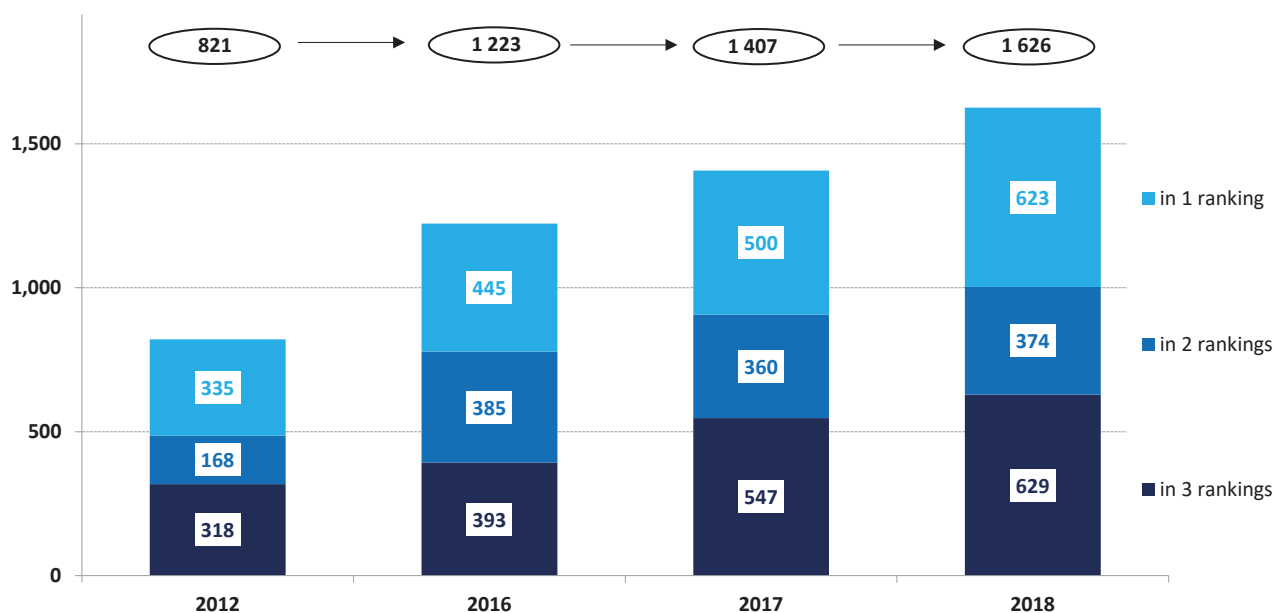
The Cross Ranking (CR) is a new initiative aiming to link available data contained in the most important world rankings in order to provide the richest and most comprehensive information about the performance as well as strengths and weaknesses of higher education institutions and national higher education systems. Our Cross Ranking of the world higher education institutions is based on their results in the three most prestigious and influential world university rankings: the [Academic Ranking of World Universities](#) (ARWU), the [QS World University Rankings](#) (QS) and the [THE World University Rankings](#) (THE). The three rankings have been chosen because they are widely respected by the world academic community and have the longest tradition, because they are transparent, publishing their methodologies in sufficient detail and indicating their data sources, because they communicate with their users, and also because they are continually trying to improve.

Since 2012 when first steps to putting together our meta-ranking were taken, the quite demanding process of unifying the different names of institutions and linking all three rankings has actually become a learning process, where most links elaborated in previous years serve for updating the Cross Ranking data set in the following year. We have linked score of individual higher education institutions attained in all three rankings in order to get substantially more comprehensive data about each institution that correspond to aggregate data from all three rankings. For 2018, data on a total of 1 626 universities were identified and linked together.

The figure below clearly illustrates that the increasing number of higher education institutions published in the three rankings (ARWU, QS, and THE) increases not only the total number of institutions entering into the Cross Ranking (from 821 in the year 2012 to 1 626

Cross Ranking 2012, 2016, 2017 and 2018

Number of institutions according to the inclusion in rankings ARWU, QS and THE



Source: EPC CU, ARWU, QS, THE

in the year 2018) but also the number of institutions whose data from all three rankings considered are available (between the years 2012 and 2018 their number increased from 318 to 629).

All the 1 626 institutions included in the Cross Ranking 2018 undoubtedly represent high quality higher education institutions in the world, in each world region and in each individual country. However, no longer they make only a rather limited elite top. Globally, almost 10% of all higher education institutions are ranked in the Cross Ranking 2018 but already a fifth in the EU 28, a quarter in the EU 15, and even a third in Oceania (in terms of population dominated by two developed OECD countries, Australia and New Zealand).

Thus we can analyse not only the current status and position but since 2012 also the development of a large number of higher education institutions

from all over the world (97 countries had at least one institution in one of the rankings in 2018). Moreover, we can also analyse both the position and the development of higher education systems, as revealed by their total score that is by the sum of scores of all higher education institution from a given country. The conclusions are very interesting, sometimes they confirm our expectation, sometimes they offer new facts, views or findings.

Our aim, however, is not only to determine an overall score and a final position of the best higher education institutions and systems in the world. What is more important to us, is the opportunity to provide their far more detailed and comprehensive profiles based not on a limited number of dimensions (as it is the case of ARWU, QS and THE) but on their aggregate, the 17 dimensions of the Cross Ranking. And moreover, this is possible to do not only for each higher education institution but also for each higher education system.

The Cross Ranking links all the information contained in the three rankings in their 3 overall scores and also in their 17 dimensional scores (that is in 6 dimensional scores in the ARWU and the QS, and 5 dimensional scores in the THE) that together create the profile of each institution. Thus the Cross Ranking provides significantly richer information about each higher education institution and also about each individual higher education system than contained in each of the three rankings separately.

The linked Cross Ranking data have been computed and become available for the years 2012, 2016, 2017, and 2018. They allow to analyse the development of individual institutions and also of individual higher education systems in the last seven years. So let's take a look at main CR results (overall results for all HEIs as well for national systems of higher education 2012–2018 are available at: <http://www.strediskovzdelavacipolitiky.info/app/crossranking/>).

At the institutional level, the Cross Ranking TOP 25 remain almost unchanged between 2012 and 2018, with only a few minor shifts in position of individual HEIs. In all three years under review (2012, 2016, and 2018) the first position belongs unambiguously to Harvard University, followed by another 17 HEIs from the US, 4 from the UK and the best HEI's from Switzerland, Canada, and Japan.

However, some interesting tendencies begin to appear at lower levels of the Cross Ranking such as a growing number and, at the same time, an improving position of HEIs from Europe, Asia (especially China and South Korea) and Oceania (Australia)—particularly at the expense of North American HEIs (both the United States and Canada). When we look at the TOP 250 level of the CR 2018, only 26% HEIs are located in the United States and 4% in Canada, whereas as much as 47% HEIs are located in Europe,

followed by Asia (16%), Oceania (6%), Latin America 1%, and Africa (less than 1%).

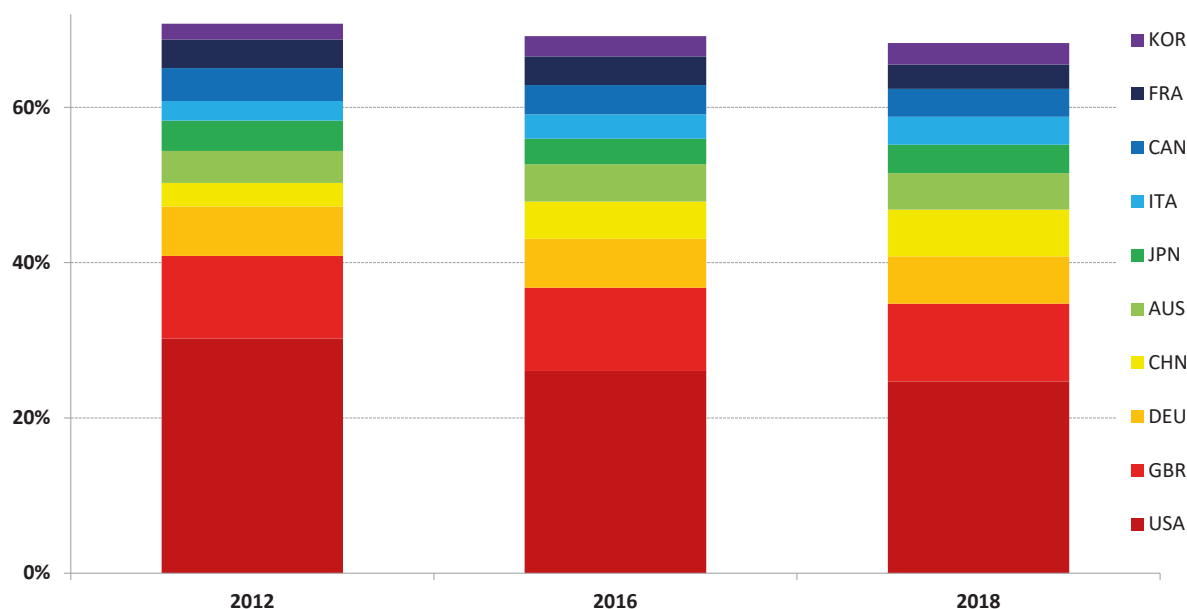
Another important insight is offered by the development of the number of HEIs at TOP 821 level (4.5% of the best HEIs in the world), that is at the level with the maximal number of institutions included in all three Cross Rankings (2012, 2016, 2018). By the number of institutions ranked at TOP 821 level, Europe dominates (322 HEIs in 2012, 347 HEIs in 2016 and 336 HEIs in 2018). However, Oceania is in a better position (increasing the number of HEIs from 34 in 2012 to a maximum of 43 in 2016 a slight reduction to 41 in 2018) as well as Asia (from 204 HEIs in 2012 to a maximum of 212 in 2018). On the other hand, the position of Africa (only 10 HEIs in the CR TOP 821 in 2012 and 11 HEIs both in 2016 and 2018) seems to be permanently weak.

And which particular countries are behind the weakened or strengthened positions of individual world regions at TOP 821 level? Main contributors to increasing the number of HEIs in Asia are particularly China (32 HEIs in the CR TOP 821 in 2012, 44 HEIs in 2016, and even 61 HEIs in 2018) and South Korea (21 HEIs in 2012 and 25 HEIs in 2018). The position of Europe in terms of the number of HEIs in the CR TOP 821 is strengthened particularly thanks to the contribution of 4 countries—when comparing 2012 and 2018, the countries most expanding in the number of HEIs are Italy (increase by 12 HEIs), Germany (increase by 8 HEIs), Spain (increase by 7 HEIs) and the United Kingdom (increase by 6 HEIs).

In contrast to TOP 250 level, only the USA is behind the weakening of North America (178 HEIs in 2012, 172 HEIs in 2016, and only 168 HEIs in 2018) while Canada has a better position in terms of number of HEIs (24 in 2012 and 28 in 2018). In the case of Latin America, its weaker position is due particularly to Mexico (decrease from 10 HEIs in 2012 to 2 HEIs in 2018), Chile, Argentina

TOP 10 countries in Cross Ranking 2012–2018

Share in the total score at TOP 821 level



Note: Countries are ranked by their total score in 2018.

Source: EPC CU, ARWU, QS, THE

(decrease both from 7 HEIs to 3 HEIs) and Colombia (decrease from 5 HEIs to 3 HEIs).

The position of the US is even worse when we take into account all 1 626 HEIs included in the Cross Ranking 2018 (8.9% of the best HEIs in the world). From this point of view Asia is leading with 35% (for the first time being better than Europe), followed by Europe (34%), USA (15%), Latin America (7%), the two remaining North American countries (4%), and Oceania and Africa (both 3%).

The absolute number of HEIs ranked at different levels of the Cross Ranking, however, neither tells anything about their position nor is adequate for evaluating higher education systems in individual countries. More adequate is to take account of the sum of overall scores achieved by all higher education institutions in a given country (that is of their total score). The analysis of the development of the total score of countries and regions naturally corresponds to the development of

the number of HEIs. However, the different positioning of HEIs in the CR can cause that the ranking by the total score may slightly differ from the ranking by the absolute number of HEIs.

This is the case, for example, of the US higher education system, because US HEIs are very well placed in all three rankings considered (ARWU, QS and THE) and thus also in the Cross Ranking. Indeed, the US HEIs at TOP 250 level achieved in 2018 by far the highest proportion, 30% of the total score (composed of scores of the 250 most successful HEIs). The US were followed by the United Kingdom (14%), Germany (6%), Australia (5%), and the Netherlands (5%).

The development of the share of individual countries in the total score at TOP 821 level, which we consider to be the most appropriate indicator for assessing the development of higher education systems, confirms the above mentioned trends. From 2012 to 2018 the share

of US HEIs gradually decreased (from more than 30% in 2012 to less than 25% in 2018) and this also happened to France and Canada, but not to other countries that belonged among the top 10 countries with the highest total score (and together attained about 70% of the total score).

For example, the share of Chinese TOP 821 HEIs in the total score doubled between 2012 and 2018 (from 3.03% to 6.04%). China improved its position from 9th to 4th place being more or less a par with Germany, approaching the United Kingdom. In addition to China's dynamic growth, the Republic of Korea, Australia and Italy also increased their share in the total global score.

However, it should be remembered that the US still continues to dominate the Cross Ranking by its total score. At the level of all 1 626 HEIs included in the CR 2018, the US is by far the most successful country, even though its share has fallen (23% of the total score). The United Kingdom (9%) is second, and third China (7%), fourth Germany (5%) and fifth Japan (4%) are following after a large gap.

Scores achieved by all HEIs can also be used to compare not only the absolute but also the relative performance of higher education systems in individual countries. An important indicator—the total score of each country (that is of all its institutions) divided by the number of its inhabitants—is constructed as the sum of scores achieved by all HEIs in the country relative to its population, i.e. per million inhabitants. The relationship between the absolute and the relative indicator is thus similar to the relationship between the overall level of GDP (*Gross Domestic Product*) and GDP per capita (*Per capita GDP*). While the absolute indicator of the total score achieved expresses the power of the higher education system performance, the relative indicator of the achieved score per million of inhabitants expresses its level.

When considering all 1 626 HEIs included in the CR 2018, the highest total score per million inhabitants in 2018 was achieved by Switzerland (score 44.7) followed by New Zealand (42.4), Finland (40.3), Australia (39.5) and Ireland (36.3). That means that the relative comparison (according to the total score per million inhabitants) is dominated rather by smaller countries which are quite different from those that dominate the absolute CR 2018 comparison (analogically to the case of GDP and GDP per capita indicators). For example, in the relative comparison the US ranked at 19th place (score 16.4), Germany at 20th place (15.3), Japan at 32nd place (8.0) and China even at 66th place with a score of only 1.1 per million inhabitants. At the level of world regions, Oceania was the most successful one (score 28.7 per million inhabitants), followed by North America (17.1), Europe (12.3), Asia (1.3), Latin America (1.2) and Africa (0.3).

If we want to look at the development of this indicator (total score per million inhabitants) in a given country in the whole period of 2012–2018, only the score of the first 821 higher education institutions should be analyzed again in all years. The results for both World regions and Countries (TOP 50) are shown in the following table (see page 11).

As we have already mentioned, when evaluating the Cross Ranking results we do not focus just on overall scores achieved by individual higher education institutions but also (and at least with the same emphasis) on differences in profiles of individual institutions that show a different orientation and specialisation of individual HEIs. Different profiles of HEIs can be illustrated by ten examples mentioned in the report of which we select the three following ones:

While Swedish *Stockholms universitet* is particularly focused on research activities and its strength is also in academic reputation, Dutch *Universiteit Maastricht* shows a strong focus on internationalisation and attractiveness

for students and academics from abroad, together with orientation towards co-operation with the business sector. The overall profile of Swiss *Eidgenössische Technische Hochschule (ETH) Zürich* is relatively balanced, with strong focus on internationalisation as well as on research activities and reputation among academics and employers.

In order to interpret the Cross Ranking results in a wider context, we have decided to compare them with results of the best known, most prestigious and also most serious world ranking of higher education systems named *Universitas 21 Ranking of National Higher Education Systems (U21)*. The U21 regularly publishes the TOP 50 worldwide higher education systems, evaluating them by more than two dozen indicators (with different weights) classified under four dimensions: *Resources*, *Environment*, *Connectivity*, and *Output* (which also takes into account the results of the ARWU ranking).

The comparison of higher education systems based on both rankings, the Cross Ranking (CR) and the U21, has led to the following conclusions:

Firstly, while the U21 is clearly dominated by the US (predominantly due to the absolute number of scientific outputs in the *Output* dimension, which we do not consider to be appropriate), the Cross Ranking yields a more balanced picture of the leading countries with Switzerland on the 1st position while the US ranks 16th.

Secondly, 7 higher education systems are among the TOP 10 in both rankings (namely Switzerland, Finland, Australia, Sweden, Denmark, the United Kingdom, and the Netherlands), which confirms their really high level. The TOP 10 countries only included in one of the rankings are Austria, Singapore, and the United States in the U21, and New Zealand, Ireland, and Hong Kong in the CR.

Thirdly, 39 higher education systems are among the TOP 50 in both rankings, whereas 22 higher education systems are only included in one of the rankings. Among countries only included in the Cross Ranking (and not in the U21) are especially Estonia (12th), Cyprus (18th), and further nine countries. On the other hand, countries only included in the U21 (and not in the CR) are especially China (30th in the U21 *total score* and even 22nd in the U21 *output dimension score*) and further ten countries.

