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Study of the multidimensional academic ranking “U-Multirank”

Antonio Prado

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Estudo do ranking acadêmico multidimensional "U-Multirank"

ANTONIO FERNANDO BERTACHINI DE ALMEIDA PRADO
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS-INPE
Av dos Astronautas 1758 – São José dos Campos-SP12227 – 010 - Brazil
E-mail: antonio.prado@inpe.br
ORCID: 0000-0002-7966-3231

Abstract
The present paper studies the Dimensions and Indicators of the academic international multidimensional ranking "U-Multirank". The study of this ranking is important in Brazil nowadays, because the new evaluation of the graduate programmes in Brazil is using many aspects of multidimensional evaluation, including some concepts used by the U-Multirank. This ranking shows the weaknesses and strengths of each Academic Institution, using five Dimensions that are composed by 36 Indicators. This large number of Dimensions and Indicators gives a more complete view of the Universities, but raise questions about their independence and data availability. The top 300 European Academic Institutions listed in the 2020 edition are analyzed, explaining the Dimensions and Indicators and making statistical correlations between them.

Keywords: Multidimensional academic evaluations, Evaluation of the education system, Education, International evaluation, University management.

Resumo
O presente artigo estuda as Dimensões e Indicadores do ranking acadêmico internacional multidimensional "U-Multirank". O estudo desse ranking é importante no Brasil na atualidade, pois a nova avaliação dos programas de pós-graduação brasileiros usa conceitos de avaliação multidimensional, incluindo alguns princípios usados no U-multirank. Esse ranking mostra os pontos fracos e fortes de cada Instituição Acadêmica por meio de cinco Dimensões, que são compostas por 36 Indicadores. Este grande número de Dimensões e Indicadores gera uma visão mais completa das Universidades, mas levanta questões sobre sua independência e disponibilidade de dados. São analisadas as 300 melhores instituições acadêmicas europeias listadas na edição de 2020, explicando as dimensões e indicadores e fazendo correlações estatísticas entre esses indicadores e dimensões.

Palavras-Chave: Avaliação acadêmica multidimensional**,** Avaliação do sistema educativo, Educação, Avaliação internacional, Gestão universitária.

Introduction

Academic evaluation is a problem that has been considered for a long time in education. In Brazil, evaluations have been made for a long time in higher education (GUIMARÃES and ESTEVES, 2018). Regarding graduate programmes, the "Coordenação de Aperfeiçoamente de Pessoal de Nível Superior" (CAPES) evaluates these Programmes for several decades now (RODRIGUES et al., 2020). At this moment, there is a strong modification in the criterions under study, using concepts of the multidimensional approach.

In terms of international academic evaluations, there are several famous rankings available (CALDERÓN, FRANÇA and GONÇALVES, 2017; CALDERÓN and FRANÇA, 2018; DILL and SOO, 2005; ECCLES, 2002; GANGA-CONTRERAS et. al., 2020). They started to appear in the beginning of the 21st century and gained popularity every year. Today they are considered to be important for almost all Academic Institutions in the world. It is an official "seal of quality" for those Institutions that get good positions in those rankings, which increases their capacity to "sell their products" in the hot market of global education. Academic rankings can even be considered as a field of research, when looking at the large number of publications available (BILLAUT, BOUYSSOU and VINKE, 2010; CALDERÓN and FRANÇA, 2018; GONÇALVES and CALDERÓN, 2017; HERTING, 2016; LIU and CHENG, 2005; MARGINSON and VAN DER WENDE, 2007; BERNHARD (2012), SHIN et al. (2011), SORZ et. al., 2015; STACK, 2016; VAN RAAN, 2005; WEBSTER, 2001; AGUILLO et. al., 2010; AGUILLO et. al., 2006; THÉRY, 2020).

A multidimensional evaluation in academic institutions, as considered by CAPES nowadays, is not a new idea. This concept appeared in Europe in 2008 and a multidimensional ranking was proposed (VAN VUGHT and ZIEGELE, 2012). Aspects related to which Dimensions and Indicators must be used are very important, as well as to take a first look at the level of independence of those Dimensions and Indicators. The current evaluation made by CAPES is focused on the Dimension "Research" of the "U-Multirank", so it is interesting to see the correlations of this Dimension with other dimensions, to have at least a rough estimate about what may happen in a multidimensional evaluation when made in Brazil.

The idea behind the creation of the "U-Multirank" was that there is no "best", "top 10", or any other general classification of academic institutions in the world. The "best" university is a personal choice of each student, and it depends on the goals and constraints of the prospective students. Following this concept, a multidimensional ranking should only define the main criterions (the Dimensions) and how to evaluate those criterions (the

Indicators and the rules to calculate them). The academic institutions are divided into five groups of quality for each Indicator, according to the specified rules. A classification is made only in each Indicator, without a unique ranking, and the users of the ranking can look at the Indicators that are more important for them.

The "U-Multirank" (https://www.umultirank.org/; PRADO 2021a and 2021b) was created based on this idea. It evaluates the performance of educational institutions in five Dimensions: (1) Teaching and Learning, (2) Research, (3) Knowledge Transfer, (4) International Orientation and (5) Regional Engagement. Each of these Dimensions is divided into a large number of Indicators, going from four to eleven, depending on the Dimension. It is focused in future students who want to see an international classification of higher education institutions to choose the one that most closely matches their interests. The user can evaluate each Indicator, separately or grouped in families, focusing in the most important ones for a given decision to be made.

Since the “U-Multirank” has a much larger number of Indicators (36), when compared to one-dimensional rankings, which usually have less than 15 Indicators, it is expected that a lack of data may be a potential problem, which could be a negative point of this ranking. Of course this is not as important as it is for one-dimensional rankings, since a general classification is not made, and the user can just neglect the missing information and concentrate in the available data, loosing part of the information, but not the whole ranking. But the amount of missing data is not negligible in many situations and the present paper will look at this point later.

Another main point studied in the present paper is to verify if Institutions are usually focused on some of the Dimensions and Indicators, or if they have a homogeneous behavior in all the Dimensions. This study will be made for the 300 “best performers” in Europe, because the institutions with general better performances have more complete sets of data, in particular in Europe, which minimizes the problems generated by missing data.

To make this study, the first step is to define the meaning of “best performers” in the “U-Multirank”. This is not an easy question. This ranking was created with the goal of avoiding a general classification, as explained before. The Dimensions have different numbers of Indicators and many Indicators have missing data. When asked for a general classification of Academic Institutions, or when looking at the “best performers” in a given country (https://www.umultirank.org/university-rankings/top-performing-universities/2020/), the “U-

Multirank" makes this classification based in the number of grades "A" (the maximum grade) that an Institution receives. Other grades are used only when there are ties among two or more Institutions. This is a questionable rule, because it gives little difference between "B", "E" or data not reported. The present paper considers two other options to make a general ranking. The first one makes the single average of all the 36 Indicators measured by the "U-Multirank". It has the advantage of considering all the data available, so recognizing the efforts of the Institutions in reporting data to increase their scores, even if they do not reach an "A". The disadvantage of this proposal is that the Dimensions have different number of Indicators, varying from four to eleven, so Dimensions with a higher number of Indicators will have more weight in the final classification. To solve this problem we make a second proposal. We performed the average in each Dimension first, and then the average of the five grades given to the Dimensions. Although there is no perfect solution to build a general ranking using "U-Multirank", which sometimes is necessary and made by the "U-Multirank", the present paper decided to use this last option to select the "best" 300 performers in Europe in 2020, shown in Appendix 1, because it gives equal weight for each Dimension.

After making this list of Institutions, the correlations among all pairs of Indicators of the same Dimension are calculated and analyzed. In the same way, the correlations among the averages of each Dimension are made. The reason to do those correlations is to study how correlated are the Dimensions and Indicators, to understand the level of independence of the Indicators and Dimensions. Some of them are expected to have high correlations. As examples, we can mention the absolute number of publications, the normalized number of publications and the number of "top cited" publications. It is expected that institutions that have high numbers in one of these Indicators may have high numbers in all of them. It is important to see those correlations, because they give an indication if we are really measuring 5 Dimensions and 36 Indicators, or if some of them are just different forms to measure the same aspect under a different question.

