

Academic Ranking—From Its Genesis to Its International Expansion

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Abstract

Given the visibility and popularity of rankings that encompass the measurement of quality of post-graduate courses, for instance, the MBA (Master of Business Administration) or graduate studies program (MSc and PhD) as do global academic rankings—Academic Ranking of World Universities-ARWU, Times Higher / Thomson Reuters World University Ranking and TR-THE, QS World University Rankings-TopUniversities-QS. With the sharply increasing importance of academic rankings, we seek to answer the following questions: What is the origin of academic ranking? How did it evolve from a local initiative into an international one? How have the agencies responsible for academic ranking developed? Despite this evolution, what are the constraints that still exist? In this qualitative study, we opted for bibliographic and documentary research. The findings confirm the predominance of strategic value intertwined with the reductionism of knowledge in the context of research and publication and, the non-consensual process of the internationalization of higher education, being engendered by a global elite (chiefly of American origin) geared to serve their own interests.

Keywords: Academic Rankings, Institute for Scientific Information-ISI, Strategy, The Internationalization of Higher Education, The Social Sciences Citation Index-SSCI

1. Introduction

Up until the 60s the process of internationalization of the education sector was marked by the formalization of cooperation agreements between governments and universities in different countries. These collaborations weakened in the 1990s and a more competitive political character began to strengthen among countries with a recognisable academic tradition (Slaughter & Leslie, 1997, 2001; Santos, 1999; Chauí, 2001; Goerden, 2008; Knight, 2008; Audiz & Morosini, 2009; Dias, 2010; Hazelkorn, 2011; Lima & Contel, 2011; Balbachevsky, 2013).

In environments in which relationships based on competition among institutions prevail, academic rankings give credibility to ranked universities. The institutions with higher rankings are favored by publicly funded and are strengthened by private investment and increasing enrolment of local and international students. The importance of upholding strong classifications in the global rankings make academic leaders adopt a predominantly business management logic. This makes them responsible for raising the funds to make the production of knowledge for conducting theoretical and applied research both quantitatively and qualitatively viable. Likewise, often, the criteria adopted by the heads of these rankings serve as a reference for the academic management of non-classified institutions.

On the other hand, what does the academic ranking stand for? According to Hazelkorn (2011), it implies a classification of universities. Hence, its use is made of a set of carefully defined indicators, objectives which allow comparisons among institutions or training programs that may reach national, regional or global dimensions.

Repeatedly, people confuse academic ranking and educational accreditation, even though the terms refer to distinct situations. “Accreditation is undertaken by governments directly or by specialized agencies to recognize the legitimacy of particular HEIs”. This aims at assuring the quality of universities performance through pre-established criteria (Hazelkorn, 2011, p. 40).

It is worth noting that Benchmarking—systematized process of good practice (measure of quality)—also harnesses the rankings or accreditations for which higher education institutions can be identified by their peers for their true conditions of performance, quality and production.

In short, given the visibility and popularity of rankings that encompass the measurement of quality of post-graduate courses, for instance, the MBA (Master of Business Administration) or graduate studies program (MSc and PhD) as do global academic rankings—Academic Ranking of World Universities-ARWU, Times Higher / Thomson Reuters World University Ranking and TR-THE, QS World University Rankings-TopUniversities-QS. With the sharply increasing importance of academic rankings, we seek to answer the following questions:

What is the origin of academic ranking? How did it evolve from a local initiative into an international one? How have the agencies responsible for academic ranking developed? Despite this evolution, what are the constraints that still exist?

Hence, we opted for a review of available literature linked to documentary research. The bibliographic research was based on academic articles and books whose themes are related to academic rankings. With regard to documentary research, we consulted subjects available at various websites on the topic of academic rankings as well as the information contained in the official websites of the pioneering global academic rankings (ARWU, THE and QS), US News and World Report Best Colleges-USNWR and Institute for Scientific Information-ISI.