rank 2018 by		Cross Ranking 2012, 2016, 2018 TOP 821 HEIs World, Regions & Countries	2012			2016			2018		
total score	total score per capita		number of HEIs	total score (%)	total score per capita	number of HEIs	total score (%)	total score per capita	number of HEIs	total score (%)	total score per capita
		World	821	100.0%	2.3	821	100.0%	2.5	822	100.0%	2.7
		World Regions									
1	5	Europe	322	40.8%	8.8	347	41.7%	10.3	336	40.8%	10.9
2	4	of which: EU 28	288	37.0%	11.7	317	38.1%	13.7	309	37.4%	14.5
3	2	of which: EU 15	266	36.0%	14.4	291	36.6%	16.7	285	35.6%	17.5
4	3	Northern America	213	34.9%	16.3	201	30.1%	15.7	200	28.6%	15.9
7	7	Latin America	38	1.8%	0.5	25	1.9%	0.6	22	1.9%	0.6
5	6	Asia	204	16.6%	0.6	194	19.6%	0.8	212	22.1%	1.0
8	8	Africa	10	0.8%	0.1	11	0.9%	0.1	11	0.9%	0.2
6	1	Oceania	34	5.1%	22.6	43	5.8%	27.3	41	5.7%	28.4
		Countries (TOP 50)									
1	18	United States	178	30.2%	15.7	172	26.0%	15.1	168	24.7%	15.2
2	9	United Kingdom	61	10.6%	26.9	76	10.7%	30.3	67	10.0%	30.3
3	19	Germany	42	6.4%	12.5	47	6.3%	14.2	50	6.1%	14.7
4	56	China	32	3.0%	0.4	44	4.8%	0.6	61	6.0%	0.9
5	4	Australia	27	4.1%	30.1	35	4.8%	37.9	33	4.7%	38.9
6	32	Japan	36	3.9%	4.8	27	3.3%	4.7	33	3.6%	5.6
7	21	Italy	28	2.5%	6.7	38	3.2%	9.6	40	3.6%	12.0
8	16	Canada	24	4.2%	19.9	27	3.8%	19.6	28	3.6%	19.7
9	27	France	39	3.7%	9.3	33	3.7%	10.5	27	3.1%	9.6
10	25	South Korea	21	2.0%	6.5	26	2.6%	9.4	25	2.8%	10.8
11	26	Spain	20	1.6%	5.6	19	1.9%	7.4	27	2.5%	10.6
12	10	Netherlands	13	3.0%	29.0	13	2.7%	29.1	13	2.5%	29.0
13	1	Switzerland	9	2.1%	42.5	10	2.0%	44.8	10	1.9%	44.9
14	6	Sweden	11	2.0%	34.8	11	1.9%	35.1	11	1.7%	34.4
15	43	Russian Federation	16	0.7%	0.8	19	1.4%	1.8	16	1.5%	2.1
16	23	Taiwan	15	1.4%	9.9	16	1.4%	11.1	14	1.4%	11.6
17	13	Belgium	7	1.5%	21.5	8	1.4%	22.5	7	1.2%	21.1
18	8	Hong Kong	6	1.2%	28.1	6	1.2%	30.0	6	1.1%	31.1
19	3	Finland	8	1.0%	30.1	9	1.1%	37.7	9	1.1%	39.3
20	62	India	12	0.7%	0.1	11	0.9%	0.1	11	1.1%	0.2
21	55	Brazil	12	0.8%	0.7	8	0.8%	0.8	12	1.0%	1.0
22	2	New Zealand	7	1.0%	36.9	8	0.9%	38.0	8	1.0%	43.1
23	7	Denmark	5	1.1%	30.2	7	1.1%	35.3	6	1.0%	34.3
24	15	Austria	10	1.0%	18.5	7	0.7%	15.5	8	0.9%	20.5
25	14	Israel	6	0.9%	20.5	7	0.9%	20.4	7	0.8%	20.8
26	5	Ireland	8	0.9%	31.1	9	0.9%	33.2	8	0.8%	35.5
27	12	Norway	4	0.8%	25.0	5	0.7%	25.4	5	0.7%	25.7
28	42	South Africa	5	0.6%	1.9	7	0.7%	2.3	6	0.6%	2.3
29	22	Portugal	8	0.4%	6.3	6	0.6%	10.5	6	0.6%	11.7
30	36	Malaysia	7	0.4%	2.1	6	0.5%	3.2	6	0.6%	3.9
31	46	Iran	2	0.1%	0.3	4	0.3%	0.7	9	0.6%	1.5
32	47	Turkey	9	0.6%	1.2	9	0.6%	1.3	8	0.6%	1.5
33	17	Singapore	2	0.6%	17.6	3	0.6%	20.6	2	0.6%	19.7
34	38	Saudi Arabia	7	0.5%	3.0	4	0.5%	3.2	3	0.4%	2.8
35	45	Poland	4	0.3%	1.2	3	0.3%	1.3	5	0.4%	1.9
36	30	Greece	6	0.3%	4.0	7	0.4%	6.9	5	0.4%	6.6
37	58	Mexico	10	0.4%	0.5	2	0.3%	0.4	4	0.4%	0.6
38	31	Czech Republic	4	0.2%	3.4	5	0.3%	5.8	4	0.4%	6.6
39	29	Hungary	4	0.2%	2.7	7	0.3%	5.5	5	0.3%	6.7
40	37	Chile	7	0.3%	2.9	7	0.5%	4.9	3	0.3%	3.5
41	57	Thailand	8	0.3%	0.7	4	0.2%	0.7	3	0.3%	0.7
42	59	Egypt	5	0.2%	0.3	2	0.1%	0.3	4	0.2%	0.5
43	52	Argentina	7	0.3%	1.3	4	0.3%	1.2	3	0.2%	1.1
44	54	Colombia	5	0.2%	0.8	5	0.3%	1.1	3	0.2%	1.0
45	35	United Arab Emirates	3	0.1%	2.3	3	0.2%	4.2	3	0.2%	5.1
46	63	Indonesia	8	0.2%	0.1	2	0.1%	0.1	3	0.2%	0.1
47	11	Estonia	1	0.1%	9.4	2	0.2%	24.7	2	0.2%	26.4
48	33	Lebanon	2	0.1%	3.3	1	0.1%	3.2	2	0.2%	5.6
49	20	Slovenia	1	0.1%	4.5	2	0.1%	10.8	2	0.1%	12.9
50	49	Kazakhstan	7	0.2%	1.7	3	0.1%	1.4	2	0.1%	1.5

Introduction: World university rankings

Another season of world university rankings 2018—lasting every year from spring to autumn—is over again. As the first one of the best known world university rankings, the [U-Multirank](#) (funded by the European Commission) was published at the beginning of April 2018, followed by the [U21 Ranking of National Higher Education Systems](#) published at the beginning of May 2018, and the [QS World University Rankings](#) published at the beginning of June 2018. During the summer months, the [ARWU Academic Ranking of World Universities](#) and then the [THE World University Rankings](#) appeared. However, dozens of other more or less successful attempts to assess the quality of higher education institutions globally or regionally were published last year as well. They were produced by private agencies, media houses, associations of universities or organisations directly set up by states or supra-national institutions.

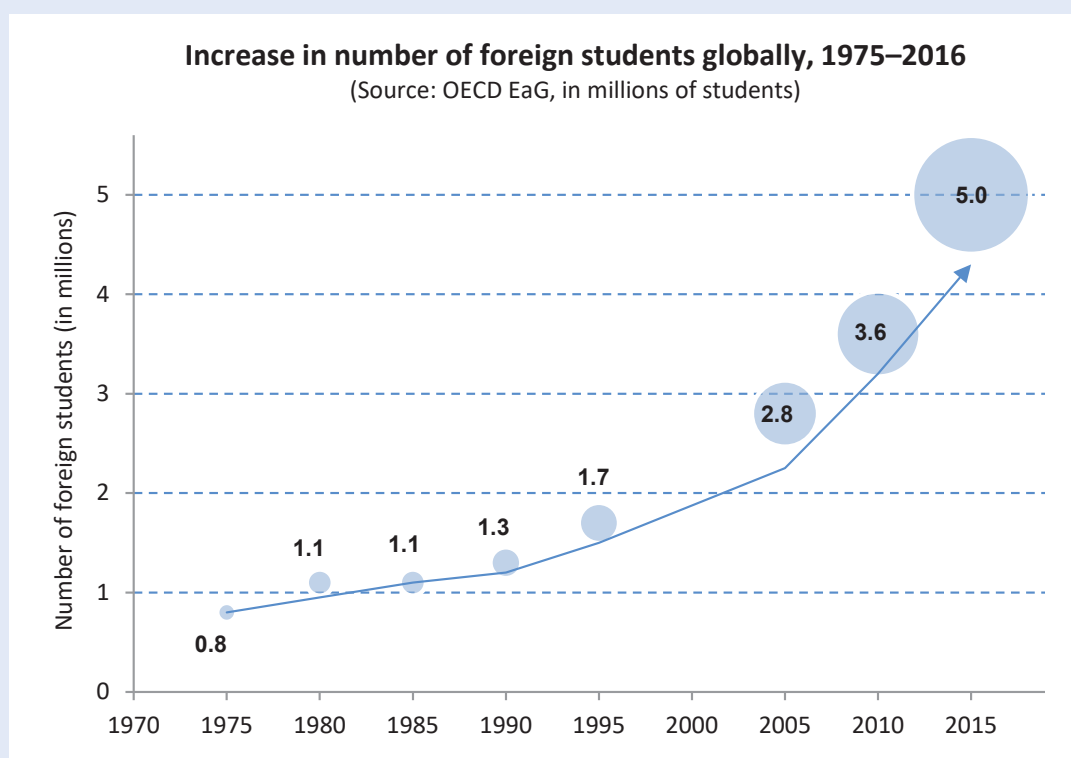
The importance of world university rankings is without doubt still growing. This is mainly due to globalisation and economic integration that have been taking place over the last decades, as well as to the gradually increasing interconnection of the EU countries. Higher education institutions are not only one of major accelerators of such developments but, at the same time, globalisation, integration and interconnection are retroactively influencing them, and gradually changing their characteristics. The fact that higher education institutions are gradually surpassing the boundaries of their national context and increasingly becoming part of the European or even global higher education area is not a completely new or unknown phenomenon. In fact, when established in the Middle Ages, many European universities have had a significantly international scope. By participating in the process of formation of the European Higher Education Area (EHEA), higher education institutions are, to some extent, returning to their original mission.

The process of higher education globalisation is, of course, accompanied by a much greater need for mobility, both on the part of students and graduates of universities, and on the part of their teachers. The following chart, for example, illustrates the speed of global expansion of the number of foreign higher education students in recent decades. It has almost tripled over the last twenty years, it has increased by more than half over the last ten years and now reaches nearly five million students!

However, what is at issue is not an increasing international mobility only of higher education students and graduates or academic staff, but also of specialists and experts in various fields of human activities. This logically implies the need to recognize and identify education and qualifications achieved—especially at the highest levels—also in countries other than those where they have been acquired. To make it possible, it is also necessary to provide reliable information about the quality of education provided. This, of course, leads to, and stimulates, previously unprecedented international competition between higher education institutions and higher education systems.

Closely interlinked with the mobility of persons is also the enormously important global movement of ideas, knowledge, technological processes, research results, innovations and their applications, enabled and directly stimulated by modern technologies. The dynamics of the rapid development of these globalisation trends is illustrated by the following figure showing countries producing scientific publications having international teams of authors in 1998 and in 2011 (only countries with more than 10 thousand of such publications are indicated). China, for example, had only 9 thousand such publications in 1998, so it does

Internationalisation of higher education



Source: *OECD Education at a Glance*. OECD 2018

not appear there (neither does the Czech Republic), while till 2011 China increased the number of publications produced within international collaboration to 74 thousand. This is reflected by the size of the point labelled China, and also by links to other countries showing where the largest absolute numbers of co-authors came from. Also the Czech Republic appears there as a small point; however co-operation with any particular country was not strong enough to be captured in the figure.

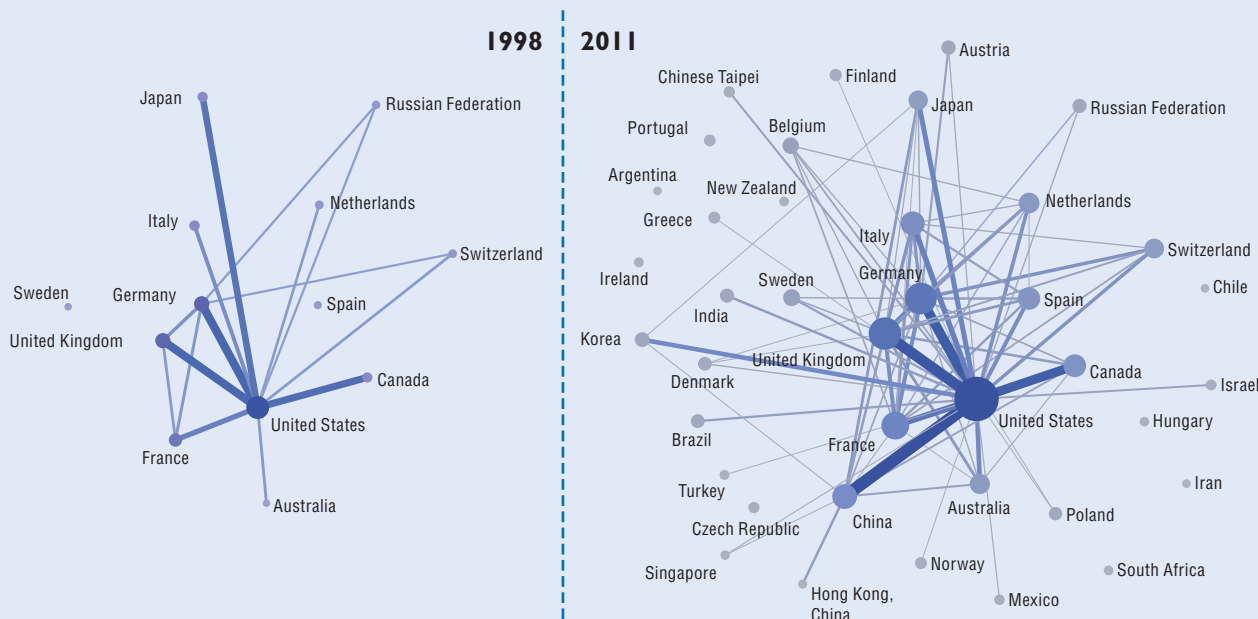
Above all, it is clear that a small number of publications from only thirteen countries and a sparse network of relations between them in 1998 significantly changed into a dense spider web of relations of varying intensity in 2011, linking thousands of authors from dozens of countries collaborating in international teams. The total

number of publications with an international team of authors has grown from 154 thousand to 504 thousand between 1998 and 2011, and to more than 640 thousand today.

An increasingly global character of higher education and challenges facing the whole European Higher Education Area (EHEA) are heading towards a wider and deeper multinational co-operation also in areas of quality assurance and transparency. The European Commission reports over the past twenty years have shown that the European quality assurance infrastructure has developed enormously in recent years. This is true both in terms of the internal/national quality assurance of higher education institutions and in terms of the external/international accreditation of institutions and study programmes. This is also confirmed by

International co-operation in R & D

Number of publications by international authors' teams in 1998 and in 2011 (only countries with more than 10 thousand publications are indicated).



Source: *OECD Science, Technology and Industry Scoreboard*. OECD 2013

the growing number of quality assurance agencies not only at national but also at European level.

Despite a number of imperfections and weaknesses, the existing world university rankings are still the only serious attempts so far how to identify, assess and measure the quality of higher education institutions at international level. Moreover, their methodologies and data collection techniques have been gradually improving, and as they have been updated every year they also provide important and valuable comparisons of development over time. However, to make fast and simple conclusions (based just on results of rankings) is mostly misleading or even dangerous although very tempting, especially for policymakers. The position of an individual institution as well as its causes and context can be understood only with a good knowledge of the evaluation methodology. It

is necessary to look not only at overall results but also at other less visible aspects of the methodology employed and the way how it has been constructed.

Rankings are gradually more and more influencing the behaviour of higher education institutions, as a good position in rankings significantly increases the prestige of institutions and also makes them more visible. For this reason, many higher education institutions are making considerable efforts to maintain or even improve their position in rankings. And institutions not yet included in *league tables* (as rankings are called sometimes) are under pressure to get involved in the game. In fact, higher education institutions use their position in international rankings to increase their prestige, to attract foreign students, professors and also investments, and in many cases also to boost government support.

In addition, many countries as part of their higher education policy make every effort to achieve the best position of their higher education institutions; their government bodies (ministries, accreditation institutions, etc.) set up the most appropriate conditions for doing so, introduce incentives, bonuses and other tools or announce support programmes, openly declaring their aim to have more institutions in top positions of the most prestigious rankings. For example, the Russian government has introduced the “5–100 Programme” with the aim to have five Russian universities in the “Top 100” of world university rankings by 2020.

The United Kingdom, France or Germany publish a number of significant data on individual higher education institutions (for example about students’ satisfaction, graduates’ employability and salaries, or positions in international rankings) to make possible their easy accessibility and comparability. Other countries—such

as Ireland, Norway and some other countries—have begun to use international rankings as part of their strategies for restructuring and funding higher education institutions.

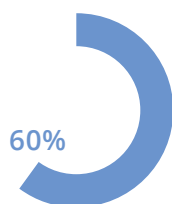
On the other hand, some countries with underdeveloped higher education systems use ratings for identifying the top world universities, and then encourage and support their most talented students to study there. For example, the Brazilian government has announced high scholarships for Brazilian students admitted to the top world universities (to the first four hundred institutions) to help them to pay most of high tuition fees and part of the costs related to studying abroad.

As a result, rankings have often become the basis for a deep transformation both of higher education institutions and systems. In many countries they have

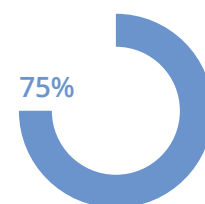
HEIs use rankings for analysis, strategic planning and policy making

Over the past decade, HE institutions have increasingly utilized rankings for analysis, strategic planning and policy making. In 2014, The European University Association (EUA) reported that 60% of European university representatives indicated that rankings played a role in their institutional strategy, while 75% used rankings in marketing and publicity materials. With such rapid growth in ranking use, alongside technological breakthroughs and accessibility to online information, universities will continue to use data from rankings to establish comparisons with rival institutions, as well as to maintain and improve on their global reputation and influence.

Use rankings for institutional strategy



Use rankings for marketing and publicity



Source: *Rankings in Institutional Strategies and Processes: Impact or Illusion*. EUA 2014

also greatly influenced expenditure on higher education, research and development, and even political and government programmes. Similar to credit rating agencies, rankings have a huge impact on governments, higher education institutions and society as a whole, both in positive and negative terms.

Not only the number of published world university rankings but also their influence on the development of higher education systems and on the behaviour of individual institutions has been constantly increasing. Therefore, it is not sufficient just to follow the results of institutions in different rankings. It is necessary to take into account the information on the dynamics both general and of individual tendencies and trends, and also to examine particular impact and influence of rankings not only on individual institutions but also on higher education systems and government policies. Even more, it means that the very dynamic and innovative development of the rapidly changing global quality assessment of universities has to be monitored and assessed very carefully. Our meta-analysis attempts to be the first step in this direction.

Comparison of the most prestigious world university rankings

As confirmed by analyses of their methodologies, innovations and changes that have occurred over the past fifteen years, the most prestigious and also the most influential world university rankings differ a lot, they have their strengths and weaknesses, and they take different characteristics of institutions from different sources into account. This is why it is less appropriate to compare positions of individual institutions and the differences between them only on the basis of just one of rankings, because each ranking reflects only a partial piece of information about them, and works only with limited data sources. A substantially more comprehensive view can be obtained by linking different pieces of information from the most important world university

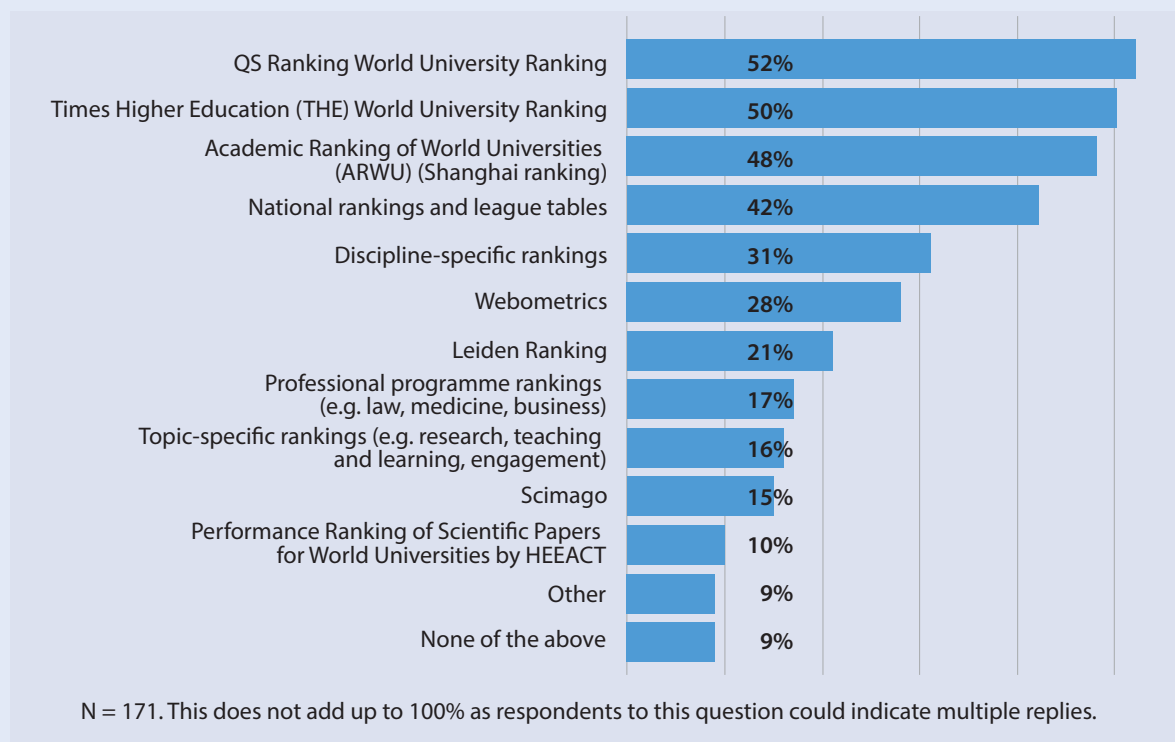
rankings, and by creating a sort of a meta-ranking that we have named Cross Ranking (CR).

Our Cross Ranking of the top world higher education institutions is based on their results in the three most prestigious and influential world university rankings: the [Academic Ranking of World Universities](#) (ARWU), the [QS World University Rankings](#) (QS) and the [THE World University Rankings](#) (THE). The three rankings have been chosen because they are widely respected by the world academic community and have the longest tradition, because they are transparent, publish their methodologies and communicate with their users, and also because they are continually trying to improve.