Regarding Dimensions, the present paper looks for the statistical correlations among all Dimensions, to see if the Institutions have homogeneous performances in the different Dimensions or are more focused in some of them. For example, we will see if the best performers in "Teaching and Learning" are also the best performers in "Research", or any other Dimension. It is also interesting to see the correlations among Dimensions, because the traditional evaluation made by CAPES is focused in the Dimension "Research", so it is

interesting to see how this Dimension is usually related with others in multidimensional rankings.

A Brief History of international rankings

International rankings for academic evaluation emerged in the 2000s (CALDERÓN and FRANÇA, 2018), with the goal of identifying academic institutions that could be considered as "World Class Institutions". The first international academic ranking was the "Academic Ranking of World Universities (ARWU) (http://www.shanghairanking.com/ARWU2020.html), also known as the "Shanghai Ranking", created in 2003 by the University of Shanghai, in China (CALDERÓN and FRANÇA, 2018). This ranking was created to provide information for the Chinese government to select international educational institutions to send Chinese students abroad and also to verify the status of the Chinese Institutions in terms of international standards.

Inspired by this ranking, other international rankings emerged, such as the "Webometrics Ranking of World Universities" (http://www.webometrics.info/en; AGUILLO, ORTEGA and FERNANDEZ, 2008) in 2004 and the ranking "THE-QS", also in 2004, which would be separated into the "Times Higher Education World University Rankings", known as "THE" (https://www.timeshighereducation.com/world-university-rankings) and "QS World University Rankings", known as "QS" (https://www.topuniversities.com/university-rankings) in 2010. Following this success, many other countries created regional or national similar rankings, in particular because international rankings do not show results for smaller and local Academic Institutions in all regions of the globe (RIGHETTI, 2019; SHIN and TOUTKOUSHIAN, 2011).

The "U-Multirank"

The first idea of a multidimensional ranking appeared in a conference in 2008 (VAN VUGHT and ZIEGELE, 2012), under the French Presidency of the European Union. The necessity of a new methodology to measure the different Dimensions of quality in higher education institutions was observed. This idea generated the creation of the "U-Multirank", which lists now 1,759 universities from 92 countries, in the version 2020. It means about 5,000 faculties and more than 11,400 courses in 28 subject areas. (https://www.umultirank.org/about/u-multirank/frequently-asked-questions/).

As already mentioned, the “U-Multirank” was not designed to elaborate a general classification of Educational Institutions. The classifications are made only in each of the specific performance Indicators, grouped in Dimensions. Therefore, this ranking presents institutional performances showing the strengths and weaknesses of each one, in each Indicator and Dimension. Considering these points, each user can make their own ranking, selecting the Dimensions and Indicators that they considered to be more important for their needs. Another usual justification presented for the multidimensionality is that one-dimensional rankings are not robust, since small changes in the weights of the currently used Indicators significantly change the results, which greatly reduces the validity of these one-dimensional rankings.

In the “U-Multirank”, the institutions are classified into five performance groups for each Indicator: A (Very good), B (Good), C (Average), D (Below average) and E (Weak). This is done to reduce accuracy problems, since grouped institutions can filter small differences obtained from numbers below the accuracy of the measurements. Therefore, accuracy problems appear only in the border lines between the performance groups, which minimize the problem. A consequence of this grouping is the large number of Institutions having the same grades.

A closer look at the “U-Multirank” shows that the Indicators that are obtained from sources not related to the Institutions under evaluation, like the number of publications, citations, etc; are available for all educational institutions and have a high level of reliability. In the opposite side, information such as place of work of graduates and time of graduation, which are obtained from questionnaires sent by educational institutions and students, are not always available and do not have a high level of accuracy. Besides that, some data are classified as “Not-Applicable”, like the number and job location of graduates in the Master program in institutions where master programmes are not offered, etc.

Figure 1 shows the classical view that summarizes the results of the “U-Multirank” (https://www.umultirank.org/export/sites/default/press-media/media-center/universities/2020/country-reports/UK-Country-report-2020.pdf). The circle shows the five Dimensions of the rank: Teaching and Learning (green), Research (pink), Knowledge Transfer (blue), International Orientation (orange) and Regional Engagement (purple). Each of them is divided in the Indicators as follows. Teaching & Learning: 1- Bachelor graduation rate, 2- Masters graduation rate, 3 - Graduating on time (bachelors), 4 - Graduating on time

(masters). Research: 5 - External research income, 6 - Research publications (size-normalized), 7 - Art related output, 8 - Citation rate, 9 - Top cited publications, 10 - Interdisciplinary publications, 11 - Post-doc positions. Knowledge Transfer: 12 - Income from private sources, 13 - Co-publications with industrial partners, 14 - Patents awarded (size-normalized), 15 - Industry co-patents, 16 - Spin-offs, 17 - Publications cited in patents, 18 - Income from continuous professional development. International Orientation: 19 - Foreign language bachelor programmes, 20 - Foreign language master programmes, 21 - Student mobility, 22 - International academic staff, 23 - International doctorate degrees, 24 - International joint publications. Regional Engagement, 25 - Bachelor graduates working in the region, 26 - Student internships in the region, 27 - Regional joint publications, 28 - Income from regional sources, 29 - Master graduates working in the region. More details can be found in the Indicator book of "U-Multirank" (https://www.umultirank.org/export/sites/default/press-media/documents/Indicator-Book-2020.pdf), where all calculations for obtaining all Indicators are explained in detail.

Figure 1 – Classical graphical form to show the results of the "U-Multirank" (https://www.umultirank.org/export/sites/default/press-media/media-center/universities/2020/country-reports/UK-Country-report-2020.pdf).

When comparing with the tables generated by the site, we see that seven of the 36 Indicators showed in the tables are not showed in the graphical format: Research publications (absolute numbers), Strategic research partnerships, Professional publications, Open access publications, Patents awarded (absolute numbers), Graduate companies and Regional publications with Industrial partners.

Each of the bars representing the Indicators are divided in five parts and painted in dark color to represent the grade received in the Indicator. It means that a full dark bar represents an “A”, while a full light bar represents “No data available”.

Making a general classification using the “U-Multirank”

There are many ways to make a general classification using the “U-Multirank”. When asked for that, the “U-Multirank” uses a classification similar to the “Olympic Medals Table”, considering the best performers as the institutions that obtained the highest number of maximum scores (A). Scores B and below are only used for tiebreakers. This implies, for example, that an Institution that has 20 scores “A” and 16 scores “E” appears ahead of an institution that obtained 19 scores “A” and 17 scores “B”. This a questionable rule to make a general classification, which almost do not differentiate “B” from “E”. In an extreme situation, institutions may focus their activities on a smaller number of Indicators and neglect completely others to obtain a better classification, giving poor services to their students in some aspects.

The present paper proposes two other rules to make a general ranking that takes into account all the grades. The first one is the simple average of all the Indicators presented. It considers all the data available, but it gives the same weight to all the Indicators, not giving a proportional importance to all the Dimensions involved. The reason is that the number of Indicators varies from four to eleven, depending on the Dimension. Therefore, some Dimensions would have much more weight than others in the final grade.

To solve this problem, it is proposed another form to make a general evaluation, which first makes the averages inside each Dimension and, after that, the global average using the grades of each Dimension. It gives equal weight for each Dimension and different weights for the Indicators.

To give an idea of the effects of using the rules defined by the “U-Multirank”, Figure 2 shows the average of the Dimensions, in the vertical axis, as a function of the position of the Academic Institution as given by the “U-Multirank” in the horizontal axis. All the 1070 European Academic Institutions listed in the 2020 version are considered for this study. Of course there is a tendency of higher averages for the best performers, but the correlation is not strong, as clearly seen in Figure 2. Many Institutions with grades above 2.5 are among the last

300 hundred positions in the general ranking. It shows that the rules defined by the "U-Multirank" need to be considered with caution, and even be revised.

