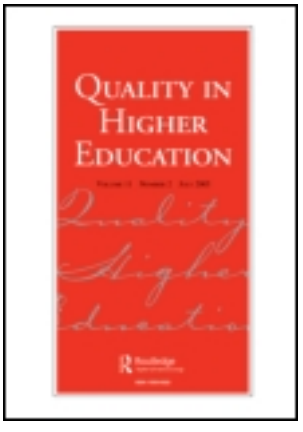

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Evaluation of ninety-three major Greek university departments using Google Scholar

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Evaluation of ninety-three major Greek university departments using Google Scholar

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In this article, 93 Greek university departments were evaluated according to their academics' h-index. A representative sample from the fields of social sciences and humanities, sciences, engineering, pharmacy and economics was adopted. In the reported study, 3354 (approximately 1 out of 3) academics serving in Greek universities were evaluated. The number of papers, citations and h-index have been collected for each academic, department, school and university using the Google Scholar scientific database and the citations analysis software program Publish or Perish. Analysis revealed that departments of the same academic discipline but located in different universities are characterised by strong differences on the scientific outcome. In addition, in the majority of the evaluated departments, a significant difference in h-index was observed between academics who report scientific activity on the departments' website and those who do not. The viability of the adopted method for measuring and ranking the scientific performance of higher education departments proved to be quite high.

Keywords: research evaluation; h-index; Greek university departments; Google Scholar; evaluation; higher education; quality

Introduction

As a result of the need to ensure quality in education, and particularly in higher education, the issue of evaluating both the educational process and research quality and productivity emerges (Moed, 2008). The multifaceted nature of such an evaluation raises a series of questions related to the procedures that should be followed to certify and highlight good teaching practices and scientific excellence, the factors that affect the quality of education and ways to evaluate them in a reliable and valid manner (Harvey, 2008; García-Aracil & Palomares-Montero, 2010). Furthermore, a critical attribute of an evaluation process, beyond its validity and reliability, is its efficiency.

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That is, the possibility to draw conclusions using relatively few human or other resources.

For the assessment of the researchers' effort and scientific contribution, a variety of approaches have been proposed, including expert-based qualitative approaches, such as evaluation by widely accepted researchers in specific disciplines with broad recognition in the scientific community. This process characterises the model of academic staff selection in most countries. However, it is not without drawbacks, as it requires significant resources (Holmes & Oppenheim, 2001) and it is influenced by personal perceptions and the specific scientific profile of the evaluators (Martin, 1996).

The rapid Internet proliferation and the easier access to scientific databases, offers an alternative approach to assessing the scientific outcome of a researcher. Nowadays, it is relatively easy to identify the publication record of a researcher, which typically comprises publications in refereed journals, books and conferences (Hirsch, 2005). Hicks (2009, p. 393) examined university research evaluation practices in the United States, United Kingdom and Australia concluding that 'there seems to be a movement towards bibliometric measures'. However, apart from the number of publications, an issue of publications' quality also emerges, as the requirements and publication practices differ across different subjects, as well as among the journals, books and conferences within a specific field (Bar-Ilan, 2008a, 2008b; Lazaridis, 2010).

One suggestion is to take into account the citation record of an academic (Hirsch, 2005). However, this approach also presents some problems, especially when a researcher has few publications with too many citations and all the remaining publications have little scientific impact (Hirsch, 2005). Another practice that can lead to erroneous conclusions is that of conducting research with numerous colleagues. Such a practice increases the number of citations for all researchers, without a clear view concerning the contribution of each one (Hirsch, 2005).