The remainder of the paper is structured as follows. We divided it into five sections: introduction, which is followed by the history of practice to classify the universities; in the third section, we further observe the evolution of some academic rankings to reach the international dimension; the fourth section addresses the criteria and academic domains; finally, the fifth section contains conclusions and suggestion.

2. History of the Onset of Academic Ranking

Starting with the first question on the origin of academic rankings, based on literature available (Catell, 1921; Hazelkorn, 2011), the first work, that indirectly ranked educational institutions, was published in the United States in 1910. It was sponsored in 1902 by the executive committee of the Carnegie Institute (Note 1) and run by James McKeen Cattell. At the time the intention was to have a list of the name of American scientists—A Biographical Index of the Men of Science of the United States (Catell, 1902). The findings of such work were for the exclusive use of the Carnegie Institute in Washington. However, in 1910, the contents became public with the title of American Men of Science (Catell, 1921).

According to Hazelhorn (2011, p. 29) “Cattell weighed the prominence of scientists employed and the ratio of ‘starred’ scientists to total faculty in order to arrive at a final score”. In other words, the report authored by Cattell highlighted the academic relevance of some American universities and the strength of science production undertaken by some faculties.

It is worth remembering that the early twentieth century was marked by a major technological breakthrough, specifically in the area of transport, i.e., the aviation and the automobile industries (Note 2). Similarly, this period was also marked by sheer secularization in Europe, by modern art with culturally post-romanticism movements, especially in painting with Cubism and Dadaism, and in music with Dodecaphonism and Jazz. In the political sphere, in 1917, the British Commonwealth of Nations (Note 3) was established, the Russian Revolution also occurred along with the establishment of Communism, and Japan was recognized as a potential world country after the Russian-Japanese War. In the same period (1914-1918), the First World War was fought.

Even with a brief overview of the first two decades of the twentieth century which consisted of technological innovations, cultural changes and tensions between the major world powers, it is possible to understand the strategic nature of the Carnegie Institute’s request. After all, the finding of Cattell’s work underpinned the strengthening of American power granted by knowledge production of research centers and the academic reputation of the country.

In the 1960s the hegemony attained by the American Academy was established in the rankings in which evaluation criteria emphasize science production and technical knowledge, i.e., the academic reputation of universities (Hazelkorn, 2011). As a result, in 1961 the Science Citation Index-SCI rate was created. It was improved five years later and renamed The Social Sciences Citation Index-SSCI, allowing access to papers in distinct areas of knowledge.

The dissemination of knowledge promotes relevant changes. According to Eugene Garfield (1963, p. 6), the founder of such indexes:

The Science Citation Index can be the expression of a useful partnership between the researcher and the information scientist, between government and industry, between all sectors of our society concerned with scientific information including all educational media, institutions, and the press.

The first science citation index, made manually—Shepard's Citations—was created by Frank Shepard in 1873. He was a bookseller connected to a publishing house specialized in Law. However, in the 1950s owing to the advance computer technology, the end of World War II, and the increase in scientific research through the incentive policy of the American government, the interest in the method of indexing and retrieval of papers published in journals grew. Once again, the strategic character ascribed to knowledge is explicit.

In 1951, the First Symposium on Machine Methods in Scientific Documentation was held, sponsored by Johns Hopkins University Machine Indexing Project and the American Documentation Institute from the National Library of Medicine, the former Armed Forces Medical Library. The National Library of Medicine had an indexing project entitled Welch, whose focus was the investigation of the role of automation in the organization and retrieval of medical literature.

It was at this symposium that Garfield met the ex-vice president of Shepard's Citations, W.C. Adair. Even with the cancelation of the Johns Hopkins University project in 1953, they kept in touch (Garfield, 1963). In addition to the knowledge acquired through Adair, Garfield also drew on the ideas of Vannevar Bush described in the essay *As We May Think*, published in 1945 (Note 4).