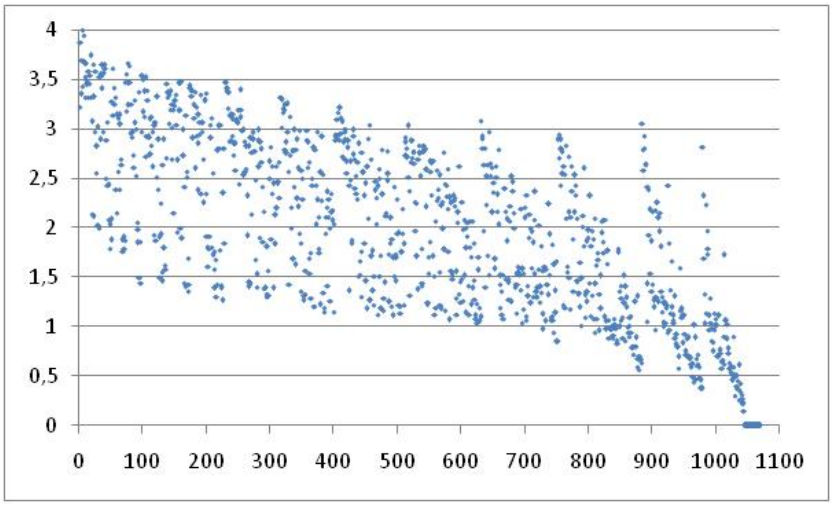


Figure 2 - Average of the Dimensions, in the vertical axis, as a function of the position of the Academic Institution as given by the "U-Multirank" in the horizontal axis.

To study deeper this point, Figure 3 shows the results of those three approaches for making general classifications. The horizontal axis shows the position in the ranking generated by the "U-Multirank", using only the numbers of "A". In the vertical axis we have the position of the Institution as given by the "U-Multirank" in blue dots; the position obtained from the average of Indicators, represented by red dots; and the position obtained from the average of Dimensions, showed in green dots. The 1070 European academic institutions listed in the 2020 version of the "U-Multirank" were also used here. European countries were used because they have more complete databases compared to countries from other continents.

It is clear that the differences in positions are very large. Statistical correlations were calculated for each pair of classifications and the results are: "U-Multirank" vs. average of the Indicators: 0.8035; "U-Multirank" vs. average of the Dimensions: 0.6179; average of the Indicators vs. average of the Dimensions: 0.8403. It means that using the averages of Indicators and Dimensions gives the best similarities in the results, while the use of the rules given by the "U-Multirank" gives less correlated results, in particular when comparing with the results obtained from the average of Dimensions. This proposal of using the average of

Dimensions looks to be the more reasonable to make a general classification, so it is used here to select the "best 300 performers" in Europe in 2020.

Of course the effects of missing or "Not Applicable" data are present in all the classifications. It does not count as an "A" in the classification made by the "U-Multirank", and it counts as zero for the classifications using the average of Indicators or the average of Dimensions. The effects will be stronger in the last two classifications, but the present paper considers that it is fair to give penalty to institutions who did not return data, which is the only reason for the missing data. The "Not Applicable" data occurs in a much smaller scale and is not responsible for modifications that are large enough to affect the conclusions of the statistical studies made here.

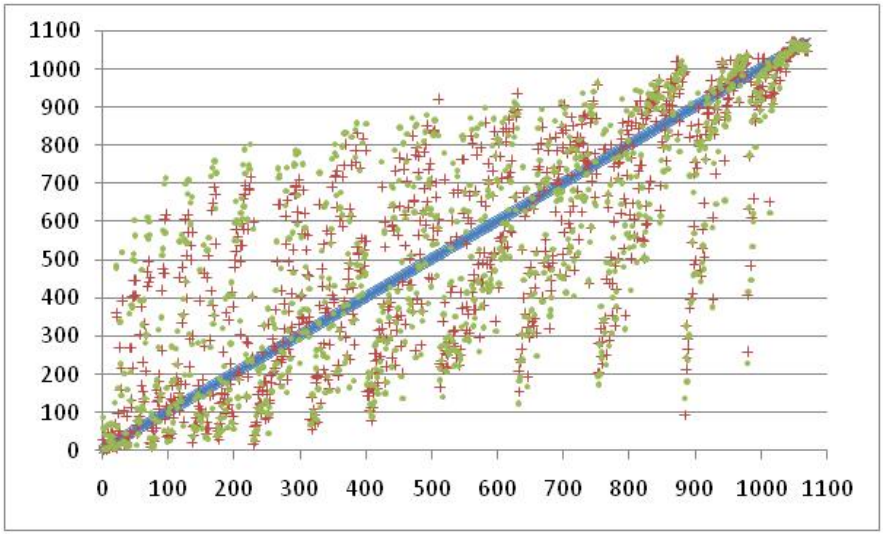


Figure 3 – Positions of the 1070 European Academic Institutions according to the "U-Multirank" (blue dots), average of Indicators (red dots) and average of Dimensions (green dots) as a function of positions given by the "U-Multirank".

To obtain the average of Dimensions, it is first necessary to make the average for each Dimension of the "U-Multirank". Then, it is interesting to see the distribution of those averages. To have a general first idea, we build Figure 4. The horizontal axis shows the average of the Dimensions for each Institution. In the vertical axis we have the average for Teaching and Learning (in blue diamonds), Research (in red squares), Knowledge Transfer (in green triangles), International orientation (in purple circles) and Regional Engagement (in

blue X). The 1070 European academic institutions listed in the 2020 version of the "U-Multirank" are also used here.

It is noticed a cloud of dispersed points with a tendency of a positive correlation, which means that the grades of the individual Dimensions tend to be higher for Institutions with higher average of Dimensions. This is an expected fact, of course, but Figure 4 shows these evolutions in more detail. It is clear the presence of vertical lines, which shows the interval of grades in each Dimension for a given average of the Dimensions. They have a large magnitude, near 2 units in most of the cases, which is half of the total interval showed, since the averages are in the interval from zero to 4.0.

These results show that the average of Dimensions varies very much for each Academic Institution, because they do not have homogeneous performances in all the Dimensions, even for the European countries. It indicates that making a general classification is really not a good idea, because it will hide a diverse performance and there are no reasons to consider one Dimension better than the others, at least in general.

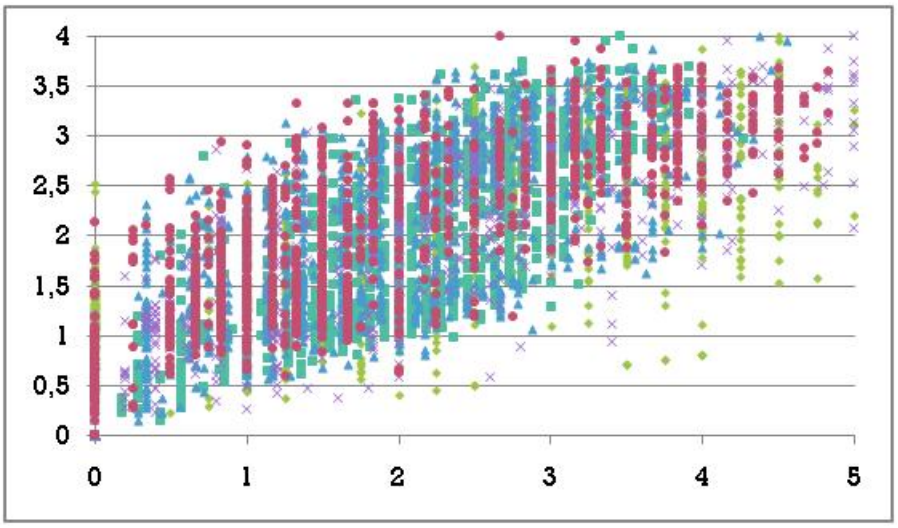


Figure 4 - Average for Teaching and Learning (blue diamonds), Research (red squares), Knowledge Transfer (green triangles), International orientation (purple circle) and Regional Engagement (blue circle) in the horizontal axis, as a function of the average of the Dimensions in the vertical axis for the 1070 European academic institutions listed in the 2020 version of the "U-Multirank".