I. The **ARWU** ranking, first published in 2003, is the oldest world university ranking. Since then, the ARWU has been annually comparing and evaluating the top 500 higher education institutions in the world. The ARWU is published by *Shanghai Jiao Tong University* at the request of the Chinese government, its original purpose having been to show the position of Chinese universities as compared to the best world universities. In contrast to other well-known rankings, it only focuses on research outcomes, which is often criticised for reducing its basis of the overall evaluation as compared with the two other rankings. Based predominantly on English-written scientific articles published in the *Web of Science* database, it favours universities of the English-speaking countries. The six dimensions of evaluation, indicators and weights have remained almost without change, which makes its results comparatively stable. On the other hand, the ARWU has not been subjected to substantive innovations, as its two main competing rankings have been, and therefore it does not respond to changing expectations of the public. Historically, even the number of higher education institutions evaluated and published remained the same until 2017 when it was increased to 800 institutions. The record number of 1 000 universities was published in 2018.

Rankings that HEIs found the most influential or with the greatest impact

The European University Association (EUA) respondents (European university representatives) identified those rankings that they found the most influential or those they considered as having the greatest impact on them (2014). QS, Times Higher Education (THE), and ARWU are considered the most influential. A wide range of other rankings, including national and discipline-specific rankings, were also listed, suggesting that EUA respondents used a multiplicity of different rankings.



Interestingly, U-Multirank was mentioned as influential by 2% of respondents even though, at the time of the survey, U-Multirank had not yet been launched. This could point to either the anticipation of what this new provider will bring to the market, or simply demonstrates the miscommunications which plague discussions about rankings.

Source: *Rankings in Institutional Strategies and Processes: Impact or Illusion*. EUA 2014

2. The **QS** ranking has been published since 2004 by the research company [Quacquarelli Symonds Limited](#). It focuses on a multidimensional assessment of relative strengths of leading world universities whose number has been constantly increasing up to the record number of 1 000 institutions in 2018. Compared to the ARWU, it does not use the US database *Web of*

Science but the database *Scopus* of the Dutch publishing house *Elsevier*, which of course contributes to a greater balance between institutions from English-speaking and non-English-speaking countries. Compared with the two other top rankings, it has the widest scope, as it is addressed by its authors not only to future students and their parents to guide them what university to choose

but also to present students, academics, employers, government agencies and all other users to indicate to them what level a given university has reached. The methodology of evaluation is based on six dimensions. The QS is based partly on so-called “hard” data and partly on data from two extensive global reputational surveys among academics and employers (a kind of a global peer review).

3. The **THE** ranking has been published since 2010, when the British journal *The Times Higher Education* (THE) terminated their previous co-operation with the research company [Quacquarelli Symonds Limited](#) and withdrew from publishing their joint ranking *THE-QS World University Rankings* that had been published since 2004. The THE ranking has been constantly increasing the number of evaluated and published institutions. In 2012 there were 400 institutions, in 2015 already 800 institutions and in

2017 even 1 103 higher education institutions. The THE has given greater weight to the size of the institution evaluated. This is the case in about half of THE indicators, while in both ARWU and QS rankings only one of six dimensions takes account of it. This is also why in the THE 2017 ranking a relatively small US university of *Caltech* placed third (right behind *Oxford* and *Cambridge Universities*) or why a relatively small but quite important Czech university of VŠCHT was included (but not in other two rankings). The THE ranking uses five main dimensions; two of them based on results of their own academic reputation survey of teaching and research activities of higher education institutions.

In the table below all 17 dimensions, their weights and brief characteristics used by the rankings ARWU (6 dimensions), QS (6 dimensions) and THE (5 dimensions) in the year 2018 are indicated.

Characteristics and dimensions of the most important rankings (ARWU, QS a THE)

ARWU

Alumni (10%) – The total number of the alumni of an institution winning Nobel Prizes in Physics, Chemistry, Medicine and Economics and Fields Medal in Mathematics. Alumni are defined as those who obtain bachelor’s, master’s or doctoral degrees from the institution. Different weights are set according to the periods of obtaining degrees. If a person obtains more than one degrees from an institution, the institution is considered once only.

Award (20%) – The total number of the staff of an institution winning Nobel Prizes in Physics, Chemistry, Medicine and Economics and Fields Medal in Mathematics. Staff is defined as those who work at an institution at the time of winning the prize. Different weights are set according to the periods of winning the prizes. If a winner is affiliated with more than one institution, each institution is assigned the reciprocal of the number of institutions.

HiCi (20%) – The number of Highly Cited Researchers selected by Clarivate Analytics. The Highly Cited Researchers list issued in November 2017 (2017 HCR List as of November) was used for the calculation of HiCi indicator in ARWU 2018. Only the primary affiliations of Highly Cited Researchers are considered.

N&S (20%) – The number of papers published in Nature and Science between 2012 and 2016. To distinguish the order of author affiliation, a weight of 100% is assigned for corresponding author affiliation, 50% for first author affiliation (second author affiliation if the first author affiliation is the same as corresponding author affiliation), 25% for the next author affiliation, and 10% for other author affiliations. Only publications of 'Article' type is considered.

PUB (20%) – Total number of papers indexed in Science Citation Index-Expanded and Social Science Citation Index in 2017. Only publications of 'Article' type is considered. When calculating the total number of papers of an institution, a special weight of two was introduced for papers indexed in Social Science Citation Index.

PCP (10%) – The weighted scores of the above five indicators divided by the number of full-time equivalent academic staff. If the number of academic staff for institutions of a country cannot be obtained, the weighted score of the above five indicators is used.

QS

Academic reputation (40%) – The highest weighting of any metric is allotted to an institution's Academic Reputation score. Based on Academic Survey, it collates the expert opinions of over 70 000 individuals in the higher education space regarding teaching and research quality at the world's universities. In doing so, it has grown to become the world's largest survey of academic opinion, and, in terms of size and scope, is an unparalleled means of measuring sentiment in the academic community.

Employer reputation (10%) – Students will continue to perceive a university education as a means by which they can receive valuable preparation for the employment market. It follows that assessing how successful institutions are at providing that preparation is essential for a ranking whose primary audience is the global student community. Employer Reputation metric is based on over 30 000 responses to QS Employer Survey, and asks employers to identify those institutions from which they source the most competent, innovative, effective graduates.

Faculty/Student Ratio (20%) – Dimension is interpreted as the most effective proxy metric for teaching quality. It assesses the extent to which institutions are able to provide students with meaningful access to lecturers and tutors, and recognizes that a high number of faculty members per student will reduce the teaching burden on each individual academic.

Citations per faculty (20%) – The total number of citations received by all papers produced by an institution across a five-year period divided by the number of faculty members at that institution. All citations data is sourced using Elsevier's Scopus database, the world's largest repository of academic journal data. In 2017, QS assessed 99 million citations from 10.3 million papers once self-citations were excluded.

International faculty ratio (5%) – Indicator measures the ability of a university to attract undergraduates, postgraduates and faculty from all over the world that is key to its success on the world stage.

International student ratio (5%) – The internationalization of students expresses scores reflecting the proportion of foreign students (foreigners) out of the total number of students.

THE

Teaching (30%) – The most recent Academic Reputation Survey (run annually) that underpins this category was carried out in January to March 2018, attracting 10 568 responses. It examined the perceived prestige of institutions in teaching. The responses were statistically representative of the global academy's geographical and subject mix. The 2018 data are combined with the results of the 2017 survey, giving more than 20 000 responses.

Research (30%) – The most prominent indicator in this category looks at a university's reputation for research excellence among its peers, based on the responses to our annual Academic Reputation Survey. Research income is scaled against academic staff numbers and adjusted for purchasing-power parity (PPP).

Citations (30%) – Indicator examines research influence by capturing the number of times a university's published work is cited by scholars globally. In 2018 bibliometric data supplier Elsevier examined almost 62 million citations to more than 12.4 million journal articles, article reviews, conference proceedings and books and book chapters published over five years. The data include the 23 000 academic journals indexed by Elsevier's Scopus database and all indexed publications between 2012 and 2017. Citations to these publications made in the six years from 2012 to 2018 are also collected.

International outlook (7.5%) – The internationalization of academic staff reflects scores reflecting the proportion of foreign workers (foreigners) in the academic staff. A highly international university acquires and confers a number of advantages. It demonstrates an ability to attract faculty and students from across the world, which in turn suggests that it possesses a strong international brand. It implies a highly global outlook: essentially for institutions operating in an internationalised higher education sector. It also provides both students and staff alike with a multinational environment, facilitating exchange of best practices and beliefs. In doing so, it provides students with international sympathies and global awareness: soft skills increasingly valuable to employers. Both of these metrics are worth 5% of the overall total.

Industry income (2.5%) – A university's ability to help industry with innovations, inventions and consultancy has become a core mission of the contemporary global academy. This category seeks to capture such knowledge-transfer activity by looking at how much research income an institution earns from industry (adjusted for PPP), scaled against the number of academic staff it employs.

Methodology of Cross Ranking

Putting together the integrated and unified Cross Ranking data set

The first step of the whole methodological approach—that is of identifying each institution unequivocally in all three rankings—has been quite demanding, not only in terms of time but also in terms of attention and precision required. In most cases the name of an institution in each ranking differs, at least in small details, and sometimes it has even been changed during the time. In addition, the number of institutions published in rankings has been changing and gradually expanding, institutions may fall out of rankings, new ones may appear in, or return to, them. It is therefore necessary to individually compare the name of each institution in all three rankings in each year. For a better idea and understanding of the problem see below some examples of different names of one institution.

2017); *Rutgers, The State University of New Jersey–New Brunswick* (ARWU 2017 + 2018); *Rutgers University–New Brunswick* (QS 2017); *Rutgers–The State University of New Jersey, Newark* (QS 2017); *Rutgers University–Newark* (ARWU 2018). In such and similar situations we have included the institution into the Cross Ranking data set not only as a whole but as its constituent part (or parts) as well.

Further, our approach can be illustrated by the case of *University of Alabama System* constituted by three campuses. We have included it as a whole, and as its three constituent parts because they were published as such in one of the three rankings: *University of Alabama*; *University of Alabama, Tuscaloosa* (the original seat, founded in 1820); *University of Alabama in Huntsville* (founded in 1950); and *University of Alabama at Birmingham* (founded in 1969).

ARWU	QS	THE
Ecole Normale Supérieure – Paris	Ecole normale supérieure, Paris	École Normale Supérieure
Karlsruhe Institute of Technology (KIT)	KIT, Karlsruhe Institute of Technology	Karlsruhe Institute of Technology
Swiss Federal Institute of Technology Zurich	ETH Zurich – Swiss Federal Institute of Technology	ETH Zurich – Swiss Federal Institute of Technology Zurich
University College London	UCL (University College London)	University College London
Charles University in Prague	Charles University	Charles University in Prague
The Ohio State University – Columbus	The Ohio State University	Ohio State University

However, it happens sometimes that an institution is included as a whole in one ranking, and as one of its constituent parts only in another one. For example: *City University of New York–Baruch College* (ARWU 2018); *City University of New York City College* (ARWU 2017); *City University of New York* (QS 2018), or *Rutgers, the State University of New Jersey* (THE

Also in other specific cases caution and consistent checking of information from various sources are needed when putting together an integrated and unified data set. This is particularly true for Chinese universities whose terminology is most unclear, since their names are similar and moreover often changing. Chinese military medical universities can serve as a

specific example. Only thanks to an article called *Reform of military medical universities to focus back on combat* (<http://www.globaltimes.cn/content/1093285.shtml>) in the Chinese *Global Times* in March 2018 we have been able to detect that China completely renamed all military medical universities as follows:

Second Military Medical University was renamed to *PLA Naval Medical University*, *Third Military Medical University* to *Army Medical University* and *Fourth Military Medical University* to *Air Force Military Medical University*. However, this information is not widely available on the web (e.g. Wikipedia) and one institution can be easily mistaken for two different ones. In order to be sure and make no mistake, we have checked not only the overall scores of institutions that most probably changed their name but also all their dimensional scores in both consecutive years 2017 and 2018. The fact that the difference between both years was very small for all dimensions has confirmed to us that only the name of an institution already included in the 2017 integrated and unified data set was changed.

Since 2012 when first steps to putting together the meta-ranking were taken, the whole process of quite demanding unifying the different names of institutions and linking all three rankings has actually become a learning process, where most links elaborated in previous years serve for updating the Cross Ranking data set in the following year. We have linked obtained score of individual higher education institutions in all three rankings (ARWU, QS and THE) in order to get substantially more comprehensive data about each institution that correspond to aggregate data from all three rankings. For 2018, data on a total of 1 626 universities were identified and linked.

The process of linking and unifying data on higher education institutions can be illustrated by the way how the Cross Ranking 2018 has been elaborated.

The starting point of this process was the data set put together for the Cross Ranking 2017 including a total of 1 413 institutions.

The first ranking published in May 2018 and indicated as the QS 2019 included a total of 1 000 institutions, that is 41 institutions more than in 2017. (Please note that although the official designation is the QS 2019, we take into account the year of publication in order to make a correct comparison.) Out of it, 929 institutions have been linked automatically by the converter built in previous years. The remaining 71 institutions have been individually reviewed and manually included into the Cross Ranking 2018 data set. They have come under four categories:

- institutions included both in the QS and the CR for the first time (41 cases)
- institutions included in the QS for the first time but already included in the CR (9 cases)
- changes of the name of institutions already included in the QS (19 cases)
- new institutions created by merging other higher education institutions (2 cases)

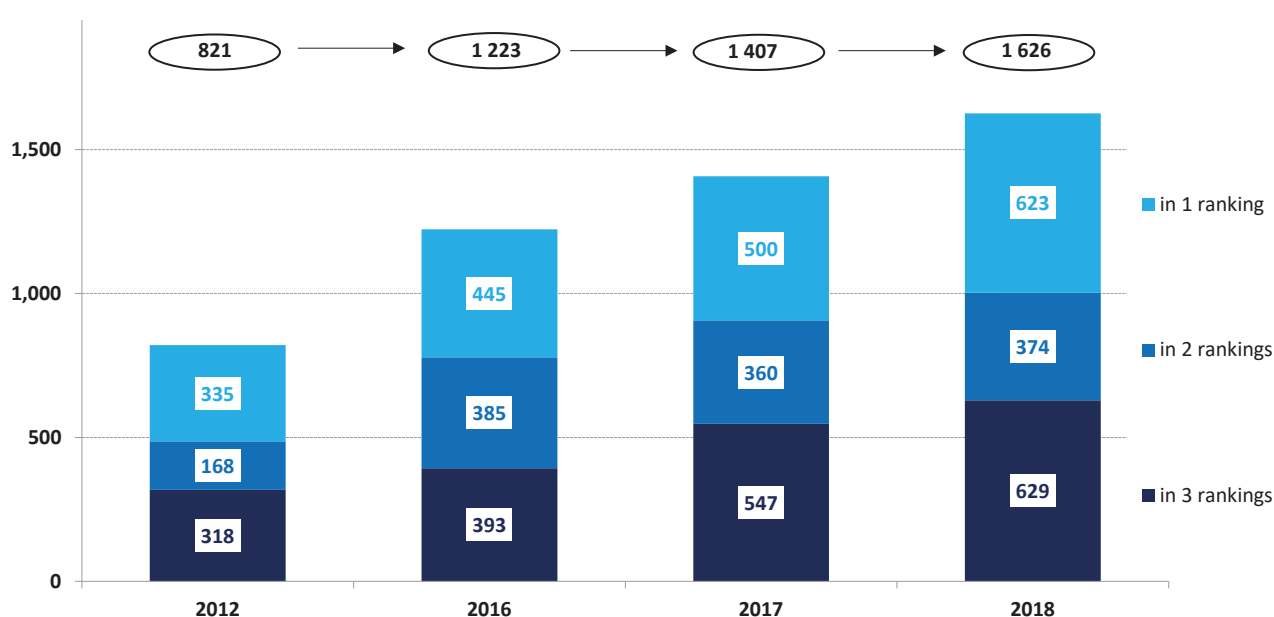
The second ranking ARWU 2018 was published in August 2018 (please note that in this case the official designation is the same as the year of publication). For the first time it included also a total of 1 000 institutions (arrived at by the ARWU methodology), that is even 200 institutions more than in 2017. Out of it, 876 institutions have been linked automatically by the converter built in previous years (and extended by the above mentioned 71 institutions based on the QS 2018). The remaining 124 institutions have been individually reviewed and manually included into the Cross Ranking 2018 data set. They have come under three categories:

- institutions included both in the ARWU and the CR for the first time (86 cases)
 - institutions included in the ARWU for the first time but already included in the CR (32 cases)
 - changes of the name of institutions already included in the ARWU (6 cases)
- As the last one of the three ranking considered, the THE 2019 was published in September 2018 (as in the case of the QS, we have taken into account the year of publication). It included even a total of 1 258 higher education institutions, that is 155 institutions more than in 2017. Out of it, 1 113 institutions have been linked automatically by the converter built in previous years (and extended by the above mentioned 71 institutions based on the QS 2018 and further by 124 institutions based on the ARWU 2018). As in both previous cases, the remaining 145 institutions have been individually reviewed and manually included into the Cross Ranking 2018 data set. They have come under four categories:
- institutions included both in the THE and the CR for the first time (114 cases)
 - institutions included in the THE for the first time but already included in the CR (15 cases)
 - changes of the name of institutions already included in the THE (15 cases)
 - new institutions created by merging other higher education institutions (1 case)

Naturally we have enriched (or modified) the existing converter with all above mentioned cases. The list of all names of all higher education institutions—which were listed at least once in one of the three rankings

Cross Ranking 2012, 2016, 2017 and 2018

Number of institutions according to the inclusion in rankings ARWU, QS and THE



Source: EPC CU, ARWU, QS, THE

considered in 2012 and then from 2016 to 2018—currently has 3 222 items. This will make our work easier in the coming years.

The analogous way of linking all individual higher education institutions—both in the three rankings considered (ARWU, QS, and THE) and in the years 2012, 2016, 2017, and 2018—has enabled us to monitor the development of their results not only in the three world university rankings but above all in the Cross Ranking (CR). Their overall score and thus their overall rank have been assigned to:

- 821 HEIs in 2012;
- 1 223 HEIs in 2016;
- 1 407 HEIs in 2017;
- 1 626 HEIs in 2018.

The figure on the previous page shows that the growing number of HEIs included in the ARWU, QS and THE rankings has increased not only the total number of HEIs entering the CR ranking (from 821 HEIs in 2012 to 1 626 HEIs in 2018) but also the number of institutions whose data from the three rankings considered are available (between 2012 and 2018 their number has almost doubled, from 318 to 629).

Indicators of overall and dimensional scores of higher education institutions

After linking institutions from all three 2017 rankings and putting together the unified Cross Ranking data set, it has been necessary to define indicators that will express how successful an institution is in a given ranking. What has been used most often, is its final position in individual rankings. However, this approach has a number of serious imperfections and weaknesses, and we have decided to use all scores of each ranked institution

instead, both the overall score and the partial scores in individual dimensions. Because the ARWU and the QS do not publish the overall score for all ranked institutions (only for the TOP 100 institutions), in some cases we have had to calculate our own overall score, basing it on the published dimensional scores, always in accordance with the methodology valid for a given ranking.

We have summed up the overall score of each of the three rankings and weighted it so that the weight of each of the three ratings—that is the sum of all distributed scores of the top 1 000 institutions in each ranking—would be the same (the number of 1 000 institutions published in the ARWU 2018 and the QS 2018 is the lowest of rankings considered). The CR overall score of institutions has been computed as a weighted average of the score achieved in the rankings ARWU, QS and THE with the theoretic maximum value equal to 100.

Each higher education institution, included in at least one of the three rankings considered, has been thus assigned a certain score composed of 1 to 3 overall scores and of 5 to 17 dimensional scores that constitute its profiles (the number of dimensions depending on the number of ratings). For example, *Charles University* ranked in all three rankings in 2018, and therefore its profile is composed of 3 overall and 17 dimensional scores. In contrast, *Brno University of Technology* ranked just in the QS and the THE, and therefore its profile has only 2 overall and 11 dimensional scores, while *University of Economics in Prague* ranked in the THE 2018 only, and its profile has just 1 overall and 5 dimensional scores.