h-index: a single metric to assess scientific outcome and quality

In an effort to reduce the problems introduced by quantitative indicators and total citations report, Hirsch (2005) proposed the h-index. According to this index, a scientist has index h = x where x of the N_p publications have at least x citations each and the rest (N_p – x) publications have less than x citations each (Hirsch, 2005). For instance, a scholar has an h-index which is equal to 10 if 10 of his/her papers have at least 10 citations each and no other paper has more than 10 citations (for example, other papers providing reference in a specific publication). Thus, the h-index takes into account scientific productivity as well as quality and the distribution of citations across the published papers (Hirsch, 2005). Furthermore, if the publication record increases without accompanying effect in received lifetime citations

the h-index will not increase substantially (Glänzel, 2006). In addition, the h-index calculation is characterised by simplicity and provides a rapid approach to assess the research capability of researchers. Therefore, the h-index can be used as a quantitative measure to identify a competent researcher, which is particularly necessary for issues such as the promotion of professors, research funding and research awards procedures such as Nobel prizes (Hirsch, 2005; Glänzel, 2006; Sidiropoulos *et al*., 2006; Meho, 2007).

However, using the h-index as a method to measure scientific performance presents some limitations. For example, young researchers whose levels of publications are relatively low are handicapped because they will not have been involved for many years in the research process (Glänzel, 2006). As a result, despite the significant advantages and the simplicity of h-index, it is difficult to argue that the scientific performance of a researcher could be summarised using only one index (Hirsch, 2005). In addition, the publication policies across different scientific subjects vary. If a scholar has a low number of citations, this could also be attributed to a variety of reasons such as small impact in the field due to working in a field of limited scope, publishing in a language other than English, or finally publishing mainly books (Rousseau, 2007; Harzing, 2009). Hirsch (2005) also proposed the index m, which is obtained by dividing the index h by the number of years of scientific publication. Also, the h-index may be increased not only by publishing new scientific findings but also by increasing the number of citations on previously published works (Glänzel, 2006). It is also non-sensitive to the number of authors of a paper and thus their specific contribution to it (Hirsch, 2005).

Therefore, it is necessary to have a normalisation index across different topics, even within the same academic subject. Batista *et al*. (2006) argue that despite the fact that the average h-index varies across different topics it could be normalised using the ratio of average h-index performance in a field in relation to another. For example, Batista *et al*. (2006) report that the average h indices for the scientific disciplines of biology and mathematics are characterised by a 3:1 ratio. Thus, a scientist conducting research related to biology with an h index equal to 15 has similar academic impact with a scholar conducting research in mathematics with h = 5.

Benefits of the h-index as a means to assess academic performance quality

Not surprisingly, the h-index is widely used to assess researchers' as well as scientific journals' impact (Ball, 2005; Cronin & Meho 2006; Kelly & Jennions, 2006; van Raan 2006; Bar-Ilan *et al*., 2007; Meho & Yang, 2007; Harzing & van der Wal 2008). For instance, among others, Oppenheim (2007) used the h-index to assess British researchers in information science

and librarianship, reporting the index's usefulness as an assessment tool. Imperial and Rodriguez-Navarro (2007) examined the possibility of using the h-index as a nationwide research evaluation tool in Spain. Vanclay (2007) certified the applicability and robustness of the h-index in two different scientific subtopics of biology. Norris and Oppenheim (2010) provide a thorough survey of the h-index and its applications. In addition, Egghe (2010) reported 52, 15 and 8 cases studies involving the assessement of scholars, journals and research groups or institutions, respectively.

Such indices could be easily calculated using data from scientific databases such as Web of Science, Scopus, Citeseer, Scirus and Google Scholar (Jacso, 2005a; Meho, 2007). Publish or Perish is a freely available software that retrieves academic papers from Google Scholar and calculates statistics such as the total number of publications, the total number of citations, years of research, citations per year, references per publication, publications and citations per author, authors per publication, h-index, m-index, g-index (Egghe, 2006) and various other indices (Harzing, 2009).