Making a general classification using the "U-Multirank"

Next, we conduct a deeper study about the amount of missing and available data in the "U-Multirank", as well as about the origin of these data, in terms of coming from an open source or data informed by the Institutions. The goal is to get a better understanding of each Indicator, identifying the ones that are weaker or stronger measurements of the ranking, considering source and availability. We will use again the data available for the 300 best performers in European countries in the 2020 version of the ranking.

Table 1 shows all the Indicators used by the "U-Multirank", divided into the five Dimensions. It shows the description of each Indicator, the amount of data available, not available and data that "do not apply", as well as the source of the data, divided into two categories: "IQ", which means data obtained from questionnaires answered by the institutions; or "IND", which represents data available from independent sources, like the Web of Science.

Table 1 - "U-Multirank" Indicators for the 300 best performers in European countries in 2020: "IQ" indicates a questionnaire answered by the Academic Institution and "IND" indicates independent data.

	Data Available	**Missing Data**	**"Not Applicable"**	**Source**
Teaching & Learning	**1150 (95.83%)**	**50 (4.17%)**	**0 (0.00%)**	
Bachelor graduation rate	287	13	0	IQ
Masters graduation rate	278	22	0	IQ
Graduating on time (bachelors)	291	9	0	IQ
Graduating on time (masters)	294	6	0	IQ
Research	**2687 (81.42%)**	**511 (15.49%)**	**102 (3.09%)**	
Citation rate	275	0	25	IND
Research publications (absolute numbers)	300	0	0	IND
Research publications (size-normalized)	300	0	0	IND
External research income	299	1	0	IQ
Art related output	190	109	1	IQ
Top cited publications	275	0	25	IND
Interdisciplinary publications	275	0	25	IND
Post-doc positions	283	16	1	IQ

Strategic research partnerships	0	300	0	IQ
Professional publications	215	85	0	IQ
Open Access Publications	275	0	25	IND
Knowledge Transfer	**1713 (95.17%)**	**53 (2.94%)**	**34 (1.89%)**	
Co-publications with industrial partners	275	0	25	IND
Income from private sources	281	19	0	IQ
Patents awarded (absolute numbers)	298	2	0	IND
Patents awarded (size-normalized)	298	2	0	IND
Industry co-patents	91	5	204	IND
Spin-offs	256	44	0	IQ
Publications cited in patents	275	0	25	IND
Income from continuous professional development	266	34	0	IQ
Graduate companies	141	159	0	IQ
International Orientation	**1713 (95.17%)**	**53 (2.94%)**	**34 (1.89%)**	
Foreign language bachelor programmes	286	9	5	IQ
Foreign language master programmes	298	1	1	IQ
Student mobility	289	11	0	IQ
International academic staff	294	6	0	IQ
International joint publications	275	0	25	IND
International doctorate degrees	271	26	3	IQ
Regional Engagement	**1527 (84.83%)**	**223 (12.39%)**	**50 (2.78%)**	
Bachelor graduates working in the region	228	72	0	IQ
Master graduates working in the region	248	52	0	IQ
Student internships in the region	230	70	0	IQ
Regional joint publications	275	0	25	IND
Income from regional sources	271	29	0	IQ
Regional Publications with Industrial Partners	275	0	25	IND

Looking first at the global picture, for the 300 top European academic institutions performers listed in the 2020 ranking, we expect 10,800 grades, considering the existence of 36 Indicators. However, it is noted that we have only 9,258 data available, which corresponds to 85.72%. We also have 1102 missing data (10.20%) and 440 data (4.08%) that were

considered as “not applicable”. It means that we have about 15% blank data for this select group of Academic Institutions, which is not negligible.

It is also noted that the distribution of missing data is not uniform, making some Indicators more complete than others. From Table 1, it is possible to make Figure 5, which visually shows the number of data available per Indicator. A reading of this information shows a great imbalance between the Indicators, regarding data available.

The first observation is the existence of two Indicators that are very weak from this point of view, with less than 100 (33%) data available: “Strategic research partnerships”, with only missing data; and “Industry co-patents”, with 91 grades available, 5 missing and 204 “Not Applicable”. Since we have other 34 Indicators that are more complete, those two Indicators will be removed from the statiscal analyses from now on, to avoid the influence of large number of unavailable data.

For the remaining Indicators, we have one (“Graduate companies”) below 50% and above 33% of data available; one in the range 50%-66% (“Art related output”) and two in the range 66%-75% (“Professional Publications”, “Spin-Offs”). Therefore, there are 30 Indicators with more than 75% of data available, representing 83.33% of the Indicators.

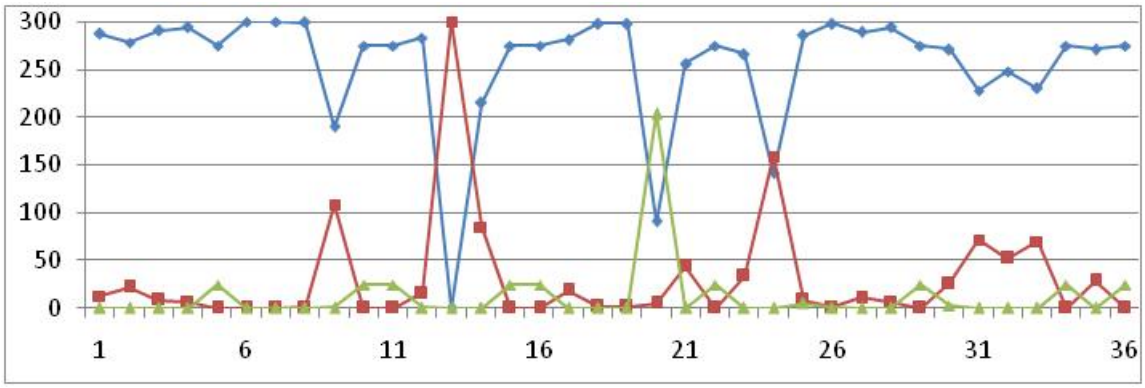


Figure 5 – Number of data available (blue), missing data (red) and “Not applicable data” (green) for the 36 Indicators measured in the “300 top performers” of the European Academic Institutions listed in the 2020 version of the “U-Multirank”.

Regarding Dimensions, we have 95.83% data available for “Teaching and Learning”, 81.42% for “Research”, 95.17% for “Knowledge Transfer”, 95.17% for “International Orientation”, and 84.83% for “Regional Engagement”. In that sense, “Teaching and Learning”, and “International Orientation” stand out as more reliable Dimensions, with

percentages above 95%, but the other Dimensions also have acceptable numbers, all of them above 80%.

Next, Table 2 shows the amount of data obtained from independent sources and data provided by the Academic Institutions. There are 22 Indicators obtained through questionnaires (61.11%) and 14 Indicators (38.89%) obtained from independent sources. This fact indicates a strong dependence of the results of this ranking with the data reported by the Academic Institutions. This means that a complete database is essential, and the applicability of the "U-Multirank" varies between geographic regions, since the lack of data varies greatly from country to country. Looking at each Dimension, we see that "Teaching and Learning" have no data coming from open sources, "Research" (54.55%) and "Knowledge Transfer" (55.56%) have a little more than half of their data obtained from open sources, while "International Orientation" has only 16.67% and "Regional Engagement" 33.33% of data collected from open sources. So, more efforts are recommended to motivate the Institutions to report their data in the most complete form possible.

Table 2 - Amount of data obtained from independent sources and questionnaires answered by the Institutions for each Dimension.