By 1960, Garfield had already taken part in two pilot projects whose purpose was to test the feasibility and efficiency of the science citation indexing practice. The first project concerned the creation of a database, that would index 5,000 patent quotes in chemistry, belonging to two pharmaceutical companies. The second pilot project, conducted in 1962, aimed to develop an index linked to published literature in the genetic field. It was a partnership between Garfield's newly incorporated company—the Institute for Scientific Information-ISI (now Thomson-Reuters-ISI) (Note 5)—and the National Institutes of Health. Both organizations are based in the United States. Furthermore, this second project, compared to the first one, was considered far more complex. Three databases were built to cover the literature taking over 1 year, 5 years and 14 years with a variable number of publications indexed in the respective source (Note 6).

All in all, Garfield's work enabled the development of information on retrieval algorithms, such as HITS (Hyperlink-Induced Topic Search) and PageRank (which calculates the number of links leading to the webpage), and, more importantly the creation, with his partner Irving H. Sher, of the Journal Impact Factor-IF. A measurement scale “re-sorts the autor citation index into the journal citation index” (Garfield, 2005, p. 2). These initiatives contributed to the assignment criteria that helped evaluate science production, focusing on universities academic reputation.

Among the factors counted by Bourdieu (2011, p 106), in his work *Homo Academicus*, he claims to belong “to an editing committee of journal—or the board members of a collection (intellectual awareness); the possession of a rate of in excess of 5 citations in the Science Citation Index (scientific prestige)” at least one faculty in French universities in 1967. Also, in Bourdieu's words,

the privilege ascribed to social sciences experts in relation to the scholars is due to the weight of the Science Citation Index, which contributes quite strongly to the determination of it. The Science Citation Index also favours the different disciplines and notable researchers when they come closer to American science and tradition (Bourdieu, 2011, p. 115).

In light of the above, not only did we answer question one, but also partially question two on the conditions in which the academic rankings have evolved from a local initiative into international one, since it led to rank universities globally. The other part of question two on ranking universities worldwide will be clarified in the following section.

3. The Emergence of the Rankings—From National to International

From the late 50s onwards, we observe the proliferation of the academic rankings in the United States (Table 1). A wide range of national rankings focused on higher education, the World Report Best College (Note 7), published since 1983, has been the most recognized in academia up to this day. Originally, this ranking resulted from a peer review, involving 1,300 presidents of Colleges based in the United States and with minimum four-year existence (Hazelkorn, 2011).

Table 1. National rankings in the United States

Author(es)	Ranking	Year(s)
Hayward Keniton	Graduate Study and Research in the Arts and Sciences of University of Pennsylvania *	1959
Allan Carter	Assessment of Quality in Graduate Education	1966
Kenneth D. Roose and Charles J. Andersen	Rating of Graduate Programs	1970
Peter Blau and Rebecca Zames Margulles	Ranking of Professional Schools in Change Magazine	1973, 1974 and 1975
Everett Carl Ladd Jr. and Seymour Martin Lipset	Rankings Published in the Chronicle of Higher Education	1979
	US News and World Report Best College Rankings – USNWR	1983
Mortimer B. Zuckerman	US News and World Report Best Universities Rankings	1999

Source: Adapted from Hazelkorn (2011, p.30) and retrieved from <http://www.usnews.com/usnews/usinfo/history.htm> in August/2013.

Note. *University where Garfield, the founder of Science Citation Index, got his PhD in Structural Linguist.

For Hazelkorn (2011), the sheer acceptance of the rankings was due to the possibility of providing information on the teaching of American undergraduate and graduate programs, particularly in the areas of Business, Engineering, Law and Medicine. The consideration given to that ranking led to annual publication. The data serve as a sort of guide to American Colleges addressed to students, their families, shareholders, governments, intergovernmental agencies among others.

Additionally, the success of USNWR led to the publication of partial results online from 1993 onwards. However, in order to access the the full context an annual subscription (\$ 29.95 American dollars) is charged (Note 8).

