Universidade do Porto no U.S. News 2015 Best Global Universities rankings

http://www.usnews.com/education/best-global-universities

I. Metodologia do U.S. News Best Global Universities rankings e participação da U.Porto

"The overall Best Global Universities rankings encompass the top 500 institutions spread out across 49 countries. The first step in producing these rankings, which are powered by Thomson Reuters InCites™ research analytics solutions, involved creating a pool of 750 universities that was used to rank the top 500 schools.

To be included in the 750, an institution had to first be among the top 200 universities in the results of Thomson Reuters' global reputation survey […]. Next, an institution had to be among those that had published the most number of articles during the most recent five years, de-duplicated with the top 200 from the reputation survey.

[…]

The second step was to calculate the rankings using the 10 indicators and weights that U.S. News chose to measure global research performance. Each school's profile page on usnews.com lists numerical ranks, out of 750, for the 10 indicators, allowing students to compare each school's standing in each indicator.

The indicators and their weights in the ranking formula are listed in the table below, with related indicators grouped together; an explanation of each follows.

Ranking indicator	Weight
Global research reputation	12.5%
Regional research reputation	12.5%
Publications	12.5%
Normalized citation impact	10%
Total citations	10%
Number of highly cited papers	12.5%
Percentage of highly cited papers	10%
International collaboration	10%
Number of Ph.D.s awarded	5%
Number of Ph.D.s awarded per academic staff member	5%

Reputation Indicators

Results from Thomson Reuters' Academic Reputation Survey were used to create the two reputation indicators used in our ranking analysis.

The survey, which aimed to create a comprehensive snapshot of academics' opinions about world universities, had respondents give their views of the disciplinary programs with which they were familiar. This method allowed respondents to rate universities at the field and department level, rather than at the institution level, creating a more specific and accurate measurement of a university's reputation as a whole.

In order to appropriately represent all regions, Thomson Reuters took steps to overcome language bias, differing response rates and the geographic distribution of researchers. These steps included:

- Sending an invitation-only survey to academics selected from Thomson Reuters' databases of published research, based on the estimated geographic proportions of academics and researchers across the globe
- Providing accessibility in 10 languages
- Rebalancing the survey's final results based on the geographic distribution of researchers in order to overcome differing response rates

The results of the survey were used in two separate ranking indicators as follows.

Global research reputation (12.5 percent): This indicator reflects the aggregation of the most recent five years of results of the Academic Reputation Survey for the best universities globally for research.

Regional research reputation (12.5 percent): This indicator reflects the aggregation of the most recent five years of results of the Academic Reputation Survey for the best universities for research in the region; regions were determined based on the United Nations definition. This indicator had the effect of significantly increasing the international diversity of the rankings, since it focused on measuring academics' opinions of other universities within their region. This is the first time this indicator has been used in any global ranking.

Bibliometric Indicators

The bibliometric indicators used in our ranking analysis are based on data from the Web of Science™ for the five-year period from 2008 to 2012. The Web of Science™ is a Web-based research platform that covers more than 12,000 of the most influential and authoritative scholarly journals worldwide in the sciences, social sciences, and arts and humanities.

Publications (12.5 percent): This is a measure of the overall research productivity of a university, based on the total number of scholarly papers (reviews, articles and notes) that contain affiliations to a university and are published in high-quality, impactful journals. This indicator is closely linked to the size of the university. It is also influenced by the discipline focus of the university, as some disciplines, particularly medicine, publish more than others.

Normalized citation impact (10 percent): The total number of citations per paper represents the overall impact of the research of the university and is independent of the size or age of the university; the value is normalized to overcome differences in research area, the publication year of the paper and publication type.

NCI is considered one of the core measures of research performance and is used by various research evaluation bodies globally. The subject fields used in the analysis came from Thomson Reuters' InCites™ product, which helps institutions evaluate research output, performance and trends; understand the scope of an organization’s scholarly contributions; and articulate outcomes to inform research priorities. InCites utilizes the content and citation indicators found in the Web of Science™.

Total citations (10 percent): This indicator measures how influential the university has been on the global research community. It is determined by multiplying the publications ranking factor by the normalized citation impact factor. Total citations have been normalized to overcome differences in research area, publication year of the paper and publication type.