Dimension	Teaching and Learning	Research	Knowledge Transfer	International Orientation	Regional Engagement
IQ	4 (100%)	5 (45.45%)	4 (44.44%)	5 (83.33%)	4 (66.67%)
IND	0 (0.00%)	6 (54.55%)	5 (55.56%)	1 (16.67%)	2 (33.33%)

Looking deeper in the definitions of the Indicators, we see that they are very objective, with clear definitions and based on numbers with pre-defined rules (https://www.umultirank.org/export/sites/default/press-media/documents/Indicator-Book-2020.pdf). There are no results based in "reputation", where the international academic and industrial communities choose the best academic Institutions based on their experience and personal ideas, not based in numbers. In this aspect, there is a substantial difference of this ranking, when compared to one-dimensional rankings. As examples, the "Times Higher Education World University Rankings-THE" (https://www.timeshighereducation.com/world-university-rankings) has 33% of weight in the final classification for Indicators related to "Reputation" and the "QS World University Rankings-QS" (https://www.topuniversities.com/university-rankings) has even more, reaching 50%. This point is a strong aspect of the "U-Multirank". But, besides being very objective, 61.11% of

the data comes from the Institutions, and many of them still do not report data properly. This is a point of some concern and there is room for improvements here.

Analyzing the Correlations for all Indicators and Dimensions of the "top 300" European Academic Institutions of the "U-Multirank" in 2020

The next point to be studied here is the behavior of the statistical correlations for different Indicators and Dimensions of the "U-Multirank". This is a very important aspect, because high correlations among many Indicators would show that we are really not measuring 36 Indicators, since some of them would be redundant and we would be measuring similar aspects, just using different questions. This fact could be a strong point against the results of the "U-Multirank" and its multidimensional characteristics, which is the main new aspect of the ranking.

These measurements also help to predict the behaviors of the Institutions when evaluated by multidimensional rules and to understand better whether the institutions considered in the present paper have homogeneous or heterogeneous performances in different Dimensions.

The best "300 performers" in Europe in the 2020 edition of the "U-Multirank" were used for this study. The choice of this sample is not only made by the fact that they have more complete data set, as already explained, but they also have the advantage of belonging to the same continent, which can reduce effects coming from too different cultures and other particularities, leaving the main focus on the Indicators and Dimensions used by the ranking.

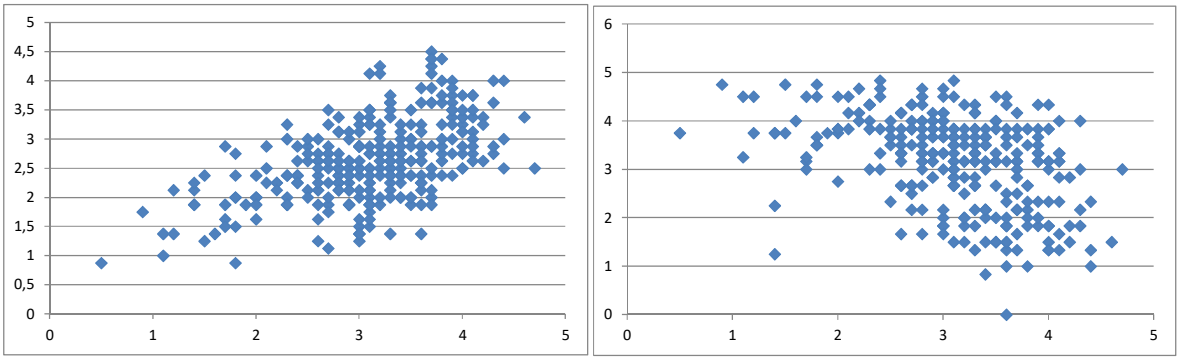
The most important statistical tool used for the analysis made here is the correlation coefficient, which is defined by:

$$Correl\,(X,Y) = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}} \quad (1)$$

In this equation X and Y are the values of the two variables under study and n is the number of pairs of data. The result is a number in the range -1 to 1. The value -1 stands for a 100% negative correlation, meaning that the variables are exactly linearly related and when one variable increases the other one decreases. The value 1 stands for a 100% positive correlation, meaning that the variables are exactly linearly related and when one variable increases the other one also increases. The value zero means that the variables are completely

independent, and they represent quantities that are totally not related. Intermediate values mean partially related variables, either positive or negative. For the present study we consider the following interpretations for those numbers: -0.19 to 0.19: very weak correlation; -0.20 to 0.39: weak correlation; -0.40 to 0.69: moderate correlation; -0.70 to 0.89: strong correlation; -0.90 to 1.00: very strong correlation. The first results are shown in Table 3. It shows the correlations among all the five Dimensions of the U-Multirank for the "Top-300 performers" in Europe in 2020.

First, it is observed that there are no "strong" and "very strong" correlations among the Dimensions and only two "moderate" correlations appear: a positive one between "Research" and "Knowledge Transfer" and a negative one between "Research" and "Regional Engagement". This is very good for the ranking; because it shows that we are very close of having really five independent Dimensions under study. To see those "moderate" correlations better, Figure 6 shows the distribution of grades for both of them: a) has the data for "Research" and "Knowledge Transfer" (Correlation of 0.5509) and b) has the data for "Research" and "Regional Engagement" (Correlation of -0.4175). They are typical plots of moderate positive and negative correlations.



(a) (b)

Figure 6 - Distribution of grades for: a) "Research" (horizontal axis) and "Knowledge Transfer" (vertical axis), with Correlation of 0.5509 and b) "Research" (horizontal axis) and "Regional Engagement" (vertical axis), with Correlation of -0.4175.

The real meaning of those "moderate" correlations is that the Institutions tends to have similar performances in "Research" and "Knowledge Transfer" and opposite performances in "Research" and "Regional Engagement".

Although the correlations are “weak”, the negative numbers with magnitude larger than 0.2500 for the pairs of Dimensions “Teaching and Learning” and “Research”; “Teaching and Learning” and “Knowledge Transfer”; “Knowledge Transfer” and “International Orientation” also call some attention, meaning that they have some level of opposite performances in each pair of Dimensions.

Table 3 - Correlations among the Dimensions of the U-Multirank for the “Top-300 performers” in Europe in 2020.

	Research	Knowledge Transfer	International Orientation	Regional Engagement
Teaching and Learning	-0.3745	-0.2940	-0.1507	0.2021
Research		0.5509	0.3613	-0.4175
Knowledge Transfer			0.3123	-0.2344
International Orientation				-0.3168

In the same way, the positive “weak” correlations with magnitude larger than 0.2500 for the pairs of Dimensions “Research” and “International Orientation”; “Knowledge Transfer” and “International Orientation” also call some attention, meaning that they have slight similar performances.

But, as a general conclusion, the Dimensions are not very correlated, which means that we are measuring different aspects of the Academic Institutions and that they do not have homogenous performances in all the Dimensions. They can be an outstanding performer in one Dimension and not so good in others.

This independence of Dimensions gives even more importance to a multidimensional ranking not designed to make general classifications of Academic Institutions. A general classification would make an average of Dimensions and Indicators that are not correlated, hiding the weaknesses and strengths of the Institutions.

Correlations among the Indicators of all Dimensions

The present paper now concentrates in the correlations among the Indicators of the same Dimension, for all the Dimensions measured by the "U-Multirank". The first one is "Teaching and Learning". The results are shown in Table 4.

Table 4 – Correlations for the Indicators in the Dimension "Teaching and Learning"

	Masters graduation rate	Graduating on time (bachelors)	Graduating on time (masters)
Bachelor Graduation Rate	0.0254	0.3118	0.0261
Masters graduation rate		-0.1179	-0.0721
Graduating on time (bachelors)			0.6496

Table 4 shows that there are no "strong" or "very strong" correlations among the Indicators, and only one "moderate" correlation, a positive one between "Graduating on time (bachelors)" and "Graduating on time (masters)". It means that Institutions that have their students graduating in the time expected do that for both levels, Master and Bachelor, with a moderate correlation among them. The other correlations are "weak", which means that the Dimension "Teaching and Learning" have only four Indicators, but they have a good level of independence, so they are adequate to measure this Dimension. As a summary, the average of the magnitudes of all Indicators of this Dimension is 0.2005, with a standard deviation of 0.2443. This is the lowest average of all the Dimensions. These results validate this Dimension for the group of Institutions studied here.

Next, it is considered the Dimension "Research". Table 5 shows the correlations for the Indicators for this Dimension.