It is estimated that 75% of indexed items in Google Scholar are academic journals, with the remainder referring to books, conference papers, working papers and student theses (Jacso, 2005b, 2006; Harzing, 2008). However, not all journals are covered in Google Scholar and the degree of coverage seems to be very high for fields such as: business administration, finance and economics, engineering, computer science, mathematics, social sciences, arts and humanities (Norris & Oppenheim 2007; Harzing, 2008). For other scientific fields, it is advisable to verify the results with either Scopus or the Web of Science (Falagas *et al*., 2008; Harzing, 2008). The effectiveness and richer coverage of scientific items of Google Scholar is shown in a series of studies (Bar-Ilan *et al*., 2007; Bar-Ilan, 2008a, 2008b). In addition, Web of Science and Google Scholar seem to rank specific groups of scholars in a relatively similar way. Saad (2006) examined 55 scientists in consumer research and found that the correlation between the Web of Sciences and Google Scholar h-indices was 0.82. In contrast, Belew (2005) found Google Scholar to have an extensive coverage for references published in the last 20 years, although Web of Science was found to have superior coverage before then based on the number of citations found before and after 1990. As a result, Google Scholar might underestimate the impact of researchers who have mainly published before 1990. In conclusion, in order to have more accurate results a combination of databases such as Google Scholar, Scopus and Web of Science could be beneficial (Bauer & Bakkalbasi, 2005; Ball & Tunger, 2006).

As far as self-citations are considered, they may bias some of the results (May, 1997). Therefore, whenever possible, they should not be taken into account for the calculation of the h-index (Vinkler, 2007). However, their impact is not considered substantial. Bartneck and Kokkelmans (2011) argue that while the h-index is vulnerable to manipulation by self-citations, they conclude 'that the best way to increase one's h-index is to write interesting

papers' (Bartneck & Kokkelmans, 2011, p. 98). Huang and Lin (2011) examined the impact of self-citations, by exploring 583 researchers in environmental engineering. They concluded that self-citations have little impact on the h-index and the h-index rankings. Rad *et al*. (2012) examined the impact of self-citation on the h-index in academic radiology. They report that due to self-citation, the mean h-index increased from 13.7 to 14.0 and the mean of citations increased from 1804 to 1870. They also found that h-index numbers did not change in 376/487 (77%) authors as a result of self-citation (Rad *et al*., 2012). Aksnes (2003), using a three-year citation window in the scientific production of Norway, reports that self-citations make up for 36% of all citations. In addition, he argued that the share of self-citation shows significant variations among different scientific disciplines. However, he found that a minor proportion of the overall increase in citation rates was due to self-citations.

Study objectives and questions

The aim of this study was to examine the quality of Greek higher education with regard to their academic members' h-index. Towards this goal, a significant portion of Greek university departments was evaluated using the h-index as calculated from Google Scholar. In particular, 93 Greek academic departments were evaluated from the fields of social sciences and humanities, sciences, health sciences (pharmacy), engineering and economics. The evaluation was conducted at an academic staff level involving a total of 3354 academics, which is approximately one out of three Greek academics in higher educational institutes, as well as at a department level. The calculation of the h-index was carried out using the tool Publish or Perish, which relies on the Google Scholar database. The data about each academic (surname, name and academic rank) were extracted from the website of each department. Emeritus professors were not included.

The goal of the study was manifold. First, to evaluate the effectiveness of researchers in similar departments. Second, to investigate possible variations in scientific practices and to assess the quality of scientific productivity on a nationwide basis. Third, to investigate the effectiveness and applicability of the method, especially in the case of evaluating research performance at a national level. Fourth, to investigate complementary academics' practices, such as whether the scientific performance (operationalised using the h-index) of researchers correlates with publication of detailed information about their research on the department's website.

Methodology

Research design

Ninety-three departments from five different scientific fields were selected for the study (Table 1). The criteria to select the departments were: (a) the

Table 1. Evaluated departments for each scientific field.

Field	Number of evaluated departments	Departments' names
Social sciences and humanities	34	Psychology
		Education sciences and early childhood education
		Primary education
		Philosophy
		Philology
Economics	10	Economics
Health sciences	3	Pharmacy
Natural sciences	20	Mathematics
		Physics
		Biology
		Chemistry
Technological sciences	26	Civil engineering
		Architecture
		Electrical and computer engineering
		Chemical engineering
		Mechanical engineering

popularity across the Greek students based on their yearly applications to be enrolled; (b) the need to evaluate a representative sample across different scientific disciplines. Only the medicine and law departments were excluded, mainly due to the large number of members of the departments.