Number of highly cited papers (12.5 percent): This indicator reflects the number of papers that have been assigned as being in the top 10 percent of the most highly cited papers in the world for their respective fields. Each paper is given a percentile score that represents where it falls, in terms of citation rank, compared with similar papers (same publication year, subject and document type). As the number of highly cited papers is dependent on the size of the university, the indicator can be considered a robust indication of how much excellent research the university produces.

Percentage of highly cited papers (10 percent): This indicator is the percentage of a university's total papers that are in the top 10 percent of the most highly cited papers in the world (per field and publication year). It is a measure of the amount of excellent research produced by the university and is independent of the university's size.

International collaboration (10 percent): This indicator is the proportion of the institution's total papers that contain international co-authors divided by the proportion of internationally co-authored papers for the country that the university is in. It shows how international the research papers are compared with the country in which the institution is based. International collaborative papers are considered an indicator of quality, as only the best research will be able to attract international collaborators.

School-Level Indicators

Publicly available data sources were used to create the school-level indicators.

Number of Ph.D.s awarded (5 percent): This indicator reflects the total number of doctoral degrees awarded in 2012. The number of doctorates awarded can be considered an alternative indicator of research output and is linked to volume.

Number of Ph.D.s awarded per academic staff member (5 percent): This is the number of Ph.D.s awarded per the number of academic faculty members for the same year. This is a size-independent measure of the education environment at the university.

How the Overall Global Scores and Numerical Rankings Were Calculated

To arrive at a school's rank, the overall global scores were calculated using a combination of the weights and z-scores for each of the 10 indicators used in the rankings. In statistics, a z-score is a standardized score that indicates how many standard deviations a data point is from the mean of that variable. This transformation of the data is essential when combining diverse information into a single ranking because it allows for fair comparisons between the different types of data.

Several of the indicators were highly skewed, so the logs of the original values were used. The indicators that used logs were:

- Publications
- Total citations
- Number of highly cited papers
- Number of Ph.D.s awarded
- Global research reputation
- Regional research reputation

This log manipulation rescaled the data and allowed for a more normalized and uniform spread across each of the indicators. After these six indicators were normalized, the z-scores for each indicator were calculated in order to standardize the different types of data to a common scale.

In order to calculate a school's overall global score, the calculated z-scores for each of the 10 indicators were then weighted using the assigned weights described earlier. U.S. News determined the weights based on our judgment of the relative importance of the ranking factors and in consultation with bibliometric experts.

The overall global score for each school was calculated by summing the school's weighted values for each indicator. The minimum score from the pool of 750 schools was then subtracted from each of the scores in order to make zero the lowest possible score.

The scores were then rescaled by multiplying the ratio between the overall performance of each university and the highest-performing university by 100. This forced the scores to fall on a 0-100 scale, with the highest-performing school earning an overall global score of 100.

The top 500 universities out of the 750 were then numerically ranked in descending order from 1 to 500 based on their weighted, rescaled overall global score. Each school's overall global score was rounded to one decimal place in order to increase variance between scores and to minimize the occurrence of ties.

In addition, the 750 universities received a numerical rank for each of the 10 ranking indicators, such as publications, total citations and global academic reputation, based on their z-score for that indicator. The highest-scoring university for each of the 10 indicators received a rank of 1 and the lowest-scoring university received a rank of 750. Ties were allowed.

As noted earlier, the numerical ranks for each of the 10 indicators are published on usnews.com for each school ranked in the top 500. This means that there are some schools in the top 500 rankings that have ranking indicators with numerical ranks in the 501 to 750 range. The numerical ranks published for each ranking indicator are to be used to determine the relative position of each school in that indicator. The numerical indicator ranks were not used to calculate the overall global score.

Data Collection and Missing Data

The data and metrics used in the ranking were provided by Thomson Reuters InCites™ research analytics solutions. The bibliometric data were based upon the Web of Science™.

Publications are limited to those published between 2008 and 2012. However, the citations to those papers come from all publications up to the most recent data available. For the 2015 edition of the U.S. News Best Global Universities, published in 2014, this cutoff was around April 2014. It is necessary to use a slightly older window of publication to allow for citations to accumulate and provide statistically relevant results.