The results show that there is only one "very strong" correlation, for the Indicators "Citation Rate" and "Top Cited Publications". They have a correlation index of 0.9402, indicating near perfect positive relation. It means that the Institutions that have more citations are also the ones who have the most cited publications. This fact is not surprising, but the high value of this index says that we are getting nearly the same ranking in both Indicators and those Indicators are redundant.

After that, the second highest correlation coefficient is between "Research publications (absolute numbers)" and "Research publications (size-normalized)", with a value of 0.6953, just in the limit for a "strong" correlation. It means that the rankings of total publications and publications by faculty member are similar, but not the same. I believe that the publications/faculty member is a better indicator, because it is not correct to compare those numbers for Institutions of different sizes, but the results are not so different.

Table 5 – Correlations for the Indicators in the Dimension "Research"

	Research publications (absolute numbers)	Research publications (size-normalized)	External research income	Art related output	Top Cited Publications	Interdisciplinary publications	Post-doc positions	Professional publications	Open Access Publications
Citation rate	0.5130	0.5188	0.4120	-0.3294	0.9402	0.4929	0.3998	-0.1824	0.5024
Research publications (absolute numbers)		0.6953	0.3725	-0.3515	0.4728	0.4104	0.3667	-0.2223	0.5975
Research publications (size-normalized)			0.4768	-0.3154	0.4866	0.3657	0.4500	-0.1602	0.4494
External research income				-0.1755	0.3776	0.2436	0.3343	0.0161	0.2179
Art related output					-0.2931	-0.0916	-0.1657	0.3823	-0.2368
Top Cited Publications						0.4391	0.3641	-0.1676	0.4458
Interdisciplinary publications							0.1648	-0.1228	0.5537
Post-doc positions								0.0567	0.2234
Professional publications									-0.2622

There are eleven more “moderate” correlations, as shown in Table 5. In general, the average of the magnitude of all Indicators of this Dimension is 0.3515 and the standard deviation is 0.1763. This is the highest average of all the Dimensions, but it is not high enough to consider the Indicators as redundant. Therefore, the results also validate this Dimension for the group of Institutions studied here.

Some interesting facts about the correlations are noted. The Indicator “External Research Income” has no “strong” or “very strong” correlation with any other Indicator. It means that, in general, those external income do not generate more publications, citations, art related products, etc. The same is true for “Pos-doc” positions, which do not affect those productions.

We focus now in the Dimension “Knowledge Transfer”. Table 6 shows the correlations for the Indicators for this Dimension.

The results show that there is no “very strong” correlation, but there are two “strong” correlations. The first one is among the Indicators “Patents awarded (absolute numbers)” and “Patents awarded (size-normalized)”. They have a correlation index of 0.8077. It means that the Institutions that are good at delivering new products have good grades in both Indicators. Those Indicators have a high degree of redundancy.

The second “strong” correlation is among the Indicators “Co-publications with industrial partners” and “Spin-offs”, which shows that industrial outputs are connected. They have a correlation index of 0.7197. Those Indicators also have a high degree of redundancy.

There are also four “moderate” correlations, as shown in Table 6. The average of the magnitude of all the Indicators of this Dimension is 0.2722 and the standard deviation is 0.1985, which also shows that this Dimension has a good group of Indicators, with only one redundancy out of seven Indicators, in the group of Institutions used here.

Table 6 – Correlations for the Indicators in the Dimension "Knowledge Transfer"

	Income from private sources	Patents awarded (absolute numbers)	Patents awarded (size-normalized)	Industry co-patents	Spin-offs	Income from continuous professional development	Graduate companies
Co-publications with industrial partners	0.2249	0.4883	0.4691	-0.0155	0.7197	-0.2425	-0.2946
Income from private sources		0.1440	0.2254	0.0656	0.1579	0.2563	-0.1031
Patents awarded (absolute numbers)			0.8077	0.1692	0.5578	-0.2382	-0.2779
Patents awarded (size-normalized)				0.2253	0.5110	-0.1874	-0.2030
Industry co-patents					0.0034	-0.1893	0.1707
Spin-offs						-0.2198	-0.3969
Income from continuous professional development							0.0566

We focus now in the Dimension "International Orientation". Table 7 shows the correlations for the Indicators for this Dimension.

The results show that there are no "very strong" or "strong" correlations among the Indicators of this Dimension. There are only two "moderate" correlations. Therefore, the Indicators of this Dimension are very independent from each other. The average of the magnitude of all the Indicators of this Dimension is 0.2451, and the standard deviation is 0.1278, so the results validate this Dimension for the group of Institutions studied here.

Table 7 – Correlations for the Indicators in the Dimension "International Orientation"

	Foreign language master programmes	Student mobility	International academic staff	International joint publications	International doctorate degrees
Foreign language bachelor programmes	0.4607	0.0519	0.0596	-0.1789	-0.0975
Foreign language master programmes		0.2201	0.4195	0.2102	0.2308
Student mobility			0.2891	0.1949	0.1818
International academic staff				0.3810	0.3138
International joint publications					0.3868

Next we analyze the Dimension "Regional Engagement", with the results available in Table 8. The results show that there is no "very strong" correlation, but there is a "strong" correlation among the Indicators of this Dimension. It happens for the Indicators "Bachelor graduates working in the region" and "Master graduates working in the region", with a correlation coefficient of 0.7668. It is not a surprising correlation, since those Indicators are similar. It means that Institutions that have a large number of students graduating and working in the region have this fact for both bachelors and master levels. Besides that, there is only one "moderate" correlation. Therefore, the Indicators of this Dimension are very independent from each other, except by one. The average of the magnitudes of all the Indicators of this Dimension is 0.2483 and the standard deviation is 0.2001. Therefore, the results validate this Dimension for the group of Institutions studied here.

Table 9 makes a summary of the averages and standard deviations of the magnitudes of the Indicators for each Dimension. It confirms that there are good levels of independence among the Indicators, with a maximum average correlation coefficient of 0.3515, which occur for the Dimension "Research", which is the highest correlation. It confirms that the Dimensions and Indicators selected by the "U-Multirank" make a good set to evaluate Academic Institutions, with not many cases of redundancy in the measurements.

Table 8 – Correlations for the Indicators in the Dimension "Regional Engagement"

	Master graduates working in the region	Student internships in the region	Regional joint publications	Income from regional sources	Regional Publications with Industrial Partners
Bachelor graduates working in the region	0.7668	0.3682	-0.1083	0.2238	-0.2295
Master graduates working in the region		0.3468	-0.0546	0.2437	-0.1699
Student internships in the region			-0.0685	0.2658	-0.2005
Regional joint publications				-0.0618	0.5596
Income from regional sources					-0.0565

Table 9 – Averages and standard deviations of the magnitudes of the Indicators for each Dimension.

Dimension	**Teaching and Learning**	**Research**	**Knowledge Transfer**	**International Orientation**	**Regional Engagement**
Average	0.2005	0.3515	0.2722	0.2451	0.2483
Standard Deviation	0.2443	0.1763	0.1985	0.1278	0.2001

Conclusions

The present paper made a study of the academic international multidimensional ranking "U-Multirank", which is a ranking that has five Dimensions and 36 Indicators. This ranking was studied by Capes during the preparation of the new evaluation of the Post-Graduate programmes in Brazil (CAPES, 2019). This fact justifies further studies of this ranking using data already available; to have an idea of what type of results it may give when applied in Brazil.

Sometimes the "U-Multirank" makes a list of "best performers" by country for a given year, which is not an easy task for multidimensional rankings. We showed that there are several ways to make such a general classification. The "U-Multirank" uses an "Olympic Medals Table" format, considering the best ones as the institutions that obtained the highest number of maximum scores. The present paper showed some problems generated by this rule and proposed two other forms to make this general ranking: the simple average of all the Indicators and the average of the Dimensions, which was considered better in the present paper, because it uses all the data available and gives the same weight to all the Dimensions. This point is important, since some types of classification will be required if multidimensional evaluation is used by Capes.

Missing data was also analyzed, and the paper showed that this is not a negligible problem in this ranking. For the "top 300 performers" in Europe in 2020, there are 10.20% missing data, but this number increases when considering other continents and Institutions that are not so good performers.