Also due to the success of the USNWR ranking, those responsible have invested in sub-projects. For instance, in 1999, they released the world universities ranking called The US News & World Report Best Universities. Interestingly, the US News magazine, launched by journalist David Lawrence in 1933, only gained notoriety when it was incorporated the World Report Best College in 1983 due to its acquisition by Mortimer B. Zuckerman. Zuckerman, who graduated from Harvard Law School, was co-editor president for New York Daily News, and former professor at the Harvard Graduate School of Business, where he taught for nine years (Note 9).

In a critical interpretation of the great appreciation that the United States advocates to academic rankings, Wolff claims

Americans treat education as a homogeneous process of absorbing information and skill development without crises. The irregular, irrational, inappropriate, by chance are seen with a failure of education. The only difference between traditional and progressive attitudes is that the first blames the students for these aberrations, while the second blames the school. The fact of being unwanted is never ascertained (Wolff, 1993, p. 124).

Approval of the rankings has spread beyond the US borders in recent times. In 1998, the Centre for Higher Education Development, founded in 1994 by the Bertelsmann Foundation and the German Rectors' Conference created CHE-Hochschul-Rankings. Those institutions are responsible for its development, using web-based technologies to facilitate use. Thus, it allows the user to elect “the indicators [that] are for him/ her more relevant such as: discipline or field of science, location, type of institution, purpose of education and so on” (Hazelkorn, 2011, p.88).

Going beyond the borders of the United States and Europe, already in the 21st century, more precisely in 2003, the first global academic ranking in China was created—Academic Ranking of World Universities-ARWU, designed by the Shanghai Jiao Tong University at the government Chinese's request. With the initial purpose of “measuring the backwardness of Chinese universities against the major foreign universities and—according to the founders (the faculties Liu and Cheng)—also to lead Chinese scholarship policy” (They, 2010, p. 3).

Initiating, thus, the third phase of higher education ranking: the ranking whose greatest weight will be allocated to scientific publications—science citation indexes of Thomson Reuters and Scopus Elsevier's (Note 10) and faculty qualification, confirming once again the strategic character ascribed to knowledge. From the 21st century, we draw attention to the strategic value intertwined with the increment of knowledge capable of generating new technologies and promoting innovation in the productive sector, with geopolitical implications.

In the following year of the launch of the ARWU (2004), the second global academic ranking—Times Higher Education Quacquarelli Symonds World University Rankings: The Top 200 World Universities-THE/QS—was released by Times Higher Education Ltd-THE and Quacquarelli Symonds Ltd-QS. Both institutions originated from England. This second ranking ascribed the greatest value to peer reputation survey. Possibly due to the fact that the THE-QS, unlike the ARWU, has no direct link with Academy. In other words, none of the editing board members THE/QS were or are faculties or researchers.

In the next section, we try to answer the third question—how have the agencies responsible for academic ranking developed?

4. Criteria and the Academic Domain

The appreciation of the indicators related to science production and faculty qualification is clearly evidenced by the criteria of ARWU as well as THE/QS rankings. From a total of 100%, over half of this percentage is assigned to these indicators (Table 2). It means global rankings measure academic quality by undertaking surveys among the faculties, disregarding teaching activity.

Owing to the fact that work involving research and publication lends itself towards quantification, the subjectivity of education hinders the elaboration of objective and quantifiable indicators of quality. Even the THE/QS ranking tries to “analyze—the possible extent—the quality of training given to students” (Thery, 2009, p 12.). Thus, despite the lack of rationale, global rankings are based on the assumption that universities with oriented-research rely on highly qualified faculties. Therefore, they are able to build compelling learning environments and motivate students to study.

Comparing the two highest indicators of the global rankings to those of the renowned ranking of American universities-USNWR (Table 2), we note at once that the latter is not aimed at measuring scientific activity. One of the arguments, based on empirical studies, is the indicator related to the faculty's commitment to research which correlates negatively against the commitment of the faculty with teaching (Dill & Soo, 2005).