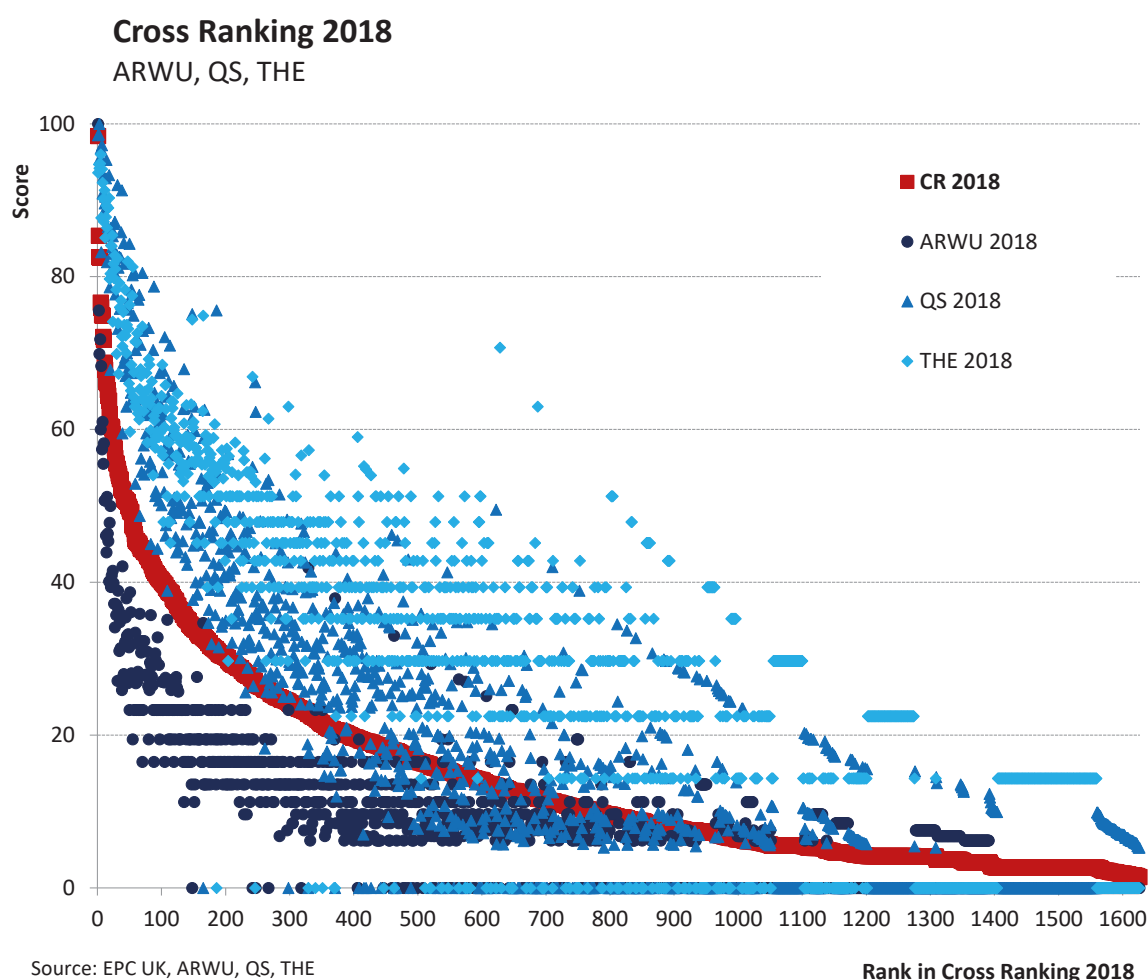
Employing this approach and the results of all three 2018 rankings (ARWU, QS, THE), it has been possible to assign the CR overall score to 1 626 best world higher education institutions and to rank them accordingly. They represent almost 9% of the total number of about 20 thousand higher education institutions around the world (exactly 18 500 higher education institutions in

186 countries at the beginning of 2018 according to the world's largest *World Higher Education Database*, *International Association of Universities*). The ratio for 522 European universities included in the Cross Ranking is higher, about 13%.

The figure below illustrates how the CR overall score assigned to the 1 626 evaluated institutions is distributed, ranging from the most successful one (scoring 98.4 points) to the least successful one (scoring 1.4 points). The shape of the curve is evidently exponential, the score is decreasing relatively steeply at higher positions and consequently more and more flatly at lower positions. This is primarily influenced by the score assigned by the ARWU, especially to the best-ranked higher education institutions. In the ARWU 2018, for

example, the first *Harvard University* scored 100 points but the second *Stanford University* was assigned the score of only 75.6 points, and the tenth *University of Chicago* the score of only 55.5 points.

However, what applies to the ARWU is not the case for the two other rankings. In the QS 2019 (published in 2018), the first *Massachusetts Institute of Technology* (MIT) scored 100 points, the second *Stanford University* was assigned the score of 98.6 points and the tenth *University College London* (UCL) even reached a quite high score of 92.9 points. In the THE 2019 (published in 2018) a different approach was used: the first institution was not assigned the score of 100 points but the weighted average of its five dimensional scores. The first *University of Oxford* thus scored 96.0 points, the second



University of Cambridge scored 94.8 points and the tenth *University of Chicago* was assigned a comparatively high score of 90.2 points.

To make it more illustrative, the figure on page 25 shows not only the CR overall score but also overall scores that each higher education institution reached in each of the three rankings (at the same time serving as the input for computing the CR overall score). The figure illustrates not only different shapes of curves and score values for the rankings ARWU, QS and THE but also the dispersion of score values assigned to institutions in each ranking. That confirms the fact mentioned previously that the rankings ARWU, QS and THE take into account different characteristics of higher education institutions. Without mentioning other things, the dispersion of scoring in different rankings alone is a significant argument for linking and unifying data from all three rankings, thus without any doubt providing a more comprehensive and complex evaluation of higher education institutions.

Weights and relations between dimensions in ARWU, QS and THE

For a more thorough assessment why the results of individual higher education institutions differ in each of the three rankings, we have to use the data on their results in all 3 rankings (their overall score) and all 17 dimensions of the rankings considered. Each higher education institution included into the unified CR set provides information both of its overall score in rankings it participates in as well as of all its dimensional scores. All scores attained make the profile of the institution. The number of dimensions is set by the number of rankings the institution has participated in.

In order to analyse relations between all individual dimensions of all three rankings, naturally only data on institutions included in all three rankings could be used. 551 institutions met this requirement in 2018.

However, some of them did not meet another requirement, namely that they should have their dimensional scores defined in all dimensions. As some dimensional scores were missing (mostly due to inadequate input data), we have used results of the correlation and factor analysis in order to assess the real weight and the relations between all 17 dimensions (and also the three overall scores for each of the three rankings). Thus altogether 678 institutions have been assigned 3 overall scores and dimensional scores in 15 dimensions at least, that is in 75% of all dimensions.

Correlation analysis

The correlation analysis of all 20 (3+17) variables (scores) has shown strong relations between some dimensions within each ranking considered, maybe influenced to some extent by the methodology or the data acquisition method applied, thus leading to a mutual reinforcement of weights of these dimensions in the overall score of evaluated institutions. But this high correlation does not necessarily confirm a true causality. However, another interpretation is possible as well: although individual dimensions of most rankings aim at capturing different characteristics of higher education institutions, their high correlation (whatever its cause) actually indicates that they capture very similar characteristics.

Besides, the analysis has also shown strong relations between some dimensions of different rankings. They can be explained by a similar or close orientation of the dimensions in question, for they try to capture similar characteristics of higher education institutions. As a matter of fact, they can be considered as a confirmation of the correctness and suitability of indicators used, although they were processed quite independently and on the basis of different data sources (we have to bear in mind that the rankings in question are independent competing projects). Also in this case such highly correlated dimensions reinforce

each other and therefore increase their weight in the Cross Ranking overall score.

Specific examples of very strong relations (that is of high positive values of correlation coefficients in selected 678 higher education institutions) between 3 overall scores and 17 dimensional scores within one ranking can be indicated especially as follows:

1. Dimensions *Teaching* and *Research* within the THE ranking (correlation coefficient of 0.922)—a strong relation between dimensions evaluating the quality of teaching and research (their total weight in the THE is 60%) is without doubt influenced by the fact that both dimensions largely rely on reputation indicators of higher education institutions in teaching and research activities based on the *Academic Reputation Survey* conducted among academic staff. Those who criticize this view point particularly to the fact that many respondents from other higher education institutions or even from other countries are mostly able to evaluate only one indicator of reputation, most often the reputation of research and perhaps also of doctoral studies. They have only general or insufficient information about the reputation of teaching, and therefore tend to evaluate both reputation indicators equally. Research studies focused on this issue conducted in some countries tend to confirm the view that the relation between the quality of research and of teaching activities of a higher education institution may be far from being so close.
2. Dimensions *Academic Reputation* and *Employer Reputation* within the QS ranking (correlation coefficient of 0.823)—a strong relation between dimensions evaluating the reputation of higher education institution among academic staff and among employers (their total weight in the QS

is 50%) confirms an analogy between this and the previous case: a quite similar perception of the reputation of individual higher education institutions between academics and employers of its graduates.

3. Dimensions *HiCi* and *N&S* within the ARWU ranking (correlation coefficient of 0.789)—a strong relation between the extent of publishing activity of academic and research staff in the most cited scientific journals and the total number of citations of their publications anywhere (their total weight in the ARWU is 40%) confirms the strong orientation of the ARWU on the characteristics of the scientific and research level of higher education institutions, and on the use of very traditional indicators and ways of evaluation.

On the other hand, specific examples of strong relations between dimensions from different rankings can be indicated in particular as follows:

1. Dimensions *International Faculty* (QS) and *International Outlook* (THE) with the correlation coefficient of 0.848—a strong relation between the two dimensions focused on identifying the level of internationalization of higher education institutions confirms the consistency of both indicators used.
2. Dimensions *Research* (THE) and *N&S* (ARWU) with the correlation coefficient of 0.781—a strong relation between the two dimensions reflecting the scope and level of scientific and research orientation of higher education institutions also confirms the consistency of their indicators.
3. Dimensions *PUB* (ARWU) and *Academic Reputation* (QS) with the correlation coefficient of 0.722—a strong relation between the

two dimensions confirms the link between the scope of publication activity of academics and researchers of a higher education institution and its reputation among the world academic community.

However, analysing the matrix of all mutual relations between the 3 overall scores and all 17 dimensional scores of the ARWU, QS and THE rankings (that is between 20 variables) is in itself too complicated and little understandable. For a more summary and comprehensive presentation of main relations between all overall and dimensional scores we have also used the multidimensional scaling methods (namely the factor analysis). Outcomes of the correlation and factor analyses have led to some significant conclusions:

The first conclusion is that relations between all 20 dimensions are quite tight because the factor model is very robust (and the average correlation coefficient is 0.528). The first four factors are explaining even nearly 80% of the total variability between all dimensions, and from the fifth factor onwards the explained percentage of the total variability (the fifth factor explains only 4.17% of variability and the *Initial Eigenvalue* is less than 1) is smaller than any of the original 20 dimensions (5%).

The second conclusion is that mutual relations are stronger between dimensions within each of the ranking than between dimensions of different rankings. The strongest relations are among dimensions of the ARWU ranking. On the contrary, dimensions of the QS ranking have the weakest relations, both between dimensions within the QS ranking and between the QS dimensions and the ARWU and THE dimensions (the table below shows the average correlation coefficients between dimensions of all three rankings).

The third conclusion is that particularly dimensions *Research* (THE), *Teaching* (THE) and *N&S* (ARWU) belong among those that are strongly correlated with

other dimensions (and overall scores of all three rankings). In the factor model they also reinforce each other most, which also affects the overall score of individual institutions. On the other hand, the weakest relations with other dimensions (and therefore the weakest position in the factor model) have *International faculty* (QS), *International students* (QS), *International Outlook* (THE), *Faculty student ratio* (QS) and especially *Industry Income* (THE), only little related to other dimensions.

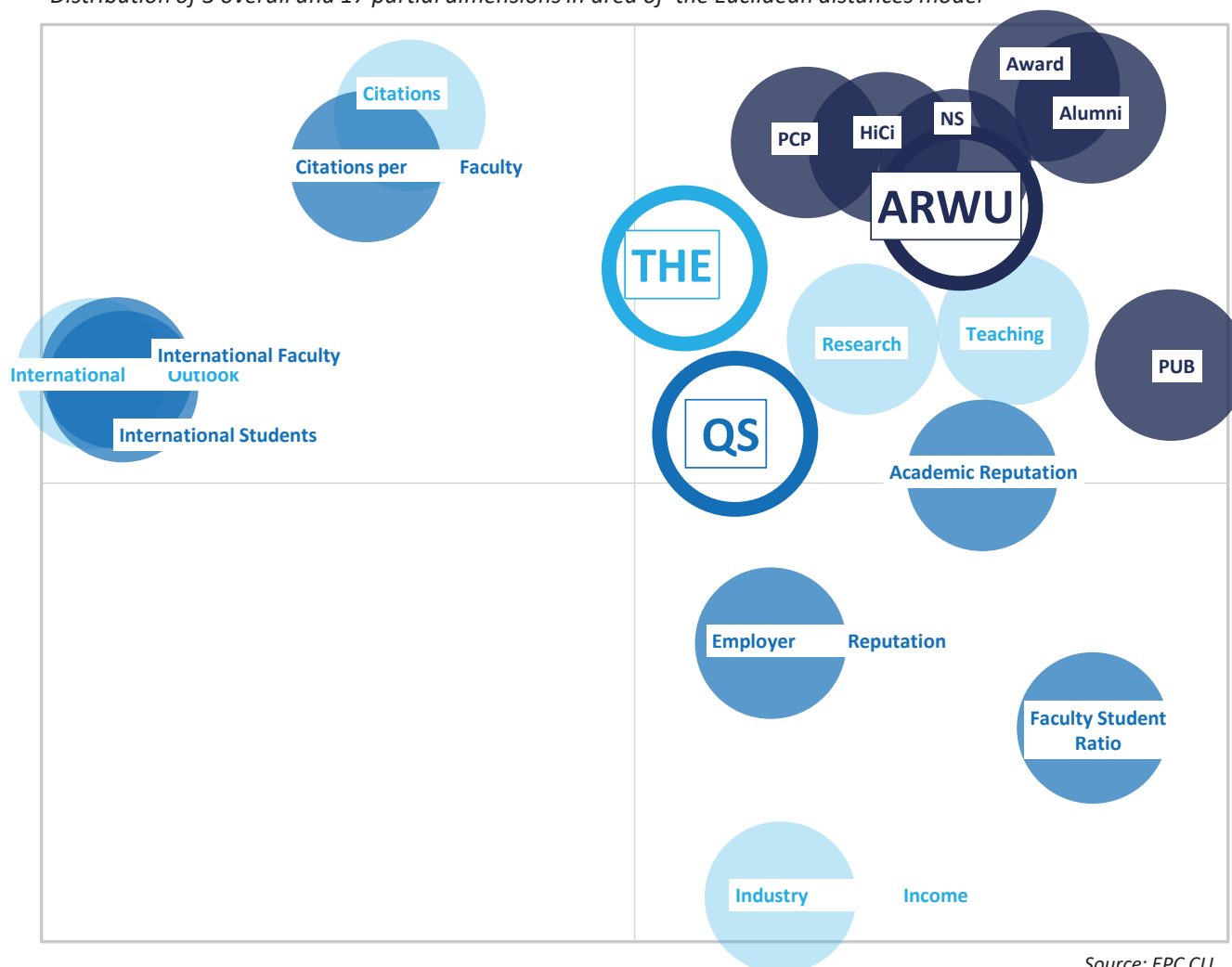
Multidimensional scaling

Basic results of the multidimensional analysis of relations between all 20 dimensions (3 overall and 17 partial dimensions of the ARWU, QS, and THE rankings) entering the Cross Ranking in 2018 are summarized in the following figure (see page 29). It defines, in particular, the area of all 20 dimensions of profiles of 678 higher education institutions (that were assigned a score in at least 12 of all 20 dimensions in 2018), the distribution of individual dimensions in this area, and relations between them. It means that the analysis actually builds on the matrix of all correlations we have already described in the methodological part of this study.

It is evident that the presentation of all relations between 20 dimensions in a two-dimensional graph represents a certain simplification, but this is minimized in such a way that positions of individual dimensions in the graph retain three-quarters of all the information contained in them. This is made possible by applying the results of the multidimensional scaling method—one of multidimensional analysis methods—based on so-called Euclidean distances between observations that is on distances between individual dimensions. Due to the significant correlations between dimensions, it is possible to reduce the 20-dimensional area defined by 20 dimensions into a two-dimensional area. A high proportion of retained information confirms the consistency and interpretative robustness of the twenty-dimensional model chosen.

Cross Ranking 2018 – Analysis of relations between dimensions

Distribution of 3 overall and 17 partial dimensions in area of the Euclidean distances model



Source: EPC CU

A brief interpretation of results of our multidimensional analysis of relations between all 20 dimensions can begin, for example, with the largest and the tightest cluster of twelve dimensions shown in the top-right corner of the figure. It illustrates that there are somewhat weaker relations between dimensions within the QS and the THE rankings but on the other hand that there are relatively strong positive relations between all dimensions within the ARWU ranking (but for the PUB dimension expressing the number of publications in the SCIE and SCII citation index databases).

From the dimensions of the two other rankings (QS and THE), the closest ones to ARWU dimensions are the dimensions *Research* (THE) and *Teaching* (THE), both based mainly on the *THE Academic Reputation Survey* results, and next to them also the dimension *Academic Reputation* (QS), also reflecting the reputation of higher education institutions among academics.

This first cluster also clearly includes the overall score that institutions have reached in the ARWU ranking, and also their overall results in both the QS and the

THE rankings, although already slightly pushed to the left side of the figure.

Summarizing characteristics of all twelve dimensions of this first cluster, it is evident that they together express in particular the research orientation of higher education institutions corresponding naturally with their reputation not only in research but also in teaching.

On the other hand, there is another cluster in the left part of the figure. This cluster represents only three but mutually very closely interconnected dimensions. They are *International Faculty* (QS), *International Students* (QS) and *International Outlook* (THE). There is no doubt that the three dimensions together clearly point to international orientation (internationalization) of higher education institutions (in the ARWU ranking no dimension is focused on international activities of universities).

Between the two clusters yet at some distance from them two other dimensions are placed close each to other: *Citations* (THE) and *Citations per Faculty* (QS). In contrast with the first cluster, they do not emphasize the extent of the research activities but rather its global response (the citation rate) and therefore its quality. However, the global response of research activities is simultaneously influenced by the involvement of higher education institutions and their staff (or even their students) in international research communities, which is naturally related to the internationalization of institutions. The cluster of the two dimensions can be therefore considered as a joint penetration of the first (right) and the second (left) cluster, strengthening them on the one hand and at the same time bringing them closer on the other hand.

The last three dimensions are quite far from the main “research” cluster (top-right) and especially from the second “internationalization” cluster (middle-left). Although all of them are located in the bottom-right part of the figure, they do not together

make another consistent cluster. The closest one to the first cluster of research dimensions is *Employers Reputation* (QS), the next one is *Faculty Student Ratio* (QS) and the farthest one is *Industry Income* (THE) that indicates the extent of university co-operation in research applications and innovations for the business sector (i.e. the proportion of income from the private sector). Especially the position of the last two dimensions thus confirms the conclusions based on the correlation matrix analysis: both have only weak relations with the other dimensions, and therefore, in the model of all 20 dimensions, they have just a limited influence on the overall scores of individual higher education institutions.

Factor analysis

Factor analysis offers results similar in many aspects but clarifying some details. Understanding the relations between 3 overall and 17 partial dimensions further enhances and enriches the results of correlation and scaling analysis. Already on the basis of their results, it was quite obvious that the factor models created would be very robust, which has been confirmed. While the two-factor model (sometimes called the two-component model—in this text we consider both terms to be equivalent) retains two thirds of all information and explains two thirds of variance (we use a more understandable term variance, although more precisely it is a standard deviation) among dimensions, which is a very high proportion, the three-factor model retains even three quarters of the information contained in all 20 dimensions, explaining three quarters of the variance between them.

We therefore consider the results of the rotated factor model with three factors—presented in the following table—to be the logical conclusion of multi-dimensional analyses performed for the Cross Ranking 2018. The last line of the table indicates the strength of the entire three-factor model and also the overall

Rotated Factor Matrix	Factor			
	1	2	3	Total
ARWU Total	0.894	0.281	0.158	90.3%
ARWU Alumni	0.821	0.135	0.088	70.0%
ARWU Award	0.851	0.088	0.094	74.0%
ARWU HiCi	0.749	0.298	0.251	71.3%
ARWU NS	0.880	0.265	0.191	88.1%
ARWU Pub	0.633	0.532	0.042	68.6%
ARWU PCP	0.766	0.231	0.322	74.3%
QS Total	0.510	0.696	0.426	92.5%
QS Academic reputation	0.547	0.656	0.260	79.7%
QS Citations per faculty	0.449	0.339	0.380	46.1%
QS Employer reputation	0.322	0.695	0.348	70.8%
QS Faculty student ratio	0.208	0.556	0.077	35.8%
QS International faculty	0.154	0.171	0.877	82.2%
QS International students	0.128	0.159	0.870	79.8%
THE Total	0.639	0.400	0.488	80.7%
THE Teaching	0.663	0.622	0.155	85.0%
THE Research	0.663	0.586	0.309	87.8%
THE Citations	0.546	0.035	0.568	62.2%
THE Industry Income	-0.036	0.707	-0.042	50.4%
THE International Outlook	0.127	0.050	0.942	90.7%
Explained variance (in %)	35.4%	19.4%	19.3%	74.0%

significance of each of the three factors. We have already highlighted that the rotated model with three factors explains almost three quarters of the variance of all dimensions. The strongest is the first factor that explains one third of the variance. Both of the following two factors have a similar strength; each explains one fifth of total variance.