A look at the Indicators showed that they are very objective, with clear definitions and based on numbers with pre-defined rules. It is also visible the importance of reliable data coming from the Institutions, which is shown by the fact that there are 22 Indicators obtained from questionnaires (61.11%) and only 14 Indicators (38.89%) obtained from open sources.

A summary of the averages of the magnitudes of the Indicators for each Dimension confirms that there is a good level of independence among the majority of the Indicators, with a maximum average correlation coefficient of 0.3515, for the Dimension "Research", for the group of institutions used in the present paper.

Based on the "top 300 performers" in Europe in 2020, it is possible to say that the Dimensions and Indicators selected by the "U-Multirank" make a good set of elements to evaluate Academic Institutions, with not many cases of redundancy in the measurements. The multidimensional approach introduced by the "U-Multirank" is very important, because the majority of the Institutions do not have homogeneous performances in all the Dimensions, and general classifications would hide those strong differences.

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Appendix 1 - Top 300 performers in Europe in 2020				
Institution	**Country**	**Ranking based in U-Multirank**	**Rankig based in Indicators**	**Rankig based in Dimensions**
École Centrale de Nantes	FR	6	1	1
IMT Atlantique	FR	7	2	2
Jacobs University	DE	2	3	3
EDHEC Business School	FR	19	16	4
University of Antwerp	BE	4	4	5
Montpellier SupAgro	FR	8	6	6
Vilnius Gediminas Technical University	LT	76	8	7
Toulouse INP	FR	11	7	8
Universität Bern	CH	23	5	9
National Research Nuclear University MEPhI	RU	37	19	10
Moscow Institute of Physics and Technology	RU	40	34	11
Riga Technical University	LV	79	24	12
Frankfurt School of Finance & Management	DE	41	53	13
Grenoble École de Management	FR	53	46	14
Bocconi University	IT	26	52	15
Universitat Pompeu Fabra	ES	15	43	16
Sciences Po Paris	FR	39	35	17
Johannes Kepler University	AT	75	18	18
NOVA University Lisbon	PT	33	11	19
Hasselt University	BE	35	20	20
Chalmers University of Technology	SE	17	17	21
Universitat Ramon Llull	ES	99	47	22
Université de Mons	BE	32	12	23
University of Luxembourg	LU	10	13	24
Université de Technologie de Troyes	FR	104	32	25
Universitat de Barcelona	ES	100	36	26
Politecnico di Torino	IT	230	15	27
Kharkiv National University of Radioelectronics	UA	161	57	28
Vrije Universiteit Brussel	BE	12	14	29
Université de Bordeaux	FR	231	25	30
Libera Università di Bolzano	IT	80	31	31
Politecnico di Milano	IT	73	21	32
Universidade do Minho	PT	78	27	33
People’s Ukrainian Academy	UA	156	56	34
Rezekne Academy of Technologies	LV	159	45	35
University College Cork	IE	138	22	36
University of Zurich	CH	16	9	37
Aalto University	FI	13	26	38
Universidade de Coimbra	PT	174	37	39
EPFL Lausanne	CH	5	10	40

Universidad Carlos III de Madrid	ES	175	59	41
Université Paris-Dauphine	FR	55	66	42
University of Twente	NL	36	23	43
Universidad Autónoma Madrid	ES	233	61	44
Vorarlberg University of Applied Sciences	AT	253	99	45
Universidad de Deusto	ES	178	84	46
Université de Namur	BE	107	42	47
Aix-Marseille Université	FR	176	28	48
Norwegian University of Science and Technology	NO	232	38	49
University of Bergen	NO	102	41	50
Universitat Politècnica de Catalunya	ES	143	62	51
Instituto Politécnico de Bragança	PT	182	54	52
ESIC Business & Marketing School	ES	94	83	53
Universitat Rovira i Virgili	ES	235	67	54
University of Genoa	IT	140	39	55
MCI Management Center Innsbruck	AT	200	89	56
Télécom Paris	FR	3	29	57
Peoples' Friendship University of Russia	RU	152	90	58
Universidad de Navarra	ES	142	68	59
HSE University	RU	191	108	60
University of Florence	IT	177	50	61
Ghent University	BE	24	40	62
Pforzheim University	DE	123	74	63
Universitat Autònoma de Barcelona	ES	139	63	64
Delft University of Technology	NL	9	49	65
University of Groningen	NL	18	33	66
Universidad de Valencia	ES	317	81	67
Universidad del Pais Vasco	ES	316	82	68
Erasmus University Rotterdam	NL	14	48	69
FH Oberösterreich	AT	57	91	70
Kaunas University of Technology	LT	198	69	71
Università Luigi Vanvitelli	IT	318	55	72
ITMO University	RU	108	85	73
Altai State University	RU	87	109	74
Frederick University	CY	151	92	75
Sumy National Agrarian University	UA	197	100	76
BOKU Wien	AT	52	44	77
University of Debrecen	HU	327	76	78
IMT Mines Ales	FR	147	107	79
University of Liechtenstein	LI	56	77	80
University of Siegen	DE	82	60	81
University of Siena	IT	322	95	82
FAU Erlangen-Nürnberg	DE	77	51	83

Università del Salento	IT	180	70	84
Lobachevsky University	RU	150	101	85
ETH Zurich	CH	1	30	86
Universitat Internacional de Catalunya	ES	185	134	87
Budapest University of Technology and Economics	HU	410	78	88
University of Insubria	IT	321	79	89
University of Limerick	IE	234	73	90
Univerzitet u Kragujevcu	RS	148	93	91
Universität Klagenfurt	AT	158	75	92
Università di Torino	IT	144	64	93
Universidade do Algarve	PT	323	71	94
Lithuanian University of Health Sciences	LT	255	133	95
University of Stavanger	NO	252	86	96
Glasgow Caledonian University	UK	249	147	97
Universidade de Lisboa	PT	157	102	98
RWTH Aachen University	DE	74	58	99
Dublin City University	IE	101	105	100
University of Agder	NO	407	103	101
Universitat de Girona	ES	320	110	102
Universidad Miguel Hernández de Elche	ES	242	120	103
Audencia Business School	FR	59	170	104
University of Nantes	FR	188	96	105
Otto Beisheim School of Management	DE	64	135	106
Vytautas Magnus University	LT	238	123	107
North-Eastern Federal University	RU	168	148	108
Karlsruhe Institute of Technology	DE	54	65	109
University of Pavia	IT	236	111	110
Kühne Logistics University	DE	114	182	111
Oslo Metropolitan University	NO	331	125	112
LUISS Guido Carli University	IT	103	136	113
Latvia University of Life Sciences	LV	254	124	114
Taras Shevchenko University	UA	208	203	115
Vita-Salute San Raffaele University	IT	181	149	116
IMT Mines Albi	FR	61	155	117
University of Salerno	IT	241	97	118
Gdańsk University of Technology	PL	411	112	119
Norwegian School of Sport Sciences	NO	111	126	120
University of Rome Tor Vergata	IT	406	113	121
University of Camerino	IT	247	80	122
Universitat de Lleida	ES	632	156	123
AgroParisTech	FR	20	72	124
Universidad Pontificia Comillas	ES	248	183	125
Athlone Institute of Technology	IE	413	171	126