The subject fields used in the analysis came from Thomson Reuters' InCites™ schema and did not include arts and humanities journals, and therefore they are excluded for the citation-based indicators; but articles from arts and humanities journals were included in the papers count used in the publications indicator. Arts and humanities journals accumulate few citations and citation analysis is less robust; therefore, the deliberate exclusion of arts and humanities improves the robustness of the results.

When data were not available, such as Ph.D.s awarded, a z-score of zero was used so as to neither reward nor penalize the university (i.e., it is treated as an average of all the other universities).

When the value is zero it is not possible to calculate the log value; therefore, a substitute is used. The substitute is one-tenth of the minimum value of all other institutions. There were no missing data in the bibliometric or reputation indicators."[1]

A U.S. News não solicita informação às Universidades.

[1] Robert Morse and Melinda Foster, How U.S. News Calculated the Best Global Universities Rankings Oct. 27, 2014, in http://www.usnews.com/education/best-global-universities/articles/methodology Acedido 28 novembro de 2014.

II. Posição das Universidades portuguesas no 2015 U.S. News Best Global Universities rankings

	Global Score	Global Rank	Europa	Iberoamérica
Universidade de Lisboa	41,8	265=	113	9
Universidade do Porto	36,4	333	144	15
Universidade de Coimbra	30,6	430	185	21
Universidade de Aveiro	28,0	484=	208	27

Indicator Rankings das Universidades portuguesas no 2015 U.S. News Best Global Universities rankings

	U.Lisboa	U.Porto	U. Coimbra	U. Aveiro
Global score	41.8	36.4	30.6	28.0
Global research reputation	#272	#335	#432	#520
Regional research reputation	#252	#368	#456	#510
Publications	#121	#208	#372	#428
Normalized citation impact	#472	#502	#378	#484
Total citations	#172	#253	#361	#434
Number of highly cited papers	#200	#257	#397	#421
Percentage of highly cited papers	#500	#477	#477	#459
International collaboration	#305	#483	#389	#328
Number of Ph.D.s awarded	#575	#528	#628	#679
Number of Ph.D.s awarded per academic staff member	#624	#630	#653	#530

III. Universidades portuguesas nos U.S. News 2015 Best Global Universities Subject Rankings

http://www.usnews.com/education/best-global-universities#subject-rankings

Estão presentes Universidades portuguesas em três dos 21 Subject Rankings.

A metodologia dos Subject Rankings é apresentada em Anexo.

Agricultural Sciences

	U.Porto	U.Lisboa
Agricultural Sciences World	#74	#75
Agricultural Sciences Europe	#27	#28
Agricultural SciencesIberoamérica	#7	#8
Agricultural Sciences overall score	63.3	63.2
Agricultural Sciences global research reputation	#128	#164
Agricultural Sciences regional research reputation	#226	#91
Agricultural Sciences publications	#69	#80
Agricultural Sciences normalized citation impact	#34	#67
Agricultural Sciences total citations	#42	#65
Agricultural Sciences number of highly cited papers	#28	#68
Agricultural Sciences percentage of highly cited papers	#29	#76
Agricultural Sciences international collaboration	#198	#108

Engineering

	U.Lisboa	U.Porto
Engineering World	#73=	#99
Engineering Europe	#15	#26
Engineering Iberoamérica	#2	#3
Engineering overall score	62.1	57.5
Engineering global research reputation	#127	#170
Engineering regional research reputation	#114	#177
Engineering publications	#57	#151
Engineering normalized citation impact	#104	#31
Engineering total citations	#52	#102
Engineering number of highly cited papers	#58	#75
Engineering percentage of highly cited papers	#126	#21
Engineering international collaboration	#153	#99

Mathematics

	U.Lisboa
Mathematics World	#58
Mathematics Europe	#14
Mathematics IberoAmérica	#3
Mathematics overall score	56.9
Mathematics global research reputation	#98
Mathematics regional research reputation	#102
Mathematics publications	#9
Mathematics normalized citation impact	#202
Mathematics total citations	#41
Mathematics number of highly cited papers	#71
Mathematics percentage of highly cited papers	#206
Mathematics international collaboration	#99

IV. Anexo

Metodologia de U.S. News 2015 Best Global Universities Subject Rankings

“In addition to rankings of the world's top 500 universities overall and by region and country, the inaugural U.S. News Best Global Universities rankings include an examination of the leaders in key academic subject areas. U.S. News used a separate methodology to publish the top 100 global universities in 21 subject areas. The subject rankings are powered by Thomson Reuters InCites™ research analytics solutions.