In turn, aiming to measure the quality of education, the USNWR ranking's criteria ascribe more emphasis on indicators relating to faculty and student qualifications and exclude science production (Table 2). Hence, faculty qualification is linked mainly to the university's reputation with the highest weight (25%) assigned to peer survey among the presidents of universities, deans and directors of admission. In comparison, the measurement of quality of the faculty is only given a weighting of 10%. This measurement looks at the level of education of professors (do they have a PhD) their contract hours (are they full-time) and also their salary.

Regarding student qualifications, three indicators are considered: 1) freshman retention and graduation rate; 2) the performance of high school students measured through SAT (Scholastic Aptitude Test) and ACT (American College Testing) tests; and 3) the satisfaction rate of alumni.

The highest indicator weight (20%) is freshman retention and graduate rates (Table 2). However, we call attention to the fact that precedes obtaining the mentioned highest indicator weight—the admission or selection process—the grades achieved in SAT and ACT tests.

SAT test was set up firstly by Educational Testing Service—ETS in 1926 (Note 11). In response to criticism concerning its scores, the ETS clarified as follows:

the application of this test (SAT), they were exempted from responsibility to be measuring intellectual skill, such as intelligence, creativity, openness to new ideas or the skill to understand conceptual relationships. In this case, the test only claims to measure the likelihood of student will do well in Higher Education level (Wolff, 1993, p. 121).

Searching for best practice on how to assess the best universities, even those which focus on “teaching quality” in the national American universities ranking seems to continue to converge on the academic domain. As mentioned previously, this supposed teaching quality benefits the university reputation. Factoring SAT and ACT tests score into the students admission process, it is supposed, according to the citation above, that freshmen have a greater chance of achieving good academic record. In other words, the dropout rate will be as low as possible, upholding the status of university as well-known.

Table 2. Criteria of national and international rankings

Categories	National Ranking of Universities of United States		International Academic Rankings			
	Indicators	Weight	Indicators	Weight	Indicators	Weight
Faculty Qualification	Peer assessment score is determined by surveying the presidents, provosts and deans of admissions or equivalent positions at institutions in the school's category.	25%	Number of Nobel Prize/Field Medal ^{II}	20%	Peer Appraisal (divided into five scientific fields) ^{IV}	40%
	Proportion of full-time faculty and faculty compensation.	10%	Researchers - the most cited in 21 disciplinary fields	20%	International faculty	5%
Research/ Publications			Number of Articles in the <i>Nature e Science</i> ^{III}	20%	Number of citations divided into number of researchers	20%
			Number of Articles in the <i>SCI and SSCI</i>	20%		
Size of Institution	Student-faculty ratio	10%	Size of institution/ Per capita academic performance	10%	Teaching quality/Staff-student ratio	20%
	Expenditure per student. Financial resources—academic support, student services and institutional support.	15%				
Employers Survey					Graduate employability	10%
International Student	International Student ratio	5%			International Student ratio	5%
Student Qualification	Average freshman retention rate (4%) and average graduation rate (16%)	20%				
	Average alumni giving rate	5%		10%		
	Average test scores by high school	10%				

Student in the tests SAT and ACT.			
Total	100%	100%	100%

Source: Adapted from Hazelkorn (2011) and Dill & Soo (2005).

Note.

^IAfter 2009 THE and QS broke up.

^{II}Award akin to Nobel, but for Maths field (Théry, 2010).

^{III}According to Théry (2010, p.4) “the indicator regarding the number of published papers in the journals *Nature* and *Science*, they need to be written in English. Since *Nature* is run by Nature Publishing Group (headquarters in London and New York) and *Science* by American Association for the Advancement of Science, in Washington”.

^{IV}Thomson Reuters, the largest bibliometric company, already mentioned, is the exclusive supplier of data of sample and collecting opinion for THE-TR ranking. One of the reasons that it became THE partner in 2010.