Generated factor loadings of individual dimensions (see the columns of the table above) show the contribution of each dimension to the first, second and third factor (the more significant the dimension is in the given factor, the darker its green colouring). Factor loadings are also derived from the content interpretation of each factor.

From the structure of loadings of the first and strongest factor it is evident that dimensions expressing in

particular the extent of research activities of higher education institutions tend to dominate.

In the structure of loadings of the second factor, the extent of the co-operation of higher education institutions with the business sector and their reputation (particularly among employers but also within the academic community) play a major role.

The structure of loadings of the third factor is mainly based on dimensions that characterize the extent of international orientation (internationalization) of higher education institutions.

The last column of the table (*Total*) expresses the overall importance of each dimension in the three-factor model. It shows that some dimensions are strongly

represented in the model and that the model retains for example more than 80% or even 90% of their information contained in all 20 dimensions. This is the case of the three overall scores (ARWU, QS and weaker, THE) and, for example, of *International Outlook* (THE), *Research* (THE), *NS* (ARWU), *International faculty* (QS) or *Teaching* (THE). On the contrary, other dimensions are very weak in the model (the model keeps less than 50% of its information and it does not help, for example, to increase the number of factors), particularly *Faculty Student Ratio* (QS).

Values of all 20 dimensions together create a detailed profile of each higher education institution, however too large and difficult to interpret, while results of factor analysis for each institution—that is three factor scores representing the values achieved in three factors identified—create an aggregate profile of each institution (the Cross Ranking 2018). As we have already mentioned, the aggregate profile thus consists of defining firstly the extent and level of research

activities, secondly the intensity of its co-operation with the business sector and its reputation, and thirdly the extent of orientation on international activities (internationalization). The specific values of the three scores for individual institutions are only listed in the results section of this study.

The specific form of a factor model based on a factor analysis of more than six hundred detailed profiles (with 20 dimensions) of higher education institutions developed for the Cross Ranking is, of course, evolving and changing over time. Such changes can point not only to shifts in relations between individual dimensions of all three rankings (ARWU, QS and THE) but also to the expanding database of usable indicators and the changing methodology of their processing. They can also point to significant changes in overall paradigms how to evaluate higher education institutions. However, they will only become visible in the future development of the Cross Ranking because such changes are quite small and meaningless in the short term.

Results of Cross Ranking 2018

Results of the meta-comparison and analysis of the three most important world university rankings (ARWU, QS and THE) published in 2018 and their role in the Cross Ranking 2018 will be interpreted at two main levels: firstly, at the level of individual higher education institutions, and secondly, at the level of individual countries (of their higher education systems) or world regions. At the same time, we will also focus on the development of results of institutions and countries in the Cross Ranking from 2012, when we initiated this activity.

Higher education institutions

Firstly, let's take a more detailed look at institutions included in the Cross Ranking 2018. We have already mentioned that the most credible data about number of higher education institutions is provided by the *Worldwide Database of Higher Education Institutions* (WHED) created and administered by the *International Association of Universities* (IAU) together with UNESCO. According to the latest WHED data from the end of 2018, around the world (exactly in 186 countries IAU/UNESCO) there are currently 18 406 higher education institutions that have at least one educational programme at bachelor or higher level (hence, for

example, US two-year *Community Colleges* or Czech *Vyšší odborné školy* are not included) accredited by an official accreditation agency (officially appointed by the state). The distribution both of such institutions and of institutions included in the Cross Ranking 2018 (CR 2018) in individual world regions is shown below.

All the 1 626 institutions included in the Cross Ranking 2018 undoubtedly represent high quality higher education institutions in the world, in each world region and in each individual country. However, the above table shows that no longer they make only a rather limited elite top. Globally, about 10% of all higher education institutions are ranked in the Cross Ranking 2018 but already a fifth in the EU 28, a quarter in the EU 15, and even a third in Oceania (in terms of population dominated by two developed OECD countries, Australia and New Zealand).

Thus we can say that a large part of higher education institutions of the developed world (that is mainly the member countries of the EU or the OECD) are included in the CR 2018 evaluation. On the other hand, it is also clear that higher education institutions (and higher education systems) from countries or regions that are only sporadically ranked in CR 2018 (especially Latin

Cross Ranking 2018	number of HEIs		proportion of HEIs		number of inhabitants (in millions)
	IAU/WHED	CR 2018	in CR 2018 (%)	per 1 mil. of inhabitants	
World	18,406	1,626	8.8%	2.5	7,383
Europe	3,776	551	14.6%	5.1	741
of which: EU 28	2,475	480	19.4%	4.9	507
of which: EU 15	1,684	411	24.4%	4.2	402
Northern America	2,132	309	14.5%	6.0	356
Latin America	3,820	106	2.8%	6.0	632
Asia	6,657	564	8.5%	1.5	4,420
Africa	1,881	51	2.7%	1.6	1,194
Oceania	140	45	32.1%	3.5	40

Cross Ranking 2018 (TOP 25 HEIs)		Country	CR 2018			
			Overall score	Research reputation	Co-operation and	International orientation
1.	Harvard University	United States	98.4	85.7	6.2	9.4
2.	Stanford University	United States	85.4	63.2	9.1	10.2
3.	Massachusetts Institute of Technology (MIT)	United States	82.5	64.6	8.4	10.7
4.	University of Cambridge	United Kingdom	82.5	69.0	6.6	10.1
5.	University of Oxford	United Kingdom	76.6	49.6	10.9	11.5
6.	University of California, Berkeley	United States	75.9	62.0	6.4	8.9
7.	California Institute of Technology	United States	75.0	53.8	9.1	10.6
8.	Princeton University	United States	74.9	61.6	6.3	8.9
9.	University of Chicago	United States	72.1	57.3	6.8	8.7
10.	Columbia University	United States	71.8	53.4	8.2	8.2
11.	Yale University	United States	68.8	44.8	10.3	9.0
12.	Cornell University	United States	67.8	43.8	9.4	10.2
13.	University College London	United Kingdom	66.5	34.6	11.9	11.6
14.	Swiss Federal Institute of Technology Zurich	Switzerland	66.2	35.7	11.7	12.1
15.	University of California, Los Angeles	United States	66.0	40.5	10.1	8.1
16.	University of Pennsylvania	United States	65.1	35.6	11.9	9.0
17.	Johns Hopkins University	United States	64.4	35.7	10.9	9.4
18.	Imperial College London	United Kingdom	63.8	29.9	12.8	11.9
19.	University of California, San Diego	United States	62.0	34.5	10.0	8.9
20.	University of Washington	United States	60.5	36.9	7.6	7.6
21.	University of Michigan	United States	60.4	25.9	13.4	9.1
22.	University of Toronto	Canada	60.3	26.5	12.4	11.0
23.	Duke University	United States	60.1	27.2	13.0	7.5
24.	University of Tokyo	Japan	59.4	32.9	12.3	5.1
25.	Northwestern University	United States	58.9	28.5	11.5	8.8

Note: Institutions are ranked by their overall score in 2018.

Source: ARWU, QS, THE and EPC CU

America and Africa) do not yet generally achieve the quality levels of higher education institutions of the most developed countries and regions. In such cases, the Cross Ranking 2018 really includes the best higher education institutions of these countries or regions.

We have already shown in the methodological part of this text that our interpretation will include not only overall ranking of higher education institutions and countries but also their profiles, pointing to their weaknesses and strengths. The profile of each institution and system, developed on the basis of analysis of 3 overall and 17 dimensional scores achieved in the ARWU, QS and THE rankings, consists of the summary score achieved in the Cross Ranking 2018 and of the

three factor scores indicating (1) the results of higher education institutions (or systems) in research activities, (2) the co-operation of higher education institutions (or systems) with external partners and their societal reputation, and (3) the intensity of international orientation or internationalization of higher education institutions (or systems).

Let us now look at the overall score and all three factor scores that were in 2018 achieved by the TOP 25 higher education institutions in the overall ranking of 1 626 institutions (overall score for all HEIs as well for national systems of higher education 2012–2018 are available at: <http://www.strediskovzdelavacipolitiky.info/app/crossranking/>).

The very first place in the Cross Ranking 2018 was achieved by US *Harvard University* with the highest weighted score of 98.4 (due to its strong/dominant position in the ARWU ranking). Three factor scores show that its main strength are scientific and research activities, the factor in which it has a considerable lead over the second *University of Cambridge*. In both other factors *Harvard University* does not play such dominant role.

In the TOP 25 of the CR 2018, there are another 17 institutions located in the United States, 4 British institutions (the most successful of them *University of Cambridge* ranked 4th), the Swiss *ETH Zurich* (the most successful institution in Europe on the 14th place), the Canadian *University of Toronto* (on the 22nd place) and the Japanese *University of Tokyo* (on the 24th place). This is to say that 72% of the TOP 25 institutions of the CR 2018 come from the United States and only 20% from Europe (the United Kingdom and Switzerland).

However, when we look at the TOP 250 institutions of the CR 2018 (that represent approximately 1.36% of the world's best universities), the picture of their global geographic distribution changes substantially. Only 26% of them are located in the United States, whereas 47% in Europe, in Asia 16%, in Oceania 6%, in other North American countries 4%, in Latin America 1%, and in Africa less than 1%. The position of the United States is even worse when we take into account all 1 626 higher education institutions included. From this point of view Asia is leading with 35% (for the first time better than Europe), followed by Europe (34%), USA (15%), Latin America (7%), other North American countries (4%), and Oceania and Africa (both 3%).

The number of higher education institutions ranked in the CR 2018 is, of course, not sufficient for the evaluation of the actual level of higher education systems in individual countries. To do this, it is necessary to take account of the sum of overall scores achieved by all higher education institutions in a given country (that is

of their total score). At the TOP 250 level in the CR 2018, the most successful countries are the US (30% of the total score achieved by 250 most successful higher education institutions), the United Kingdom (14%), Germany (6%), Australia (5%) and the Netherlands (5%).

At the level of all 1 626 higher education institutions included in the CR 2018, the most successful country is again the US, although its share is lower (only 23% of overall scores achieved by all 1 626 higher education institutions ranked in the CR 2018), followed by the United Kingdom (9%), China (7%), Germany (5%) and Japan (4%).

Profiles of higher education institutions

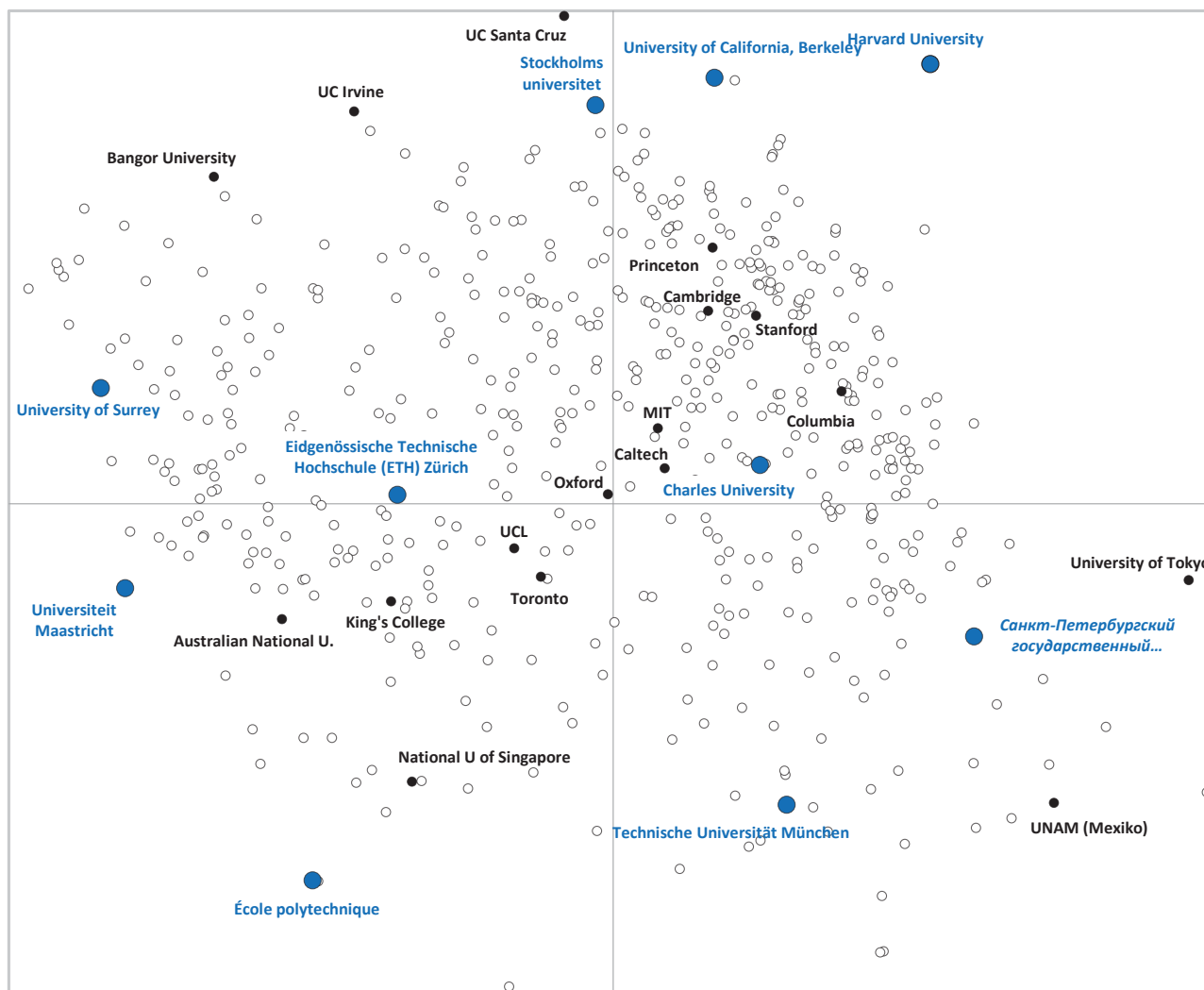
However, when evaluating the CR2018 results, we do not want to focus just on overall scores achieved by individual higher education institutions, but also (at least with the same emphasis) on differences in profiles of individual institutions.

The following figure (page 36) illustrates—analogically and in the same area (already outlined by multidimensional scaling method in the methodological part of the report)—positions of 678 higher education institutions that achieved a score in at least 12 of all 20 dimensions in the CR 2018.

Placing higher education institutions in the figure cannot substitute for a more detailed and precise analysis of their position, yet the figure shows basic features of different orientation of individual institutions that can be covered by 20 dimensions (contained in the three world university rankings considered) and displayed in a two-dimensional area. The placement of a higher education institution in the figure does not reflect its better or worse overall position (i.e. its overall score achieved) but it shows dimensions in which a higher education institution is more successful or stronger than in other dimensions, and thus defines its profile. Institutions displayed at the edges of the figure are strongly focused on corresponding dimensions positioned in the same area while other dimensions are

Cross Ranking 2018 – Profiles of higher education institutions

Distribution of 678 HEIs in an area outlined by relations between dimensions



Source: EPC CU

weaker, profiles of institutions displayed approximately in the centre of the figure are more balanced, without extreme values of some dimensions.

Different profiles of higher education institutions can be illustrated by following examples (marked with the blue colour in the figure above).

Harvard University (USA) ranked first not only in the ARWU overall ranking but also in five from six of its

dimensions, only in the dimension *Per Capita Performance* (in Figure CR 2018 indicated as PCP) ranked third. In the QS overall ranking, Harvard University was placed third, gaining 1st position in two dimensions (*Academic Reputation* and *Employer Reputation*), 7th position in *Citations Per Faculty* but 31st position in *Faculty Student Ratio*, 142nd position in *International Faculty* and only one 155th position in *International Students*. In the THE overall ranking, Harvard University ranked sixth, gaining 3rd position in *Research*, 8th position in *Citations* and

in *Teaching*, 164th position in *International Outlook* and only 343rd position in *Industry Income* (i.e. co-operation with the business sector and knowledge transfer). The overall profile of Harvard University shows its very strong focus on research (with absolutely extraordinary outcomes worldwide) that is, of course, reflected in its high reputation both between academics and employers, exceeding its position in other dimensions.

American **University of California, Berkeley** ranked best at 5th position in the ARWU overall ranking, gaining 3rd position in the dimension *Highly Cited Researchers* (in Figure CR 2018 indicated as HiCi), two 4th positions in N&S (i.e. the number of papers published in journals Nature and Science) and in *Alumni* (winning the Nobel Prize or the Fields Medal), and falling down to 30th position in *Publications*. (in Figure CR 2018 indicated as PUB). In the QS overall ranking, University of California, Berkeley was placed twenty-seventh, gaining 1st place in *Academic Reputation*, 9th position in *Employer Reputation* and also a very good 6th position in *Citations Per Faculty*. On the contrary, it ranked at 57th position in *International Faculty*, at 294th position in *International Students* and as low as at 501st position in *Faculty Student Ratio*. In the THE overall ranking it ranked at 15th position, gaining 7th position in *Citations*, 10th position in *Research*, 23rd position in *Teaching*, 257th position in *International Outlook* and only 330th position in *Industry Income*. The overall profile of University of California, Berkeley shows world-class position in research activities (only a slight distance behind Harvard University) and also in dimensions concerning high reputation where it ranked better than in other dimensions.

Swedish **Stockholms universitet** ranked best at 77th position in the ARWU overall ranking, gaining even 48th position in *Awards* (i.e. the number of staff winning the Nobel Prize or the Fields Medal) and 49th position in *Alumni*; it was placed 92nd in N&S, 120th in *Per Capita Performance* and the worst 181st in *Publications*. In the QS overall ranking, Stockholms

universitet was placed 200th, with the best 143rd position in *Academic Reputation*. On the other hand, it ranked at 444th position in *Employer Reputation*, 494th position in *Faculty Student Ratio* and 534th position in *International Students*. In the THE overall ranking, it was placed 153rd, with the best 122nd position in *Research* and 156th position in *Citations*. But it ranked in the third hundred in *International Outlook* (218th), in the fourth hundred in *Teaching* (368th) and even in the ninth hundred in *Industry Income* (840th). The overall profile of Stockholms universitet is (similarly to Harvard University and University of California, Berkeley) particularly focused on research activities and its strength is also in academic reputation.

British **University of Surrey** has a somewhat differently oriented profile than the three above universities. It ranked best at 248th position in the QS overall ranking in which it was placed in the third or fourth hundred in all dimensions, but for *Faculty Student Ratio* (502th) on the one hand, and *International Faculty* (112th) and *International Students* (even 55th) on the other hand. Similarly, in the THE overall ranking (placed 251–300th) it ranked in the third or fourth hundred in all dimensions with the exception of *International Outlook* (placed even as 45th). In the ARWU overall rankings, University of Surrey was placed 301–400th with the best 180th position in *Highly Cited Researchers* and the worst 640th position in N&S. The overall profile of University of Surrey shows a strong focus on internationalisation and related attractiveness for students and academics from abroad.

Universiteit Maastricht (The Netherlands) ranked best at 128th position in the THE overall ranking in which it was placed in the third hundred in two dimensions (230th in *Teaching* and 236th in *Citations*) but it ranked at the very good 89th position in *Industry Income* and even better at 13th position in *International Outlook*. In the QS overall ranking it ranked at 211th position, although it gained an excellent 1st position in

International Students and a relatively good 95th position in *International Faculty*; the reason was that it was placed worse than in the fourth hundred in two QS dimensions (405th in *Employer Reputation* and 502nd in *Faculty Student Ratio*). In the ARWU overall ranking Universiteit Maastricht placed 201–300th, with the best position in *Per Capita Performance* (139th) and the worst result in *N&S* (629th). The overall profile of Universiteit Maastricht shows (similarly to University of Surrey) a strong focus on internationalisation and related attractiveness for students and academics from abroad; but its strength is also in co-operation with the business sector.