University of Information Technology and Management	PL	190	137	127
Tomsk Polytechnic University	RU	117	150	128
Mondragon University	ES	120	172	129
Télécom SudParis	FR	44	114	130
Sumy State University	UA	88	139	131
Riga Stradins University	LV	250	157	132
Universidade Fernando Pessoa	PT	194	173	133
TU Hamburg	DE	141	87	134
University of l'Aquila	IT	885	94	135
University of St.Gallen	CH	65	127	136
Petro Mohyla Black Sea National University	UA	456	200	137
Universidad CEU San Pablo	ES	206	195	138
Zaporozhye National Technical University	UA	222	191	139
University of Applied Sciences and Arts Western Switzerland	CH	153	184	140
Kazan Federal University	RU	517	212	141
National University Ostroh Academy	UA	219	138	142
Hanken School of Economics	FI	119	140	143
Handelshögskolan i Stockholm	SE	29	158	144
University of Modena and Reggio Emilia	IT	319	141	145
Cork Institute of Technology	IE	145	115	146
Hochschule Reutlingen	DE	89	151	147
University of West Bohemia	CZ	419	162	148
Universität Witten/Herdecke	DE	163	142	149
University of Latvia	LV	430	177	150
University of Architecture and Construction	AZ	339	192	151
Roskilde University	DK	281	185	152
Ulster University	UK	258	204	153
Varna University of Management	BG	346	161	154
Medical University of Warsaw	PL	256	176	155
Instituto Universitário de Lisboa	PT	257	198	156
Universitatea Tehnică "Gheorghe Asachi" din Iași	RO	358	196	157
TU Graz	AT	38	88	158
Università degli studi di Trieste	IT	193	121	159
Hanze University of Applied Sciences	NL	418	205	160
Sofia University St. Kliment Ohridski	BG	328	197	161
Eindhoven University of Technology	NL	25	98	162
Politecnico di Bari	IT	116	104	163
Technical University of Munich	DE	98	118	164
FHWien der WKW	AT	375	240	165
Adam Mickiewicz University Poznań	PL	645	193	166
Universidad Antonio de Nebrija	ES	273	231	167
Institut Supérieur de l'Aéronautique et de l'Espace	FR	84	128	168
University of Chemistry and Technology Prague	CZ	81	159	169

Arctic University of Norway	NO	412	152	170
University of Duisburg-Essen	DE	402	143	171
University of Bari	IT	408	164	172
Universidad de Málaga	ES	754	206	173
Aalborg University	DK	189	163	174
Universidad Politécnica de Madrid	ES	403	154	175
Universidade de Aveiro	PT	240	116	176
École Centrale de Lyon	FR	105	119	177
Turun yliopisto	FI	184	129	178
South Ural State University	RU	432	219	179
Poznan University of Technology	PL	888	211	180
University of Oslo	NO	109	130	181
Nizhny Novgorod State Pedagogical University	RU	382	277	182
Universidad de Granada	ES	633	208	183
University of Szeged	HU	512	166	184
LUT University	FI	110	117	185
University of Ljubljana	SI	83	132	186
Uniwersytet SWPS	PL	207	187	187
Universität Stuttgart	DE	179	122	188
Universidade Lusófona de Humanidades e Tecnologias	PT	270	174	189
Palacky University in Olomouc	CZ	405	144	190
Jagiellonian University in Krakow	PL	417	178	191
Universidad de Almería	ES	634	232	192
Igor Sikorsky Kyiv Polytechnic Institute	UA	454	272	193
Eötvös Loránd University	HU	342	186	194
Universitat Jaume I	ES	753	199	195
University of Nova Gorica	SI	125	175	196
Moscow Aviation Institute	RU	133	220	197
Warsaw University of Technology	PL	274	246	198
Universidad de Valladolid	ES	756	245	199
Vrije Universiteit Amsterdam	NL	34	106	200
Universidad Politécnica de Valencia	ES	239	165	201
Universidad de Santiago de Compostela	ES	409	201	202
University of Eastern Finland	FI	404	160	203
European University Cyprus	CY	357	209	204
University of Warsaw	PL	524	216	205
Wageningen University	NL	43	131	206
Universidad CEU Cardenal Herrera	ES	282	264	207
Universidad de Salamanca	ES	521	221	208
Kharkiv Polytechnic Institute	UA	423	248	209
Aurel Vlaicu University of Arad	RO	260	207	210
Oulun yliopisto	FI	237	146	211
Universidad Rey Juan Carlos	ES	359	223	212

Galway-Mayo Institute of Technology	IE	416	233	213
Saarland University	DE	325	179	214
University of Parma	IT	513	167	215
South-West State University	RU	285	247	216
University of Maribor	SI	245	180	217
Kherson State Agrarian University	UA	440	241	218
University of Hohenheim	DE	244	153	219
University of Konstanz	DE	186	145	220
Universitatea Transilvania	RO	542	222	221
Universidad de La Laguna	ES	535	273	222
Immanuel Kant Baltic Federal University	RU	765	249	223
Norwegian University of Life Sciences	NO	113	188	224
Medical University - Sofia	BG	263	214	225
Technical University of Denmark	DK	28	217	226
Daugavpils University	LV	266	236	227
Universidad de Murcia	ES	980	258	228
RANEPA Moscow	RU	301	309	229
Epoka University	AL	369	296	230
Universidad San Jorge	ES	422	298	231
Zhytomyr State Technological University	UA	228	242	232
Universidad Politécnica de Cartagena	ES	635	237	233
Escola Superior de Educação de Paula Frassinetti	PT	220	281	234
Universidad de Castilla - La Mancha	ES	889	265	235
Universidad de Alcalá	ES	515	235	236
Uniwersytet Łódzki	PL	638	266	237
Universitatea Politehnica Timisoara	RO	544	267	238
Tomas Bata University in Zlín	CZ	226	234	239
Lucian Blaga University of Sibiu	RO	286	310	240
Universidad de Sevilla	ES	758	228	241
Pyatigorsk State University	RU	476	263	242
BA School of Business and Finance	LV	341	371	243
Universidad de Zaragoza	ES	886	244	244
University of Malta	MT	371	251	245
WSB University	PL	660	306	246
University of Graz	AT	324	189	247
Medical University of Plovdiv	BG	336	282	248
Belgorod State University	RU	543	250	249
Hochschule Esslingen	DE	218	284	250
Universidad de Extremadura	ES	526	286	251
Simon Kuznets Kharkiv National University of Economics	UA	484	278	252
Universidade da Beira Interior	PT	335	213	253
Universidad Católica de Valencia San Vicente Mártir	ES	275	283	254
Saratov State University	RU	276	321	255

Universidad de Jaén	ES	759	285	256
Silesian University of Technology	PL	541	225	257
Belarusian State University	BY	573	297	258
FH Münster	DE	537	243	259
Aalen University of Applied Sciences	DE	525	252	260
Mendel University in Brno	CZ	272	238	261
University of Ferrara	IT	445	224	262
TU Ilmenau	DE	326	194	263
Corvinus University of Budapest	HU	534	311	264
AgroSup Dijon	FR	112	190	265
Hogeschool van Arnhem en Nijmegen	NL	431	289	266
Katholische Universität Eichstätt-Ingolstadt	DE	332	268	267
University of Milano Bicocca	IT	243	259	268
University of Bonn	DE	85	181	269
Institute of Technology Sligo	IE	164	288	270
Sapienza University of Rome	IT	514	229	271
Université Claude Bernard Lyon 1	FR	106	168	272
University of Crete	GR	414	253	273
University of Rijeka	HR	769	287	274
Masaryk University	CZ	516	218	275
University of Zagreb	HR	523	254	276
Universidad Complutense de Madrid	ES	755	280	277
Samara Polytech (Samara State Technical University)	RU	137	299	278
Semmelweis University	HU	415	255	279
University of Salzburg	AT	195	226	280
EURECOM	FR	66	210	281
University of Innsbruck	AT	146	169	282
Athens University of Economics and Business	GR	433	290	283
Volgograd State University	RU	459	331	284
Transport and Telecommunication Institute	LV	533	279	285
Wirtschaftsuniversität Wien	AT	154	274	286
Orel State University	RU	557	308	287
Carlo Bo University of Urbino	IT	420	239	288
Universidad Pública de Navarra	ES	551	301	289
Ivan Franko National University of Lviv	UA	299	332	290
University of Basilicata	IT	426	291	291
Uni of Medicine and Pharmacy Iasi	RO	287	322	292
University of Pécs	HU	522	261	293
Ulyanovsk State University	RU	362	323	294
Technical University of Varna	BG	438	300	295
O.M. Beketov National University of Urban Economy	UA	314	351	296
National University of Kharkiv	UA	555	356	297
Università degli studi di Palermo	IT	890	292	298

University of Calabria	IT	527	256	299
TH Nürnberg	DE	646	324	300

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