In the international sphere, the methodology adopted in the measurement of academic quality by global academic rankings, the academic domain seems to be overlooked. The indicators are based on science citation indexes (SSCI and SCI), Nobel Prizes, Field Medals, publications in prestigious journals such as *Nature & Science* and academic reputation peer review.

It seems that such indicators point to a clear supremacy of the academic domain arising from universities in the United States and Britain which are particularly well represented among those awarded a Nobel prize. Furthermore,

it is no surprise that the Anglophone scientists easier publish, not only by being English native speaking, but also by the scientific committees of these journals (*Nature & Science*) are mostly composed of researchers from the United States and the United Kingdom (Théry, 2009, p. 4).

Based on indicators of academic quality, these spark trends towards standardization and constraints in relation to areas of knowledge by relying on statistical data of bibliometric source and science citation index. For this reason, the basis of bibliometric data used as reference for global academic rankings, the “Science Citation Index-SCI produced by the Institute for Scientific Information-ISI from a private American company Thomson Scientific [...] clearly favors (again) anglophone institutions” (Audiz & Morosini, 2009, p. 83). This draws attention to the fact that not only are American and British universities a massive presence, but also to the appearance of other universities in Anglo-Saxon countries (mainly Australia and Canada) in global academic rankings.

Additionally, owing to other criticisms addressed to the criteria adopted by global academic rankings, it has indirectly ramped up the academic domain: 1) to assist only universities undertaking research and/or which have excellence research center(s); 2) to be annual, since changes from one year to another in the research area are not too relevant. Harfi and Mathieu (2006) confirm that Nobel awards are not granted annually. Likewise, it includes a limited number of disciplines (Physics, Chemistry, Medicine and Economics). Théry (2009) also calls attention to the fact that they assign different weights to the winners in descending order, according to the periods in question. Moreover, if a winner is a member of more than one university, the points earned will be shared between the two universities; 3) to underestimate some areas of knowledge, such as Social Sciences, damaging the position of some higher education institutions in the global rankings; and 4) to consider the number of students enrolled and not that of graduated students.

Finally, the last question is answered in view of the critical constraints that still persist. In other words, although the time spent and the process characterized by polishing the evaluation criteria adopted by the different academic rankings, there were no structural changes. This means that the quality requisite of teaching remains underestimated in the evaluation criteria and the same universities, with sheer favoritism by the central countries, particularly Anglo-Saxon ones, which continue to predominate as shown in the global academic rankings scores over 10 years. Such changes are not consistent because “it is quite difficult to measure accurately the quality of teaching provided by universities. All in all there are no criteria which allow international comparisons” (Harfi & Mathieu, 2006, p. 110).

In sum, the academic hegemony of central countries is striking. This is justified by the rules imposed by society which shape the interaction of certain groups. On this issue, North (1990) and Scott (1995) state that the degree of institutional maturity of a country will determine its level of development and competition can be established.

With the exception of persistent constraints, it is worth highlighting the advantages in relation to academic rankings which by the premise of their scores, provide improvement for universities around the world, “if not their performance, at least, its presentation abroad” (Thery, 2009, p. 21). Moreover, the practice of ranking universities causes many leaders, academic managers, shareholders and parents, among others, to question mission, purpose, results, differences among universities and, the best ways of measuring the success of their higher education systems (Hafi & Mathieu, 2006; Thery, 2009; Hazelkorn, 2011).

5. Conclusions

As noted in this study, academic rankings appeared in the late 50’s, due to the strategic value ascribed to knowledge. More than 60 years later the strategic importance of knowledge has increased more and more. This may explain the growing importance that has been ascribed to the rankings, even as imperfect as they appear to be, because they undertake an extremely complex task.

The findings reveal that “knowledge today (still) takes the strategic role [...]” (Lima & Contel, 2011, p. 403). Therefore, the essence of the predominance of strategic value given to knowledge in the global academic ranking practices makes it possible to affirm the reductionism of academic quality in the context of research and publication. If we focus, in turn, on international standards that once again denounce the fact that the process of internationalization of higher education is not consensual, but engendered by a global elite (chiefly of American origin) geared to serve their own interests.