These subject-specific rankings – which are not of academic majors, departments or specific schools at universities, such as business schools or medical schools – are based on academic research performance in those subjects. We have used various bibliometric measures, including publications and citations, as well as indicators for global and regional reputation in that specific subject.

Ranking Indicators

The bibliometric indicators are based on data from the Web of Science™ for the five-year period from 2008 to 2012. The Web of Science™ is a Web-based research platform that covers more than 12,000 of the most influential and authoritative scholarly journals worldwide in the sciences, social sciences, and arts and humanities. The 21 subject fields used in the analysis came from subject schema in Thomson Reuters' InCites™, which uses the content and citation indicators from the Web of Science™.

The first step in producing the subject rankings was to create the universe of universities to determine the top 100 in each field. The top 250 universities that had published the most papers in that subject area in the 2008-2012 time period were included in the ranking universe for each subject area.

As a result, there were many cases when an institution that had a strong focus on a certain subject was ranked in the top 100 in a subject ranking but was excluded from the overall Best Global Universities rankings encompassing the top 500 universities worldwide. In total, there were 59 universities and one country, Romania, that were in the subject rankings but not the overall top 500 rankings.

The next step was to calculate the 21 separate subject rankings using the eight ranking factors U.S. News selected. Each indicator used in the subject rankings was based on bibliometric and global and regional reputation data compiled for that specific subject. For example, for the Best Global Universities for Clinical Medicine rankings, each of the eight rankings factors used in the calculations was based on data and values for clinical medicine.

The subject rankings methodology differs from the one used to produce the overall Best Global Universities rankings of the top 500 schools in a number of ways.

First, U.S. News tailored the subject ranking methodology to the different publication characteristics of the soft sciences and mathematics compared with the hard sciences. The soft sciences are computer science; economics and business; engineering; and social sciences and public health. The hard sciences are the remaining 16 subject areas listed further below.

Second, school-level data on Ph.D.s awarded and number of faculty were not available at the subject level and therefore not included in the subject rankings methodology.

The use of citation analysis within the hard sciences is well established. However, in the soft sciences the relationship between citations and performance is less clear. There are a number of reasons for this.

First, unlike the hard sciences, journal articles are often not the main method of communication of research, and citation rates to the articles may be low. Second, in the social sciences and economics and business, when a scholar cites another work, it is frequently a point of debate or discussion.

This is in contrast to the hard sciences, where the reason for citing another work is usually one of utility or influence. In the case of mathematics, although a journal article is the main method of communication, citations tend to take a longer time to accumulate than other fields and the overall citation rate to mathematics papers tends to be quite low.

These reasons do not negate the use of citation analysis for research evaluation, but they decrease confidence in the robustness of the results. Therefore, U.S. News lowered the weights assigned to these citation indicators in the soft sciences to reflect the lower confidence.

The table below lists the weights and factors used to compute the 21 subject rankings, with related indicators grouped together. For a detailed explanation of each ranking factor, please read "How U.S. News Calculated the 2015 Best Global Universities Rankings.”

Ranking indicator	Weights used for soft sciences	Weights used for hard sciences
Global research reputation	12.5%	12.5%
Regional research reputation	12.5%	12.5%
Publications	17.5%	15%
Normalized citation impact	7.5%	10%
Total citations	12.5%	15%
Number of highly cited papers	17.5%	15%
Percentage of highly cited papers	10%	10%
International collaboration	10%	10%

Subject Categories

Below is an overview of how Thomson Reuters InCites™ defines which journals are assigned to the 21 subject areas that were ranked. For a more detailed description of the scope and coverage in each field, please see the notes provided on InCites™.

Agricultural sciences: Journals focused on topics such as agronomy, soil science and food chemistry form the agricultural sciences category. From improving agricultural productivity and minimizing the effects of pests on crops and animals to studying animal breeding, genetics and nutrition, publications within this category deal with the tools, methods and technology that relate to agricultural needs.