French **École polytechnique** ranked best at 65th position in the QS overall ranking with a very good 16th position in *Faculty/Student Ratio* and even an excellent 11th position in *Employer Reputation*! In other QS dimensions, it was placed at 67st position in *International Students*, 117th position in *International Faculty*, 161st position in *Academic Reputation* and only 250th position in *Citations Per Faculty*. It achieved weaker results in the THE ranking (as 108th overall) with 376th position in *Citations*. On the contrary, it ranked at a very good 65th position in *Teaching* and at an excellent 38th position in *International Outlook*! In the ARWU overall ranking, École polytechnique was placed only 401–500th—particularly due to the 656th position in *Publications* and 531st position in *Highly Cited Researchers*. The overall profile of École polytechnique shows a strong focus on internationalisation and attractiveness for students and academics from abroad, its strength is also in co-operation with the business sector, which is reflected in an excellent reputation among employers.

Technische Universität München (Germany) ranked best at 44th position in the THE overall ranking with an excellent 1st position in *Industry Income*. In other THE dimensions, it was placed at 49th position in *Research*, 52nd position in *Teaching*, 138th position in *Citations* and 249th position in *International Outlook*. Similarly, in the QS ranking (as 61st overall) it ranked

280th in *International Faculty* and 210th in *International Students*. On the contrary, it was placed at a very good 21st position in *Employer Reputation*. In the ARWU overall ranking, Technische Universität München was placed 48th—particularly due to 17th position in *Alumni*. On the other hand, it achieved weaker results in *HighlyCited Researchers* and in *Publications* (both as 89th). The overall profile of Technische Universität München shows a strong focus on co-operation with the business sector and with potential future employers of graduates—that is on application rather than on academic dimension.

Sankt Petersburg State University (Russia) ranked best at 235th position in the QS overall ranking with 640th position both in *International Faculty* and *Citations Per Faculty*, 396th position in *International Students* and 296th position in *Employer Reputation*. On the contrary, it ranked at a very good 56th position in *Faculty Student Ratio*. Similarly, in the ARWU ranking (as 301–400th overall), it ranked at a very good 44th position in *Alumni*. On the other hand, it achieved weaker results in *Per Capita Performance* (as 339th), *Highly Cited Researchers* (as 531st) and in *N&S* (as 547th). The overall profile of Sankt Petersburg State University shows a strong orientation towards an educational function, reputation and favourable environment for teaching and learning that is reflected, for example, in a high faculty/student ratio.

Swiss **Eidgenössische Technische Hochschule (ETH) Zürich** ranked best at 7th position in the QS overall ranking, which was particularly due to 1st position in *International Faculty*, 13th position in *Citations Per Faculty*, 23th position in *Academic Reputation* and 27th position in *Employer Reputation*. On the other hand, the weakest result in the QS ranking was 123rd position in *Faculty Student Ratio*. In the THE ranking, its 11th position overall was particularly due to 10th position in *International Outlook*, 11th position in *Research* and 17st position in *Teaching*; on the other hand, its weakest result in the THE ranking was achieved in *Industry*

Income (as 234th position). In the ARWU ranking (as 19th overall), it ranked best in *Per Capita Performance* (as 11th) and in *N&S* (as 12th); on the contrary, a relatively weaker result was achieved in *Publications* (as 59th). The overall profile of Eidgenössische Technische Hochschule (ETH) Zürich is relatively balanced. The strongest focus is on internationalisation, attractiveness (especially for academic staff from abroad), research activities, its strength being also in reputation among academics and employers.

Czech **Charles University** ranked best at 201–300th position in the ARWU overall ranking, particularly due to a very good 141st position in *Publications*. On the other hand, weaker results were achieved in two dimensions where it was placed in the fourth hundred (as 374th position in *N&S* and as 352th position in *Per Capita Performance*. In the QS ranking (as 317th overall), it gained its best 200th place in *Academic Reputation*. On the contrary, relatively weaker results within the QS ranking were achieved in *Faculty Student Ratio* (as 351st), in *International Faculty* (as 534th) and in *Citations Per Faculty* (as 608th). In the THE rankings (as 401–500th overall), it ranked at 393th position both in *International Outlook* and in *Teaching*, 440th in *Research*, 529th position in *Citations* and only as 1095th in *Industry Income*. The overall profile of Charles University is relatively balanced because it is placed in the third or the fourth hundred in most of dimensions. The strongest focus is on research activities, its strength being also in reputation among academic staff.

The table on the next page refers to the overall institutional profile of TOP 30 higher education institutions of the Cross Ranking 2018 and also to other seven selected institutions whose profiles we have described in a greater detail (and that are not included in the TOP 30). It indicates the CR 2018 overall score, 3 factor scores and also all 20 dimensions from the three world university rankings (ARWU, QS, THE) published in 2018.

Example: Czech Republic. The most successful Czech higher education institution according to the CR 2018 is *Charles University* ranked at 276th place. The second most successful one is *Masaryk University* (ranked as 544th) and the third one is *Czech Technical University in Prague* (591st place). Among the TOP 1000 higher education institutions there are also other 4 Czech institutions: *Palacký University in Olomouc* (617th place), the *Czech University of Life Sciences Prague* and *Institute of Chemical Technology in Prague* (both at 924th place) and *Brno University of Technology* (937th place). However, among remaining higher education institutions ranked in the CR 2018 (at 1001–1626th positions) there are 8 more Czech institutions: *University of Ostrava*, *University of South Bohemia in České Budějovice*, *University of Economics in Prague*, *University of Pardubice*, *Technical University of Liberec*, *Tomas Bata University in Zlín*, *VSB Technical University of Ostrava* and *University of West Bohemia*.

For comparison with neighbouring countries, the most successful German higher education institution ranked at 43rd place (*University of Munich*), the best Austrian one at 154th place (*University of Vienna*), the best Polish one at 375th place (*University of Warsaw*) and the best Slovak higher education institution at 738th place (*Comenius University in Bratislava*).

While the Czech Republic has 7 higher education institutions in the TOP 1 000 and 15 institutions among all 1626 institutions ranked in the CR 2018, Germany has 56 institutions in the TOP 1 000 and 61 in total, Poland has 8 in the TOP 1 000 and 18 in total, Austria has 8 in the TOP 1 000 and 13 in total and Slovakia has 2 in the TOP 1 000 and only 3 in total.

Cross Ranking 2018 (TOP 30+ HEIs)			Country	ARWU 2018							QS 2018				THE 2018				CR 2018								
				ARWU Overall score	Alumni	Award	HiCi	NS	Pub	PCP	QS Overall score	Academic reputation	Citations per faculty	Employer reputation	Faculty student ratio	International faculty	International students	THE	Research	Citations	Industry Income	International Outlook	Overall score	CR	Research	Co-operation and reputation	International orientation
																		Overall score	Teaching	Research	Citations	Industry Income	International Outlook	Overall score	Research	Co-operation and reputation	International orientation
1	Harvard University	United States	100.0	100.0	100.0	100.0	100.0	100.0	100.0	79.6	98.5	100.0	99.8	100.0	99.3	92.1	75.7	93.6	90.1	98.4	99.6	48.7	79.7	98.4	85.7	6.2	9.4
2	Stanford University	United States	75.6	44.5	88.5	76.6	78.6	76.5	56.0	98.6	100.0	99.8	100.0	100.0	100.0	99.8	70.5	94.7	93.6	96.8	99.9	64.6	79.3	85.4	63.2	9.1	10.2
3	Massachusetts Institute of Technology (MIT)	United States	69.9	70.9	83.6	52.5	71.4	64.4	70.3	100.0	100.0	99.8	100.0	100.0	100.0	100.0	95.5	94.2	91.9	92.7	99.9	87.6	89.0	82.5	64.6	8.4	10.7
4	University of Cambridge	United Kingdom	71.8	82.3	95.4	56.7	57.6	70.9	95.5	95.6	100.0	77.2	100.0	100.0	100.0	99.4	97.9	94.8	92.1	98.8	97.1	52.9	94.3	82.5	69.0	6.6	10.1
5	University of Oxford	United Kingdom	60.0	50.8	54.2	61.3	52.6	77.1	46.8	96.8	100.0	83.0	100.0	100.0	99.6	98.8	96.0	91.8	99.5	99.1	67.0	96.3	76.6	49.6	10.9	11.5	
6	University of California, Berkeley	United States	68.3	65.6	78.4	61.3	67.8	65.1	58.2	100.0	99.9	99.8	28.9	99.5	46.1	87.7	78.7	92.3	99.7	49.3	69.8	75.9	62.0	6.4	8.9	6.4	8.9
7	California Institute of Technology	United States	57.4	53.5	67.5	34.5	57.6	45.0	100.0	97.2	98.7	100.0	81.2	100.0	96.8	90.3	94.1	94.5	97.2	99.2	88.2	62.3	75.0	53.8	9.1	10.6	
8	Princeton University	United States	61.0	55.8	97.9	44.9	47.1	44.2	73.3	90.9	99.9	100.0	96.7	70.3	70.1	69.2	92.3	89.9	93.6	99.4	57.3	80.1	74.9	61.6	6.3	8.9	8.9
9	University of Chicago	United States	55.5	59.2	90.1	35.8	42.5	52.0	44.2	93.2	99.6	83.6	90.7	97.4	74.2	82.5	90.2	90.2	90.1	99.0	41.4	70.9	72.1	57.3	6.8	8.7	8.7
10	Columbia University	United States	58.2	62.8	67.2	41.8	56.4	71.5	33.7	88.5	99.7	59.2	97.4	100.0	40.4	96.2	87.2	87.2	85.4	98.4	44.8	79.0	71.8	53.4	8.2	8.2	8.2
11	Yale University	United States	50.7	47.1	49.7	44.9	53.4	58.7	35.7	89.6	99.9	60.2	99.7	100.0	86.3	61.2	91.3	91.6	93.5	97.8	51.5	68.3	68.8	44.8	10.3	9.0	9.0
12	Cornell University	United States	50.7	43.1	49.1	46.9	47.3	61.6	43.4	90.5	98.7	95.9	90.5	70.4	93.3	77.0	85.1	79.7	85.4	97.4	36.9	71.8	67.8	43.8	9.4	10.2	10.2
13	University College London	United Kingdom	46.1	27.8	35.8	41.8	39.0	78.8	32.6	92.9	99.3	66.2	99.2	99.2	98.2	100.0	98.6	89.3	83.3	91.4	93.8	56.1	98.2	66.2	35.7	11.7	12.1
14	Swiss Federal Institute of Technology Zurich	Switzerland	43.9	29.2	35.1	33.2	49.9	58.7	47.5	95.3	98.2	98.7	96.2	82.4	100.0	98.6	89.3	83.3	91.4	93.8	56.1	98.2	66.2	35.7	11.7	12.1	12.1
15	University of California, Los Angeles	United States	51.2	29.2	46.4	55.9	44.9	73.1	32.1	81.9	100.0	92.4	99.1	41.8	56.1	42.0	86.4	82.6	87.9	97.8	49.4	62.1	66.0	40.5	10.1	8.1	8.1
16	University of Pennsylvania	United States	46.4	31.3	33.4	46.9	41.7	69.7	39.7	86.5	95.4	59.7	92.6	100.0	72.1	65.2	89.0	87.4	89.2	98.4	70.3	63.6	65.1	35.6	11.9	9.0	9.0
17	Johns Hopkins University	United States	45.4	37.3	33.2	37.1	43.4	75.7	28.7	85.9	89.7	80.2	56.9	100.0	79.9	81.6	89.0	81.9	90.5	98.5	95.5	71.9	64.4	35.7	10.9	9.4	9.4
18	Imperial College London	United Kingdom	40.1	14.4	35.4	35.8	31.0	67.7	39.1	93.3	98.7	67.8	99.9	100.0	100.0	100.0	90.3	85.8	87.7	97.8	67.3	63.8	29.9	12.8	11.9	11.9	11.9
19	University of California, San Diego	United States	47.8	19.0	35.1	53.3	53.0	65.4	35.9	78.6	91.7	84.5	56.1	62.1	64.9	70.7	79.7	65.4	79.2	98.2	96.0	59.9	62.0	34.5	10.0	8.9	8.9
20	University of Washington	United States	50.0	24.9	37.4	54.2	49.1	75.9	31.4	67.8	85.0	99.5	46.5	21.0	58.6	38.4	80.4	70.7	79.7	98.9	47.6	59.3	60.5	36.9	7.6	7.6	7.6
21	University of Michigan	United States	39.4	34.1	0.0	41.8	41.0	80.8	25.0	86.4	98.9	60.5	90.2	94.3	82.3	49.8	84.1	80.0	85.9	96.0	45.9	58.0	60.4	25.9	13.4	9.1	9.1
22	University of Toronto	Canada	40.9	19.7	17.0	35.8	38.9	83.1	31.7	83.0	98.7	47.6	94.0	74.8	96.4	92.9	84.0	75.8	86.3	92.8	50.3	82.8	60.3	26.5	12.4	11.0	11.0
23	Duke University	United States	39.7	15.2	19.0	55.9	35.6	63.9	25.5	83.9	88.2	88.2	74.7	99.3	14.3	55.0	85.4	84.1	78.8	98.2	100.0	61.0	60.1	27.2	13.0	7.5	7.5
24	University of Tokyo	Japan	41.5	38.3	25.0	25.3	46.0	72.8	29.8	85.3	100.0	72.2	99.5	94.2	12.3	25.5	74.1	84.0	87.2	61.3	67.2	35.9	59.4	32.9	12.3	5.1	5.1
25	Northwestern University	United States	39.9	15.2	27.6	48.8	33.3	62.2	31.7	81.5	85.0	68.4	73.1	99.8	72.0	54.8	81.7	69.0	83.6	97.8	75.8	63.0	58.9	28.5	11.5	8.8	8.8
26	University of Edinburgh	United Kingdom	37.2	27.3	24.6	42.8	30.9	55.9	28.7	86.9	97.3	57.2	94.0	85.5	97.4	98.8	79.8	69.2	73.7	96.8	38.2	93.3	58.5	29.0	11.1	11.4	11.4
27	Tsinghua University	China	34.1	10.2	0.0	37.1	38.4	74.6	24.1	87.2	97.0	77.4	99.4	91.5	60.6	29.2	82.8	87.7	94.1	74.8	99.8	45.0	57.5	19.4	15.7	7.9	7.9
28	New York University	United States	37.2	29.6	31.5	25.3	39.5	60.6	20.8	77.7	95.6	23.7	91.3	97.3	28.4	90.9	81.0	77.7	76.1	96.6	38.9	65.0	56.3	30.5	10.3	7.8	7.8
29	University of Melbourne	Australia	35.7	16.8	13.1	42.8	21.4	72.3	33.6	80.1	99.0	76.4	98.8	26.5	97.6	99.9	78.3	68.0	73.4	90.3	74.0	93.1	55.6	22.9	12.2	11.9	11.9
30	University of Manchester	United Kingdom	37.0	18.3	32.2	34.5	30.9	60.0	28.9	82.9	94.6	51.2	98.5	76.0	93.2	98.8	69.9	57.7	62.0	87.2	45.0	90.1	55.5	27.8	10.5	10.9	10.9
46	Technical University Munich	Germany	33.0	36.6	21.3	25.3	25.2	53.6	35.5	70.0	78.1	23.9	98.3	88.8	59.5	63.9	73.7	62.9	68.6	88.3	100.0	70.5	50.6	26.8	10.7	7.8	7.8
123	Stockholm University	Sweden	27.6	23.8	27.1	16.6	22.1	43.8	27.4	43.9	51.8	51.6	20.3	29.5	78.7	17.5	56.6	32.3	47.7	87.2	36.5	73.9	37.4	23.4	3.8	6.1	6.1
135	Ecole Polytechnique	France	11.2	21.5	0.0	0.0	8.7	25.3	21.9	67.9	46.8	47.3	99.7	99.9	95.4	95.8	60.8	58.6	68.2	70.6	94.0	35.8	10.5	10.8	10.5	10.4	10.4
181	Maastricht University	Netherlands	16.5	0.0	0.0	13.5	4.7	44.3	26.5	42.5	21.8	78.9	22.7	28.8	97.5	100.0	58.9	38.8	47.1	79.6	79.8	31.4	7.2	6.8	10.5	10.5	10.5
249	University of Surrey	United Kingdom	13.5	0.0	0.0	16.6	4.6	30.5	23.2	38.3	23.7	52.0	29.4	28.8	95.9	97.2	47.9	32.0	32.6	72.2	47.7	26.6	6.3	5.7	10.0	10.0	10.0
276	Charles University in Prague	Czech Republic	16.5	8.8	0.0	13.5	8.9	46.9	19.9	33.2	38.2	11.4	36.2	43.1	19.0	47.8	39.4	31.6	24.8	55.9	34.4	57.4	25.2	8.6	5.7	4.7	4.7
295	Saint Petersburg State University	Russian Federation	13.5	26.4	0.0	0.0	5.7	36.4	20.2	39.2	35.3	4.8	31.3	95.2	6.0	31.8	35.3	48.3	28.6	23.5	35.5	38.9	24.5	10.6	6.1	2.7	2.7

Source: ARWU, QS, THE and EPCU

Higher education systems

Scores achieved by all higher education institutions can be also used to compare the performance and the profiles of higher education systems in individual countries. An important indicator—the total score of each country (that is of all its institutions) divided by the number of its inhabitants—is constructed as the sum of overall scores achieved by all higher education institutions in the country (included in the TOP 1 626 institutions of the world in 2018) relative to the size of the country (to its population), thus expressing the sum of scores achieved by a given country per million inhabitants. The table below displays for each country (i.e. higher education system) also the absolute number of higher education institutions included among the TOP 1 626 and their share (percentage) in the overall sum of scores distributed. The table shows 50 most successful countries and other twelve European countries with worse ranks. On the other hand, the table does not include countries with less than 1 million inhabitants, as in these cases it is mostly the only one state university with a very specific conditions, not representing a whole higher education system (the case of Brunei, Iceland, Luxembourg, and Macao).

When considering all 1 626 higher education institutions included, the highest total score per million

inhabitants in 2018 was achieved by Switzerland (44.7) followed by New Zealand (score 42.4), Finland (40.3), Australia (39.5) and Ireland (36.3), that is by rather smaller countries, quite different from those that dominated the absolute CR 2018 comparison and were not very successful in this relative comparison. For example, in the relative comparison the US ranked at 19th place (score 16.4), Germany at 20th place (15.3), Japan at 32nd place (8.0) and China even at 66th place with a score of only 1.1 per million inhabitants.