Clearly more work needs to be done in this area of internationalization of higher education to understand both the nature and scope of contribution, mainly in the teaching field.

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Notes.

Note 1. The Carnegie Institution is a federal agency whose headquarter is based in Washington D.C. The name of the institute is a homage of its founder, Andrew Carnegie. Beginning in 1895, Andrew Carnegie contributed his vast fortune toward the establishment of 22 organizations that today bear his name and carry on work in such fields as art, education, international affairs, peace, and scientific research. In 1901, Andrew Carnegie retired from business to begin his career in philanthropy. Among his new enterprises, he considered establishing a national university in Washington, D.C., similar to the great centers of learning in Europe. Because he was concerned that a new university could weaken existing institutions, he opted for a more exciting, albeit riskier, endeavor—an independent research organization that would increase basic scientific knowledge. Carnegie contacted President Theodore Roosevelt and declared his readiness to endow the new institution with \$10 million. He added \$2 million more to the endowment in 1907, and another \$10 million in 1911. Today, Carnegie scientists continue to be at the forefront of scientific discovery. Working in six scientific departments on the East and West Coasts, Carnegie investigators are leaders in the fields of plant biology, developmental biology, earth and planetary sciences, astronomy, and global ecology. They seek answers to questions about the structure of the universe, the formation of our solar system and other planetary systems, the behavior and transformation of matter when subjected to extreme conditions, the origin of life, the function of genes, and the development of organisms from single-celled egg to adult. Information extracted at <http://carnegiescience.edu/> in August/2013

Note 2. From 1908, Henry Ford popularized the automobile through the mass production of the Model T Ford. With regard to aviation, the first public flights took place between 1904 and 1906 and, in 1910, the first commercial flight was made by the Wright Brothers.

Note 3. Association currently consists of 54 nations, most independent from the United Kingdom. However they uphold political bonds with the “British mother”.

Note 4. Dr. Vannevar Bush, as Director of the Office of Scientific Research and Development, has coordinated the activities of some six thousand leading American scientists in the application of science to warfare. In his essay entitled *As We May Think*, Bush described a theoretical machine, he called “Memex”, which had the aim of improving human memory through the storage and retrieval of documents linked by associations. In fact, while he wrote this essay, Bush aimed to encourage scientists, after the end of the war, to return to the task of making knowledge more accessible. In the view of the author, through this interaction that sought to disseminate scientific work, power would eliminate the inventions, which for years, understood the physical abilities of man as superior to the powers of his mind.

Note 5. At present, Eugene Garfield is president Emeritus at Thomson Reuter - ISI. Thomson Reuters is currently regarded as the producer of one of the largest bibliometric databases (Hazelkorn, 2011).

Note 6. Data retrieved from <http://www.wokinfo.com/essays/history-of-citation-indexing/#> in August/2013.

Note 7. Although this is a national ranking, unlike what can be assumed due to its title and indicates the ranking of American Colleges, it stands out for its reputation over time. Also it served as a national reference regarding

the reputation of American universities both nationally and internationally. QS-USNWR partner—extracts data from such ranking in order to rank the top universities in the United States in its global academic ranking - TOP Universities.

Note 8. Information retrieved from at http://www.usnews.com/usnews/store/college_compass.htm?src=peel in August/2013.

Note 9. Data retrieved from <http://www.usnews.com/usnews/usinfo/history.htm> in August/2013.

Note 10. It is a database of references and abstracts of peer-reviewed scientific literature, run by the Dutch publisher called Elsevier. However, this database is smaller compared to Thomson Reuters, since only Elsevier Publishing reference works that are copyrighted. Data collected at <http://www.elsevier.com/about/at-a-glance> e <http://www.elsevier.com/about/at-a-glance> in August/2013.

Note 11. At present, ETS is globally recognized for the development and administration of TOEFL (Test of English as a Foreign Language).

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