Biology and biochemistry: This category comprises a wide range of life-science-related topics. From studies on hormone regulation and the endocrine system to pollution remediation and waste treatment, publications within the biology and biochemistry category deal with the components of cells, biological molecules and living organisms.

Chemistry: Both theoretical and applied studies come together to create the chemistry category. These journals include topics from nuclear, organic and physical chemistry, as well as analytical chemistry and the isolation and analysis of clinically significant molecules.

Clinical medicine: The clinical medicine category is comprised of journals focused on a wide range of medical and biomedical topics. From anesthesia, surgery and cardiovascular medicine to nursing, obstetrics and reproductive medicine, publications in this category deal with the research and advances being made in the field of medicine.

Computer science: Research dealing with the creation, manipulation and management of computer hardware and software makes up the computer science category. From the design of computer architecture and computing methodologies, to the processing, storage, management and dissemination of information, publications in this category focus on scientific and practical approaches to computation.

Economics and business: The economics and business category comprises journals dealing with the production, distribution and consumption of goods and services. These publications cover the theoretical, political, agricultural and developmental aspects of economics, as well as the strategic planning, decision-making and financial methods that go into creating and maintaining a successful business.

Engineering: The engineering category includes publications covering a number of engineering disciplines. From aerospace, mechanical, electrical and civil engineering to nuclear energy, applied artificial intelligence and robotics, publications within this category focus on designing, building and using structures, machines and systems.

Environment/ecology: Studies of both pure and applied ecology make up the environment/ecology category. Journals in this category cover topics in ecotoxicology, environmental technology and ecological modeling, as well as research in environmental health and climate change.

Geosciences: Research on the structure, evolution and dynamics of our world come together to create the geosciences category. From geology, geochemistry and geophysics to geological, petroleum and mining engineering, publications within this category focus on the physical studies of Earth.

Immunology: Studies dealing with both the cellular and molecular aspects of immunology make up the immunology category. These journals focus on infectious diseases, autoimmunity and allergies, and also include clinical research on topics such as immunopathology and the experimental therapeutic applications of immunomodulating agents.

Materials science: The materials science category comprises journals dealing with both the discovery and design of materials. These publications include topics such as textiles, biomaterials, superconductors and semiconductors, as well as the application of chemistry and physics to materials design and testing.

Mathematics: Journals dealing with statistics, probability and pure and applied mathematics make up the mathematics category. From algorithmic matrices and graph theory to cryptography and optimization, publications within this category focus on the science of quantity.

Microbiology: The microbiology category comprises studies dealing with the biology and biochemistry of protozoa and microorganisms. From the medical implications of organisms known to cause diseases to the biotechnology applications of microorganisms for basic science and clinical use, publications within this category focus on the study of microscopic organisms.

Molecular biology and genetics: Publications focused on aspects of both basic and applied studies of genetics come together to create the molecular biology and genetics category. These journals deal with topics such as receptor biology, signal transduction and morphogenesis, as well as the genetic causes and treatment of genetic diseases.

Neuroscience and behavior: The neuroscience and behavior category includes publications that cover both the cellular and behavioral components of the nervous system. These journals include studies on molecular neuroscience, neuronal development and psychopharmacology, as well as studies on both basic and clinical neurology.

Pharmacology and toxicology: Topics dealing with both the beneficial and adverse effects of drugs form the pharmacology and toxicology category. From pharmaceutics, drug design and metabolism, to occupational exposure and the harmful effects of substances on cells, publications within this category focus on the effects that both man-made and natural chemicals can have on living organisms.

Physics: The physics category comprises journals dealing with both the classical and modern theories on the subject. From the classical studies on Galilean relativity, thermodynamics and Newton's laws of motion to the modern studies of quantum mechanics and Einsteinian relativity, publications within this category deal with the properties and interactions of matter and energy.

Plant and animal science: A wide range of topics create the plant and animal science category. From research dealing with regional botany, aquatic toxicology and plant nutrition to research focused on animal behavior, veterinary medicine and evolutionary biology, publications in this category focus on the nonagricultural aspects of plant and animal research.