At level of world regions, Oceania is the most successful (score 28.7 per million inhabitants), followed by North America (17.1), Europe (12.3), Asia (1.3), Latin America (1.2) and Africa (0.3).

rank 2018 by		Cross Ranking 2018 (1 626 HEIs) TOP 50 countries	2018				
total score	total score per capita		number of HEIs	total score	total score (%)	total score per capita	number of inhab. (in mil.)
		World	1,626	23,199	100.0%	3.1	7,383
1	5	Europe	551	9,149	39.4%	12.3	741
2	4	of which: EU 28	480	8,153	35.1%	16.1	507
3	2	of which: EU 15	411	7,609	32.8%	18.9	402
4	3	Northern America	309	6,100	26.3%	17.1	356
7	7	Latin America	106	748	3.2%	1.2	632
5	6	Asia	564	5,711	24.6%	1.3	4,420
8	8	Africa	51	356	1.5%	0.3	1,194
6	1	Oceania	45	1,135	4.9%	28.7	40

rank 2018 by		Cross Ranking 2018 (1 626 HEIs) TOP 50 countries	2018				
total score	total score per capita		number of HEIs	total score	total score (%)	total score per capita	number of inhab. (in mil.)
1.	19.	United States	251	5,243	22.6%	16.4	319.9
2.	8.	United Kingdom	102	2,148	9.3%	32.8	65.4
3.	66.	China	131	1,514	6.5%	1.1	1,397.0
4.	20.	Germany	61	1,252	5.4%	15.3	81.7
5.	32.	Japan	108	1,018	4.4%	8.0	128.0
6.	4.	Australia	37	940	4.1%	39.5	23.8
7.	23.	Italy	52	759	3.3%	12.8	59.5
8.	27.	France	56	755	3.3%	11.7	64.5
9.	18.	Canada	34	724	3.1%	20.1	35.9
10.	25.	South Korea	42	618	2.7%	12.2	50.6
11.	26.	Spain	43	565	2.4%	12.2	46.4
12.	10.	Netherlands	13	483	2.1%	28.5	16.9
13.	81.	India	57	412	1.8%	0.3	1,309.1
14.	47.	Russian Federation	40	397	1.7%	2.8	143.9
15.	1.	Switzerland	11	372	1.6%	44.7	8.3
16.	22.	Taiwan	32	343	1.5%	14.6	23.5
17.	6.	Sweden	13	341	1.5%	34.9	9.8
18.	57.	Brazil	39	337	1.5%	1.6	206.0
19.	15.	Belgium	9	250	1.1%	22.2	11.3
20.	9.	Hong Kong	7	226	1.0%	31.3	7.2
21.	3.	Finland	10	221	1.0%	40.3	5.5
22.	49.	Iran	30	213	0.9%	2.7	79.4
23.	13.	Austria	13	200	0.9%	23.0	8.7
24.	7.	Denmark	7	198	0.9%	34.7	5.7
25.	2.	New Zealand	8	196	0.8%	42.4	4.6
26.	52.	Turkey	25	193	0.8%	2.5	78.3
27.	38.	Malaysia	17	176	0.8%	5.7	30.7
28.	5.	Ireland	9	170	0.7%	36.3	4.7
29.	17.	Israel	8	168	0.7%	20.9	8.1
30.	21.	Portugal	13	160	0.7%	15.3	10.4
31.	48.	South Africa	11	151	0.6%	2.7	55.3
32.	12.	Norway	6	135	0.6%	26.0	5.2
33.	40.	Saudi Arabia	11	135	0.6%	4.3	31.6
34.	43.	Poland	18	133	0.6%	3.5	38.3
35.	67.	Mexico	23	132	0.6%	1.0	125.9
36.	35.	Chile	17	131	0.6%	7.4	17.8
37.	64.	Egypt	19	117	0.5%	1.3	93.8
38.	16.	Singapore	4	117	0.5%	21.2	5.5
39.	28.	Czech Republic	15	114	0.5%	10.8	10.6
40.	51.	Argentina	17	112	0.5%	2.6	43.4
41.	61.	Thailand	14	97	0.4%	1.4	68.7
42.	30.	Greece	9	94	0.4%	8.4	11.2
43.	56.	Colombia	12	80	0.3%	1.7	48.2
44.	33.	Hungary	7	77	0.3%	7.9	9.8
45.	78.	Pakistan	15	73	0.3%	0.4	189.4
46.	37.	United Arab Emirates	8	67	0.3%	7.3	9.2
47.	44.	Kazakhstan	10	61	0.3%	3.5	17.7
48.	84.	Indonesia	9	57	0.2%	0.2	258.2
49.	31.	Lebanon	6	49	0.2%	8.4	5.9
50.	54.	Romania	8	40	0.2%	2.0	19.9
51.	11.	Estonia	3	36	0.2%	27.5	1.3
52.	68.	Ukraine	7	35	0.2%	0.8	44.7
54.	29.	Lithuania	4	27	0.1%	9.1	2.9
55.	14.	Cyprus	3	26	0.1%	22.8	1.2
56.	24.	Slovenia	2	26	0.1%	12.7	2.1
59.	39.	Slovakia	3	24	0.1%	4.5	5.4
67.	41.	Croatia	2	17	0.1%	4.0	4.2
69.	55.	Serbia	2	16	0.1%	1.9	8.9
71.	36.	Latvia	3	15	0.1%	7.4	2.0
75.	63.	Belarus	2	13	0.1%	1.4	9.5
79.	65.	Bulgaria	1	8	0.0%	1.2	7.2
85.	62.	Bosnia and Herzegovina	1	5	0.0%	1.4	3.5

Note: Countries are ranked by the sum of their HEI's overall scores in 2018. TOP 50 + other 12 European countries.

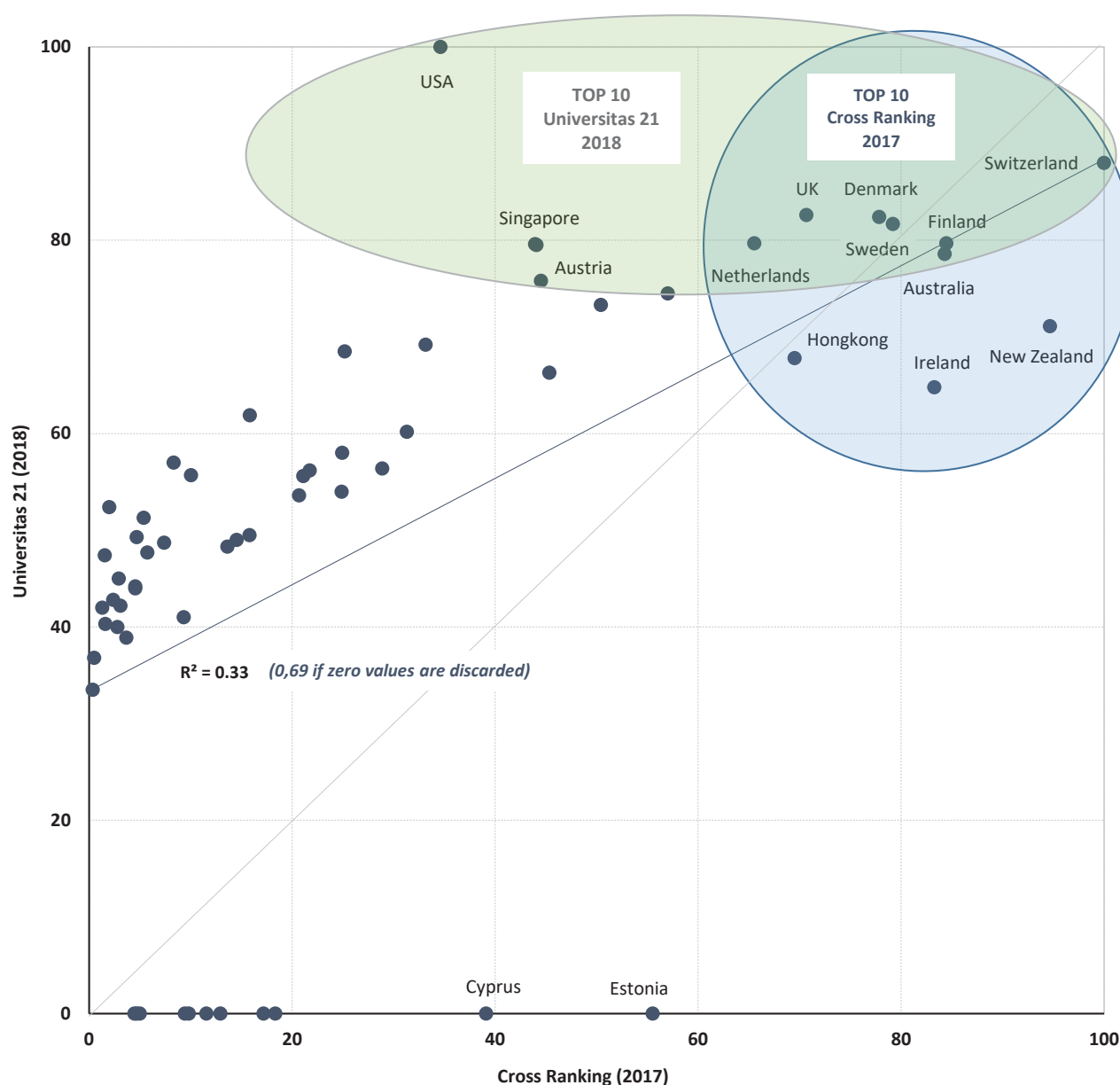
Comparison of Cross Ranking and Universitas 21

In order to interpret the Cross Ranking results in a wider context, we have decided to compare them with results of the best known, most prestigious, and also most serious world ranking of higher education systems named *Universitas 21 Ranking of National Higher*

Education Systems (U21), namely with its seventh edition in May 2018. The U21 ranking has been published by a transnational association of research universities called *Universitas 21 (The leading global network of research universities for the 21st century)* since 2012. It regularly publishes the TOP 50 worldwide higher education systems, evaluating them by more than two dozen indicators (with different weights) classified under four dimensions:

Comparing results of Cross Ranking (2017) and Universitas 21 (2018)

The 50 most successful countries



Source: EPC CU, ARWU, QS, THE and U21

Resources, Environment, Connectivity and Output (which, among other indicators, takes into account the results of the ARWU ranking).

The result of the comparison of higher education systems based on both rankings, the Cross Ranking and the *Universitas 21*, is illustrated by the figure on previous page which in particular leads to the following conclusions: Firstly, the U21 (2018) is clearly dominated by the US (due to the absolute number of scientific output in the *Output* dimension, although the data used in all other indicators and dimensions are always relative, i.e. related to the size of the country). We do not consider it to be appropriate and think that the Cross Ranking (CR 2017—for a fair comparison) yields a more balanced picture of the leading countries, Switzerland coming first (and the US ranking only 16th).

Secondly, 7 higher education systems are among the TOP 10 in both rankings (namely Switzerland, Finland, Australia, Sweden, Denmark, the United Kingdom, and the Netherlands), which confirms their really high level. The TOP 10 countries only included in one of the rankings are Austria, Singapore, and the United States in the U21 ranking, and New Zealand, Ireland, and Hong Kong in the Cross Ranking.

Thirdly, 39 higher education systems are among the TOP 50 in both rankings, whereas 22 higher education systems are only included in one of the rankings. Among countries only included in the Cross Ranking (and not in the U21 ranking) are Estonia (12th), Cyprus (18th), Qatar (29th), Lithuania (30th), Latvia (35th), the United Arab Emirates (36th), Bahrain (38th), Kazakhstan (45th), Jordan (47th) and Costa Rica (50th). On the other hand, countries only included in the U21 ranking (and not in the Cross Ranking) are China (30th in U21 *total score* and even 22nd in U21 *output dimension score*), Ukraine (38th), Brazil (39th), Serbia (42nd), Romania (43rd), Bulgaria (44th), Mexico (46th), Thailand (47th), Iran (48th), India (49th), and Indonesia (50th).

rank 2017 by		Cross Ranking 2017 (1 413 HEIs) TOP 50 countries	total score per capita	total score (max = 100)	U21 ranking 2018			
total score	total score per capita				total (rank)	total (score)	output (rank)	output (score)
13	1	Switzerland	46.3	100.0	2	88	4	64
23	2	New Zealand	43.8	94.7	14	71	20	48
21	3	Finland	39.1	84.5	6	80	9	57
6	4	Australia	39.0	84.3	10	79	3	65
24	5	Ireland	38.5	83.3	19	65	16	50
22	6	Denmark	36.6	79.2	5	82	5	63
14	7	Sweden	36.0	77.9	4	82	6	62
2	8	United Kingdom	32.7	70.7	3	83	2	70
20	9	Hong Kong	32.2	69.5	17	68	21	47
11	10	Netherlands	30.3	65.5	6	80	8	60
31	11	Norway	26.4	57.0	12	75	14	54
49	12	Estonia	25.7	55.5	-	-	-	-
19	13	Belgium	23.3	50.4	13	73	12	55
26	14	Israel	21.0	45.3	18	66	10	56
25	15	Austria	20.6	44.5	11	76	19	48
35	16	Singapore	20.4	44.1	9	80	15	54
8	17	Canada	20.3	43.9	8	80	7	62
58	18	Cyprus	18.1	39.1	-	-	-	-
1	19	United States	16.0	34.6	1	100	1	100
4	20	Germany	15.3	33.2	15	69	11	55
15	21	Taiwan	14.5	31.3	21	60	23	44
30	22	Portugal	13.4	28.9	24	56	28	40
7	23	France	11.7	25.2	16	69	13	54
10	24	South Korea	11.5	24.9	22	58	18	48
9	25	Italy	11.5	24.9	28	54	25	42
12	26	Spain	10.1	21.7	25	56	24	44
36	27	Czech Republic	9.8	21.1	27	56	30	37
61	28	Slovenia	9.6	20.7	29	54	29	38
57	29	Qatar	8.5	18.4	-	-	-	-
54	30	Lithuania	8.0	17.2	-	-	-	-
5	31	Japan	7.3	15.8	20	62	17	50
41	32	Greece	7.3	15.8	32	50	27	41
34	33	Chile	6.7	14.6	34	49	35	30
44	34	Hungary	6.3	13.6	36	48	32	32
67	35	Latvia	6.0	13.0	-	-	-	-
45	36	United Arab Emirates	5.4	11.6	-	-	-	-
29	37	Malaysia	4.7	10.1	26	56	42	27
76	38	Bahrain	4.5	9.8	-	-	-	-
52	39	Lebanon	4.4	9.4	-	-	-	-
63	40	Croatia	4.3	9.3	45	41	41	28
33	41	Saudi Arabia	3.9	8.3	23	57	33	31
62	42	Slovakia	3.4	7.4	35	49	34	30
28	43	South Africa	2.7	5.7	37	48	36	29
37	44	Poland	2.5	5.4	31	51	31	35
48	45	Kazakhstan	2.3	5.0	-	-	-	-
16	46	Russian Federation	2.2	4.7	33	49	26	41
60	47	Jordan	2.2	4.7	-	-	-	-
39	48	Argentina	2.1	4.6	40	44	38	28
27	49	Turkey	2.1	4.6	41	44	40	28
69	50	Costa Rica	2.1	4.5	-	-	-	-
32	54	Iran	1.7	3.7	48	39	43	27
51	56	Romania	1.4	3.1	43	42	46	24
18	59	Brazil	1.4	2.9	39	45	37	29
40	60	Thailand	1.3	2.8	47	40	48	20
70	61	Serbia	1.1	2.4	42	43	45	26
3	62	China	0.9	2.0	30	52	22	46
38	63	Mexico	0.7	1.6	46	40	49	17
50	65	Ukraine	0.7	1.6	38	47	44	27
84	68	Bulgaria	0.6	1.3	44	42	39	28
17	76	India	0.2	0.5	49	37	47	21
47	80	Indonesia	0.2	0.4	50	34	50	15

Note: Countries are ranked by the sum of their HEI's overall scores per 1 million inhabitants in the CR 2017.

Developments between 2012 and 2018

In order to be able to monitor how results of the Cross Ranking develop over time, we have linked individual HEIs included in all three rankings (ARWU, QS and THE) also in 2016 and 2012, using the same approach as in 2018. We have been able thus to assign a total score, and hence a total ranking, to 1 223 HEIs in 2016 and to 821 HEIs in 2012.

The **TOP 25** level of the Cross Ranking remained almost unchanged between 2012 and 2018, with only a few minor shifts in position of individual HESs. In all three years compared (2012, 2016, and 2018) the first position belonged unambiguously to *Harvard University*, followed by another 17 HEIs from the US, 4 from the UK and the best HEI from Switzerland, Canada, and Japan.

However, some interesting tendencies begin to appear at lower levels of the Cross Ranking such as a growing number and, at the same time, an improving position of HEIs from Europe, Asia and Oceania—particularly at the expense of North American HEIs (at TOP 250 level there were 92 in 2012, 76 in 2016, and only 73 in 2018). The changes in the position of world regions are documented in the table below.

When considering the number of institutions ranked at **TOP 250** level, it is dominated by Europe which strengthened its position gradually in recent

years (108 HEIs in 2012, 116 HEIs in 2016 and the record 118 HEIs in 2018). Also Oceania improved its position (an increase from 11 HEIs in 2012 to 16 HEIs both in 2016 and 2018) as well as Asia (an increase from 36 HEIs in 2012 to 39 HEIs in 2016 and even 40 HEIs in 2018). On the contrary, the positions of Latin America (2 HEIs in 2012 and 2018, and 1 HEI in 2016) and of Africa (1 HEI in 2012 and 2018, and 2 HEIs in 2016) seemed stable (see the table below).

And which countries were behind weakening or improving positions of world regions? The weakening of North America's position was caused not only by the US (77 HEIs in 2012, 65 HEIs in 2016 and only 64 HEIs in 2018) but also by Canada (14 HEIs in 2012, 10 HEIs in 2016 and only 8 HEIs in 2018). In the case of Oceania, the improvement of its position was mainly due to Australia (9 HEIs in 2012 and 14 HEIs both in 2016 and 2018).

China (7 HEIs in 2012, 8 in 2016, and 10 in 2018) and South Korea (6 HEIs in 2012 and 7 both in 2016 and 2018) contributed to the improvement in Asia. The improvement in Europe was based more broadly because 8 countries contributed to it. When comparing 2012 and 2018, the UK, Belgium, Italy, Denmark, Austria and Finland improved by 1 HEI, and France and Spain even by 2 HEIs.

However, the absolute number of institutions ranked at a certain level of the ranking does not indicate anything about the specific position of an

rank 2018 by		Cross Ranking 2012, 2016, 2018 TOP 250 HEIs World Regions	2012			2016			2018		
total score	total score per capita		number of HEIs	total score (%)	total score per capita	number of HEIs	total score (%)	total score per capita	number of HEIs	total score (%)	total score per capita
		World	250	100.0%	1.5	250	100.0%	1.4	250	100.0%	1.4
1	5	Europe	108	40.5%	5.5	116	43.2%	5.9	118	43.6%	6.0
2	4	of which: EU 28	97	36.2%	7.2	106	39.1%	7.8	107	39.1%	7.8
3	2	of which: EU 15	97	36.2%	9.2	106	39.1%	9.8	107	39.1%	9.9
4	3	Northern America	92	41.0%	12.1	76	35.2%	10.1	73	33.9%	9.6
7	7	Latin America	2	0.6%	0.1	1	0.4%	0.1	2	0.6%	0.1
5	6	Asia	36	13.1%	0.3	39	14.6%	0.3	40	15.5%	0.4
8	8	Africa	1	0.3%	0.0	2	0.6%	0.1	1	0.3%	0.0
6	1	Oceania	11	4.5%	12.4	16	5.9%	15.6	16	6.1%	15.6

individual institution—only the percentage of the total score (i.e. of the sum of all overall scores achieved by individual institutions) can indicate it (see the table attached).

Of course, similar trends at TOP 250 level can be observed when analysing the development of the share of world regions in the total score. If the total score (the sum of all overall scores achieved by all institutions ranked at TOP 250 level) is considered to be 100%, then the ranking of world regions is almost the same as the one according to the absolute number of ranked institutions. Only proportions between regions shifted slightly in favour of North America, thus confirming a higher concentration of North American HEIs at upper levels of the Cross Ranking and thus their higher average rank. Between 2012 and 2016, Europe came first with more than 40% of the total score and overtook North America whose share, by contrast, fell well below 40% (even below the EU15 share). There is also a clear increase in the share of total score attained by Asia and Oceania, while South America and Africa remain below 1%.

When looking at level of individual institutions, the rise of Asia between 2012 and 2018 was caused in particular by improved positions of mainly Chinese HEIs, namely *Tsinghua University* (from 77th to 27th position), *Peking University* (from 74th to 34th), *Fudan University* (from 148th to 65th), *Shanghai Jiao Tong University* (from 176th to 87th), *University of Science and Technology of China* (from 190th to 95th) or *Zhejiang University* (from 201st to 63rd), and also by *Indian Institute of Science* (from 571st to 238th).

Australian HEIs were without doubt behind the rising position of Oceania, namely *University of New South Wales* (from 86th to 64th position), *Monash University* (from 95th to 60th) or *University of Western Australia* (from 103rd to 86th), and at lower levels of the Cross Ranking especially *Griffith University* (from 416th to 283rd), *Deakin University* (from 412th to 260th), *James Cook University* (from 408th to 251st) or *University of Newcastle, Australia* (from 273rd to 244th).