Data acquisition tools and techniques

First, the names, surnames and academic grade of all the academics were recorded. The data were retrieved from the departments' website. In addition, for all academics it was recorded whether they report information about their scientific activity on the departments' website (or to another hyperlinked web page). For the academics reporting at least one publication on the department's website, the value 1 was assigned; otherwise the assigned value was 0. The program Publish or Perish was used to calculate the total publications, citations, h-index, m-index, year of first publication for each academic member. To reduce the possibility of retrieving data which contained results from other researchers due to the possibility of having the same name, for each department the corresponding scientific area (among the seven used by Google Scholar; see Table 2) was selected. The Google Scholar indexes citations in seven different scientific subfields. Thus, the appropriate subfields were selected for each department (presented in Table 2). For instance, for the departments belonging to the school of social sciences and humanities the 'social sciences, arts, humanities' scientific subject area was selected. However, whenever an academic reported

Table 2. Google Scholar's selected scientific fields for each department.

Department	Biology, life sciences, environmental science	Business, administration, finance, economics	Chemistry and materials science	Engineering, computer science, mathematics	Medicine, pharmacology, veterinary science	Physics, astronomy, planetary science	Social sciences, arts, humanities
Psychology							V
Education sciences and early childhood education							V
Primary education							V
Philosophy							V
Philology							
Economics		V		V			V
Pharmacy	V		V		V		
Mathematics				V			
Physics			V	V		V	
Biology	V		V				
Chemistry	V		V			V	
Chemical engineering			V	V			
Architecture	V			V			V
Electrical and computer engineering			V		V		
Mechanical engineering	V	V	V	V		V	
Civil engineering				V			V

multidisciplinary work, further relevant scientific subject areas were selected (Table 2).

In order to further validate the results obtained, the scholars' publications which contributed to the obtained h-index were examined (Schreiber, 2007; Norris & Oppenheim, 2010). That is, the papers that contributed for one additional point to the researchers' h-index were examined to validate whether they were published by the examined author, as a possibility remained of having the same name but another researcher; affiliations and their CVs (if available) were also examined to validate that the examined researcher was indeed among the authors of the paper. If the latter was the case, the bibliometric data (papers, citations, h-index) were revised and calculated manually, to exclude papers and citations written by another researcher with the same name. No data were recorded concerning the frequency of synonymy found because it was not an objective of the study. However, no more than 1 in 20 scholars, approximately, were found to have significant synonymy problems. In addition, self-citations were not excluded from the analysis, because the majority of studies examining the issue report that in general they do not greatly affect h-index (Aksnes, 2003; Huang & Lin, 2011; Rad *et al*., 2012). Moreover, as the analysis mainly focused on the total scientific performance of the academic staff serving in a department the impact of self-citations on the department's h-index, and in particular in their ranking, was expected to be non-significant (Rad *et al*., 2012). More to the point, as there is no reason to assume that one department's academics self-cite more heavily, it is expected that the ranking will not be affected. The latter was cross-checked with other related studies (Katsaros *et al*., 2008; Lazaridis, 2010) and is discussed in the final section.

Subsequently, for each department the following indices were calculated: the percentage of academic members who report information on their website, the average and standard deviation on publications, citations, h-index, m-index and the number of citations on the most cited article. The median for the h-index was also calculated. Subsequently, the aggregate results were calculated for each department, for the related departments and for each academic grade (professor, associate/assistant professor and lecturer). Separate calculations were carried out for the academics who report their scientific activity on the website and for those who do not report it. The lifetime academics' data were collected from 20 April 2009 to 1 June 2009.