Psychiatry/psychology: All research areas dealing with either the objective or scientific study of the psyche are covered in the psychiatry/psychology category. These journals include topics from specialized areas, such as applied, biological, clinical, developmental, educational, mathematical, organizational, personal and social psychology, as well as the classification, diagnosis and treatment of psychiatric disorders.

Social sciences and public health: Topics in both the social and health sciences are included within the social sciences and public health category. These journals include research on the building blocks of society, such as social policy, political science, education, demographics, law and public health and administration, as well as research dealing with ethics and the social aspects of health and addiction.

Space science: Journals focused on studying the universe make up the space science category. From astronomy and astrophysics to celestial bodies and space exploration, publications within this category deal with the study of everything in outer space.

How the Subject Scores and Numerical Rankings Were Calculated

To arrive at a school's rank in each of the 21 subjects, the subject scores were calculated using a combination of the weights and z-scores for each of the eight indicators used in each subject ranking. In statistics, a z-score is a standardized score that indicates how many standard deviations a data point is from the mean of that variable. This transformation of the data is essential when combining diverse information into a single ranking because it allows for fair comparisons between the different types of data.

Several of the indicators were highly skewed, so the logs of the original values were used. These indicators that were logged were:

- Publications
- Total citations
- Number of highly cited papers
- Global research reputation
- Regional research reputation

This log manipulation rescaled the data and allowed for a more normalized and uniform spread across each of the indicators.

After the indicators were normalized, the z-scores for each indicator were calculated in order to standardize the different types of data to a common scale.

In order to calculate a school's subject score, the calculated z-scores for each of the eight indicators were weighted using the weights described earlier. U.S. News determined the weights based on our judgment of the relative importance of the ranking factors and in consultation with bibliometric experts.

The subject score was calculated by summing the school's weighted values for the eight indicators in that subject. The minimum score from the pool of 250 schools was then subtracted from each of the scores in order to make zero the lowest possible score.

The scores were then rescaled by multiplying the ratio between the overall performance of each university in that subject and the highest-performing university by 100. This forced the scores to fall on a 0-100 scale, with the highest-performing school earning a subject score of 100.

The 250 schools in each of the 21 subject areas were then numerically ranked in descending order from 1 to 250 based on their weighted subject score. Each school's subject score was rounded to one decimal place in order to increase variance between scores and to minimize the occurrence of ties. U.S. News published the top 100 ranked schools in each subject.

In addition, in each subject area, the 250 universities received a numerical rank for each of the eight ranking indicators, such as publications, total citations and global academic reputation, based on their z-score for that indicator. The highest scoring university for each of the eight indicators received a rank of 1, and the lowest scoring university received a rank of 250. Ties were allowed.

The numerical ranks for each of the eight indicators are published on usnews.com for each school in each of the 21 subject areas. This means that there are some schools in the subject rankings that have ranking indicators with numerical ranks in the 101 to 250 range. The numerical ranks published for each ranking indicator are to be used to determine the relative position of each school in that indicator on a 1 to 250 scale, with 1 being the highest. The numerical indicator ranks were not used to calculate the subject score.

Data Collection

The data and metrics used in the rankings were provided by Thomson Reuters InCitesT^{M} research analytics solutions. The bibliometric data were based upon the Web of Science^{TM}.

Publications are limited to those published between 2008 and 2012. However, the citations to those papers come from all publications up to the most recent data available. For the 2015 edition of the U.S. News Best Global Universities, published in 2014, this cutoff was around April 2014. It is necessary to use a slightly older window of publication to allow for citations to accumulate and provide statistically relevant results.

The subject fields used in the analysis came from Thomson Reuters' InCites^{TM} schema and did not include arts and humanities journals, and therefore they are excluded for the citation-based indicators; but articles from arts and humanities journals were included in the papers count used in the publications indicator. Arts and humanities journals accumulate few citations and citation analysis is less robust; therefore, the deliberate exclusion of arts and humanities improves the robustness of the results."[2]

[2] Robert Morse and Melinda Foster, How U.S. News Calculated the Best Global Universities Subject Rankings, Oct. 27, 2014, in http://www.usnews.com/education/best-global-universities/articles/subject-rankings-methodology acedido 28 de outubro de 2014.