The strengthening of the position of Europe between 2012 and 2018 was due mainly to the contribution of

rank 2018 by		Cross Ranking 2012, 2016, 2018 TOP 250 HEIs TOP 25 countries	2012			2016			2018		
total score	total score per capita		number of HEIs	total score (%)	total score per capita	number of HEIs	total score (%)	total score per capita	number of HEIs	total score (%)	total score per capita
1	16	USA	77	35.6%	11.7	65	31.0%	9.9	64	30.3%	9.6
2	7	UK	33	13.5%	21.6	32	13.4%	20.9	34	14.0%	21.7
3	18	Germany	17	5.9%	7.2	21	7.2%	8.9	17	6.0%	7.4
4	6	Australia	9	3.8%	17.5	14	5.3%	22.9	14	5.4%	23.2
5	3	Netherlands	12	4.5%	27.3	12	4.6%	27.4	12	4.5%	27.1
6	25	China	7	2.4%	0.2	8	3.2%	0.2	10	4.0%	0.3
7	17	Canada	14	5.1%	15.2	10	3.9%	11.1	8	3.3%	9.4
8	23	Japan	10	4.0%	3.1	9	3.5%	2.7	8	3.3%	2.6
9	1	Switzerland	7	3.1%	39.9	7	3.2%	39.0	7	3.2%	38.6
10	20	France	7	2.7%	4.4	9	3.2%	5.0	9	3.0%	4.7
11	19	South Korea	6	2.1%	4.3	7	2.5%	5.0	7	2.6%	5.1
12	5	Sweden	7	2.5%	26.9	7	2.5%	26.5	7	2.5%	26.0
13	10	Belgium	5	1.8%	16.5	6	2.1%	19.1	6	2.1%	18.7
14	2	Hongkong	5	1.8%	25.2	5	1.9%	26.3	5	2.0%	27.6
15	22	Italy	5	1.4%	2.4	4	1.2%	2.0	6	1.7%	3.0
16	4	Denmark	3	1.2%	22.5	4	1.5%	27.4	4	1.5%	27.0
17	21	Spain	3	0.9%	1.9	4	1.2%	2.5	5	1.5%	3.2
18	9	Singapore	2	0.9%	17.3	2	1.0%	19.0	2	1.1%	19.3
19	14	Israel	3	1.1%	15.3	3	1.0%	13.4	3	1.0%	12.6
20	8	Norway	3	1.0%	20.0	3	1.0%	20.3	3	1.0%	19.5
21	15	Austria	2	0.6%	7.2	3	0.9%	10.4	3	0.9%	10.2
22	13	Finland	1	0.4%	8.1	2	0.7%	13.7	2	0.7%	13.7
23	11	Ireland	2	0.7%	15.0	1	0.3%	6.2	2	0.7%	14.2
24	12	New Zealand	2	0.7%	15.5	2	0.7%	14.9	2	0.6%	14.1
25	24	Saudi Arabia	0	0.0%	0.0	2	0.6%	2.0	2	0.6%	2.0

Note: Countries are ranked by the sum of overall scores of the 250 most successful HEIs in 2018.

those HEIs that ranked at TOP 250 level for the first time—for example French *Université Grenoble-Alpes* (from 711th to 226th position), German *Universität Ulm* (from 376th to 228th), Italian *Scuola Normale Superiore–Pisa* (from 535th to 229th), Spanish *Complutense University of Madrid* (from 344th to 232nd) or Danish *Aalborg University* (from 385th to 240th).

On the contrary, in the case of North America there were higher education institutions that lost their positions at TOP 250 level between 2012 and 2018—for example *Boston College* (from 250th to 312th position), *University of Georgia* (from 217th to 314th), *University of Delaware* (from 212th to 281st) or *Stony Brook University* (from 191st to 287th).

In order to be able to compare correctly the development of higher education systems in time at level of institutions included in the Cross Ranking, it has been necessary to define the same number of institutions that would be considered in each year of comparison, as the number of institutions published in the ARWU, QS and THE rankings increased during the period (that is from 2012 to 2018). As in 2012 only 821 HEIs were included in all three rankings (and thus would enable a correct comparison), we have had to take this number into account (the year 2018 was an exception, as institutions at 815–822th position had the same score, and thus it has not been possible to leave out any institution—see the table below).

The analysis at TOP 821 level, both in terms of the number of institutions and of the total score achieved in all years considered (2012, 2016, and 2018), confirms growing numbers and at the same time improved positions of HEIs in Europe, Asia and Oceania, especially at the expense of HEIs in North America (at TOP 821 level there were 213 HEIs in 2012, 201 in 2016 and only 200 in 2018) but also in Latin America (38 HEIs in the CR TOP 821 in 2012, 25 in 2016 and even only 22 in 2018).

As in the case of the CR TOP 250, Europe dominated also at TOP 821 level (322 HEIs in 2012, 347 in 2016, and 336 in 2018). However, also Oceania improved its position (increasing the number of HEIs from 34 in 2012 to a maximum 43 in 2016, and slightly reducing it to 41 in 2018) as well as Asia (from 204 HEIs in 2012 to a maximum 212 in 2018). On the other hand, the position of Africa (only 10 HEIs in the TOP 821 in 2012 and 11 HEIs in 2016 and 2018) seemed to be permanently weak.

And which particular countries were behind the weakening or strengthening positions of individual world regions at TOP 821 level? In North America, it was in contrast to the CR TOP 250 mainly the USA (178 HEIs in 2012, 172 HEIs in 2016, and only 168 HEIs in 2018), while Canada improved its position in terms of number of HEIs (24 in 2012, 27 in 2016, and 28 in 2018) although not in terms of their total score (which decreased from

rank 2018 by		Cross Ranking 2012, 2016, 2018 TOP 821 HEIs World Regions	2012			2016			2018		
total score	total score per capita		number of HEIs	total score (%)	total score per capita	number of HEIs	total score (%)	total score per capita	number of HEIs	total score (%)	total score per capita
		World	821	100.0%	2.3	821	100.0%	2.5	822	100.0%	2.7
1	5	Europe	322	40.8%	8.8	347	41.7%	10.3	336	40.8%	10.9
2	4	of which: EU 28	288	37.0%	11.7	317	38.1%	13.7	309	37.4%	14.5
3	2	of which: EU 15	266	36.0%	14.4	291	36.6%	16.7	285	35.6%	17.5
4	3	Northern America	213	34.9%	16.3	201	30.1%	15.7	200	28.6%	15.9
7	7	Latin America	38	1.8%	0.5	25	1.9%	0.6	22	1.9%	0.6
5	6	Asia	204	16.6%	0.6	194	19.6%	0.8	212	22.1%	1.0
8	8	Africa	10	0.8%	0.1	11	0.9%	0.1	11	0.9%	0.2
6	1	Oceania	34	5.1%	22.6	43	5.8%	27.3	41	5.7%	28.4

4.2% to 3.6%). In Latin America, the weakening of its position was particularly affected by Mexico (decreased from 10 HEIs in 2012 to 2 HEIs in 2018), Chile and Argentina (both decreased from 7 HEIs to 3 HEIs), and Colombia (decreased from 5 HEIs to 3 HEIs).

Main contributors to increasing the number of HEIs in Asia were particularly China (32 HEIs in the CR TOP 821 in 2012, 44 HEIs in 2016, and even 61 HEIs in 2018) and South Korea (21 HEIs in 2012 and 25 in 2018). The position of Europe in terms of the number of HEIs in the TOP 821 was strengthened particularly thanks to the contribution of 4 countries—when comparing 2012 and 2018, countries with most growing number of HEIs were Italy (increase by 12 HEIs), Germany (increase by 8 HEIs), Spain (increase by 7 HEIs) and the United Kingdom (increase by 6 HEIs).

We have found that the US were also dominating at TOP 821 level both in terms of the number of institutions included and in terms of their total score achieved, and in all three years under review (2012, 2016, and 2018) although its position was gradually weakening (the number of US HEIs in the TOP 821 dropped from 178 to 168 between 2012 and 2018, but the share of US total score dropped even more, from 30.2% to 24.7%). The second place belonged to the United Kingdom and the third to Germany, however in 2018 only by its total score, while China overtook Germany by the number of ranked institutions.

In addition to the rapidly growing China (which increased the number of institutions at TOP 821 level from 32 HEIs to 61 HEIs between 2012 and 2018), also other countries improved their position significantly during the period under review: Germany (an increase from 42 HEIs to 50 HEIs), Italy (from 28 HEIs to 40 HEIs), and Spain (from 20 HEIs to 27 HEIs) but also Iran (from 2 HEIs to 9 HEIs)!

On the other hand, there were countries whose position weakened significantly. In addition to the US (whose number of institutions at TOP 821 level decreased from 178 HEIs to 168 HEIs between 2012 and 2018) this is true for France (decrease from 39 HEIs to 27 HEIs), Mexico (from 10 HEIs to 4 HEIs), Thailand (from 8 HEIs to 3 HEIs), Indonesia (from 8 HEIs to 3 HEIs), and Kazakhstan (from 7 HEIs to 2 HEIs).

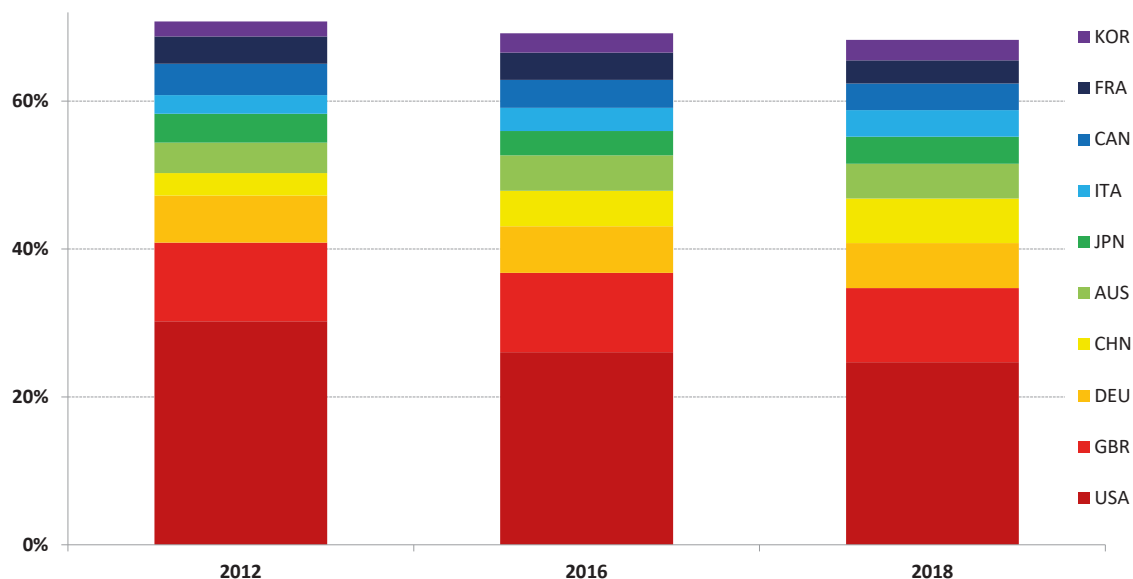
Approximately the same can be confirmed by analysing the development of the share of individual countries in the total score at TOP 821 level. The figure on the next page shows the share in the total score for the first 10 countries in 2012, 2016, and 2018. Together they have about 70% of the total score but their share was gradually decreasing. However, it is mainly due to the US whose share decreased from more than 30% in 2012 to less than 25% in 2018. By contrast, most remaining countries slightly increased their share with the exception of Canada and France visibly declining over the past six years.

On the other hand, China doubled its share in the total score between 2012 and 2018 and improved its position from 9th to 4th place. China is not only more or less on a par with Germany on third place but also approaching the United Kingdom on second place. In addition to the dynamic growth of China, other countries that also increased their share in the total score are the Republic of Korea and somewhat surprisingly also Italy and Australia.

There is one more interesting fact about the development between 2012 and 2018. We have already mentioned that the number of US HEIs at TOP 821 level decreased from 178 to 168 that is by slightly over 5%. (More precisely, 31 US HEIs dropped out of the CR TOP 821, while 21 new ones got into the CR TOP 821 level between 2012 and 2018.) Why, at the same time, did the US share in the total score fell by almost a

TOP 10 countries in Cross Ranking 2012–2018

Share in the total score at TOP 821 level



Note: Countries are ranked by their total score in 2018.

Source: EPC CU, ARWU, QS, THE

fifth even though US HEIs that dropped out of the CR TOP 821 were among those ranked worse? It could be assumed that the average score for those US HEIs that remained in the Cross Ranking would increase. But that did not happen! Although the average score of all HEIs in the CR TOP 821 increased from 19.3 to 24.1 (by 24%) over the six years between 2012 and 2018, the average US HEI score only increased from 26.9 to 29.0 (by 8%). However, this means that the US HEIs remaining in the CR lost their average position and thus also a significant share in the total score. The decomposition of the decrease of the US share in the total score at TOP 821 level by 5.5% has even shown that the decrease is largely due to the loss of position of the HEIs that remained in the CR, and only in a very small proportion due to their reduction by 10 HEIs.

On the other hand, the number of Chinese HEIs in the CR TOP 821 increased from 32 to 61 in the same period, which is almost twice the original number.

According to a similar assumption, this should lead to a decrease in the average overall score of all Chinese HEIs in the CR TOP 821. However, their average overall score increased from 15.0 to 19.5 (by 30%) between 2012 and 2018. Although it remained rather low (below the CR TOP 821 average), its increase over the last six years shows that, in addition to a significant increase in the number of Chinese HEIs at TOP 821 level, their positions and thus their scores have improved significantly. The share of Chinese TOP 821 HEIs in the total score increased by 3% between 2012–2018 (from 3.03% to 6.04%). The decomposition of this increase shows, firstly, that China earned less than 1% due to an increase in the number of its HEIs in the CR TOP 821 from 32 to 61 but, secondly, more than 2% due to a significant improvement in the ranking and score attained by the HEIs already included in the CR TOP 821.

However, the number, rank and average overall score of HEIs of each country included in the Cross Ranking also highlights other essential characteristics

of their higher education systems that we have not discussed yet. In all years under review 2012–2018 the highest average overall score was achieved by HEIs of the Netherlands, followed by those of Switzerland, Hong Kong, Singapore, Denmark, Belgium, and Sweden, that is of rather smaller countries (the largest one has less than 17 million inhabitants), but at the same time—in terms of international rankings results—of countries with successful higher education systems (mainly according to the relative indicator, the total score per million of inhabitants).

So far, we have only analyzed the numbers of HEIs or the total score (i.e. the sum of overall scores of all HEIs within a country), regardless of the considerably different size of countries. Taking into account the size of the population, then the most successful country according to the total score achieved per million inhabitants was Switzerland, consistently in all three years considered. However, this might change soon because New Zealand (always second) got very close behind Switzerland in 2018. Finland was third in 2018 (7th place in 2012), Australia fourth (6th place in 2012), and Ireland fifth (4th place in 2012). Sweden which was third in 2012 only ranked 6th in 2018.

rank 2018 by		Cross Ranking 2012, 2016, 2018 (TOP 821 HEIs) TOP 50 countries in 2018	2012			2016			2018		
total score	total score per capita		number of HEIs	total score (%)	total score per capita	number of HEIs	total score (%)	total score per capita	number of HEIs	total score (%)	total score per capita
1	18	United States	178	30.2%	15.7	172	26.0%	15.1	168	24.7%	15.2
2	9	United Kingdom	61	10.6%	26.9	76	10.7%	30.3	67	10.0%	30.3
3	19	Germany	42	6.4%	12.5	47	6.3%	14.2	50	6.1%	14.7
4	56	China	32	3.0%	0.4	44	4.8%	0.6	61	6.0%	0.9
5	4	Australia	27	4.1%	30.1	35	4.8%	37.9	33	4.7%	38.9
6	32	Japan	36	3.9%	4.8	27	3.3%	4.7	33	3.6%	5.6
7	21	Italy	28	2.5%	6.7	38	3.2%	9.6	40	3.6%	12.0
8	16	Canada	24	4.2%	19.9	27	3.8%	19.6	28	3.6%	19.7
9	27	France	39	3.7%	9.3	33	3.7%	10.5	27	3.1%	9.6
10	25	South Korea	21	2.0%	6.5	26	2.6%	9.4	25	2.8%	10.8
11	26	Spain	20	1.6%	5.6	19	1.9%	7.4	27	2.5%	10.6
12	10	Netherlands	13	3.0%	29.0	13	2.7%	29.1	13	2.5%	29.0
13	1	Switzerland	9	2.1%	42.5	10	2.0%	44.8	10	1.9%	44.9
14	6	Sweden	11	2.0%	34.8	11	1.9%	35.1	11	1.7%	34.4
15	43	Russian Federation	16	0.7%	0.8	19	1.4%	1.8	16	1.5%	2.1
16	23	Taiwan	15	1.4%	9.9	16	1.4%	11.1	14	1.4%	11.6
17	13	Belgium	7	1.5%	21.5	8	1.4%	22.5	7	1.2%	21.1
18	8	Hong Kong	6	1.2%	28.1	6	1.2%	30.0	6	1.1%	31.1
19	3	Finland	8	1.0%	30.1	9	1.1%	37.7	9	1.1%	39.3
20	62	India	12	0.7%	0.1	11	0.9%	0.1	11	1.1%	0.2
21	55	Brazil	12	0.8%	0.7	8	0.8%	0.8	12	1.0%	1.0
22	2	New Zealand	7	1.0%	36.9	8	0.9%	38.0	8	1.0%	43.1
23	7	Denmark	5	1.1%	30.2	7	1.1%	35.3	6	1.0%	34.3
24	15	Austria	10	1.0%	18.5	7	0.7%	15.5	8	0.9%	20.5
25	14	Israel	6	0.9%	20.5	7	0.9%	20.4	7	0.8%	20.8
26	5	Ireland	8	0.9%	31.1	9	0.9%	33.2	8	0.8%	35.5
27	12	Norway	4	0.8%	25.0	5	0.7%	25.4	5	0.7%	25.7
28	42	South Africa	5	0.6%	1.9	7	0.7%	2.3	6	0.6%	2.3
29	22	Portugal	8	0.4%	6.3	6	0.6%	10.5	6	0.6%	11.7
30	36	Malaysia	7	0.4%	2.1	6	0.5%	3.2	6	0.6%	3.9
31	46	Iran	2	0.1%	0.3	4	0.3%	0.7	9	0.6%	1.5
32	47	Turkey	9	0.6%	1.2	9	0.6%	1.3	8	0.6%	1.5
33	17	Singapore	2	0.6%	17.6	3	0.6%	20.6	2	0.6%	19.7
34	38	Saudi Arabia	7	0.5%	3.0	4	0.5%	3.2	3	0.4%	2.8
35	45	Poland	4	0.3%	1.2	3	0.3%	1.3	5	0.4%	1.9
36	30	Greece	6	0.3%	4.0	7	0.4%	6.9	5	0.4%	6.6
37	58	Mexico	10	0.4%	0.5	2	0.3%	0.4	4	0.4%	0.6
38	31	Czech Republic	4	0.2%	3.4	5	0.3%	5.8	4	0.4%	6.6
39	29	Hungary	4	0.2%	2.7	7	0.3%	5.5	5	0.3%	6.7
40	37	Chile	7	0.3%	2.9	7	0.5%	4.9	3	0.3%	3.5
41	57	Thailand	8	0.3%	0.7	4	0.2%	0.7	3	0.3%	0.7
42	59	Egypt	5	0.2%	0.3	2	0.1%	0.3	4	0.2%	0.5
43	52	Argentina	7	0.3%	1.3	4	0.3%	1.2	3	0.2%	1.1
44	54	Colombia	5	0.2%	0.8	5	0.3%	1.1	3	0.2%	1.0
45	35	United Arab Emirates	3	0.1%	2.3	3	0.2%	4.2	3	0.2%	5.1
46	63	Indonesia	8	0.2%	0.1	2	0.1%	0.1	3	0.2%	0.1
47	11	Estonia	1	0.1%	9.4	2	0.2%	24.7	2	0.2%	26.4
48	33	Lebanon	2	0.1%	3.3	1	0.1%	3.2	2	0.2%	5.6
49	20	Slovenia	1	0.1%	4.5	2	0.1%	10.8	2	0.1%	12.9
50	49	Kazakhstan	7	0.2%	1.7	3	0.1%	1.4	2	0.1%	1.5
52	53	Romania	4	0.1%	0.5	1	0.0%	0.3	2	0.1%	1.0
54	34	Lithuania	3	0.1%	2.9	1	0.1%	3.5	1	0.1%	5.3
58	48	Serbia	1	0.1%	0.9	1	0.1%	1.5	1	0.1%	1.5
60	24	Cyprus	0	0.0%	0.0	2	0.1%	14.5	1	0.1%	11.0
61	39	Croatia	1	0.1%	2.1	1	0.1%	3.0	1	0.1%	2.7
65	51	Belarus	1	0.0%	0.5	1	0.1%	1.2	1	0.1%	1.2
66	44	Slovakia	0	0.0%	0.0	1	0.0%	1.4	1	0.1%	2.0
68	61	Ukraine	2	0.0%	0.1	3	0.2%	0.6	1	0.0%	0.2
75	72	Latvia	0	0.0%	0.0	1	0.0%	3.3	0	0.0%	0.0

Note: Countries are ranked by the sum of overall scores of the 821 most successful HEIs in 2018. Other European countries are also included.

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