The change of data over time might be significant, due to retirement or to election of new academic members (especially in departments with a small set of academics) and the increase in publications and citations obtained (especially in departments that are characterised by significant research activity). Moreover, the majority of, if not all, scientific publications in Greek are not indexed in Google Scholar. However, a larger portion of such publications is indexed in Google Scholar compared to the Web of Science and Scopus. Also, in some cases, synonymy could slightly affect

the obtained data, as there is always the possibility of having two scholars with the same name and surname, who conduct research even in the same field. The data were 'cleaned'; however, it is difficult to claim 100% success rate while evaluating 3354 academics. In a few cases, the name of an academic was not reported with Latin characters in the departments' website. As a result, the possibility of misspelling the specific scholar's name cannot be omitted. Finally, the hypothesis, whether there is a statistically significant difference on the h-index between academics who report scientific activity on the department's website and those who do not, was examined. The results are presented in the following section.

Presentation and analysis of results

In this section, the aggregate evaluation results are presented by subject area. The following data are presented: the number of academics in a department; percentage of academics who report scientific activity on the departments' web site; publications per academic (and standard deviation); citations per academic (and standard deviation); mean h-index (and standard deviation) and median h.

Social sciences and humanities

The results for the three Greek departments of psychology (Table 3) show that the department of the University of Crete scores highest on all indices (average publications, citations and h-index per academic). It has the fewest and scientifically youngest academic members (by average year of first publication). Moreover, it is the department with the highest scientific activity web reporting percentage across its members.

In the departments of education sciences and early childhood education, the department at University of Patras scores highest on all indices except the median h (Table 4). The department of the University of Western Macedonia appears to be the newest, while the department of Aristotle University has the most members. Among all departments, the department of the University of Crete is the one that has the highest percentage of academics that report publications in the departments' website. One may notice significant differences on publications, citations and h-index which exceed 400%, 700% and 250% accordingly. This shows that departments in the same scientific subject, which have the same resources (for example, financial support from the Ministry of Education, comparable infrastructure and exactly the same wage for each academic according to their grades), have enormous differences in research outcomes. However, no scientific study or official national report state those differences. This is further evident in other subject areas, discussed below.

Table 3. Departments of psychology.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
Crete	20	100.00	**21.40** (20.27)	**146.05** (168.36)	**5.05** (3.88)	3.50
Aristotle of Thessaloniki	23	69.57	15.91 (18.77)	97.00 (132.71)	4.09 (2.92)	3.00
Panteion	25	20.00	18.24 (32.05)	137.96 (395.34)	3.44 (4.85)	1.00
Total	68	60.29	18.38 (24.09)	126.49 (239.75)	4.13 (3.91)	3.00

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

The results for primary education (Table 5) show that the department of the University of Aristotle of Thessaloniki, the department of the University of Ioannina and the department of the University of Thessaly have the same median h (1.5). However, the department of the Democritus University of Thrace takes first place with regard to the average publications, citations and h-index. The department of the National Kapodestrian University of Athens has the most academics; the department of the University of Thessaly has the highest percentage of members that report publications. Significant variations in scientific productivity across the various departments can be also observed.

As far as the departments of philosophy are concerned, the department at the National and Kapodestrian University of Athens seems to be first on all the indices (Table 6). The department's h-index (2.47) far exceeds the average h-index of the Greek philosophy departments (1.12). The department of the University of Ioannina numbers the most academics, while the department of the University of Crete has the highest percentage of members that report publications in the department's website.

As for philosophy (Table 6), the departments of philology at the Universities of Patras and Crete have the same median h (1) and comparable scientific indices (Table 7). However, the rest of the departments have median h equal to zero. Specifically, the department of the University of Crete has the highest per academic member publication and citation number (10.33 and 75.33 accordingly), while the department of Patras has the highest average

Table 4. Departments of education sciences and early childhood education.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
National Kapodestrian of Athens	26	61.54	10.88 (10.37)	28.35 (30.96)	2.27 (1.74)	2.5
Patras	20	90.00	**17.65** (24.10)	**55.80** (123.36)	**2.90** (2.79)	2
Thessaly	22	81.82	10.36 (9.59)	47.77 (81.24)	2.36 (2.14)	2
Aegean	19	21.05	14.16 (24.78)	31.42 (87.22)	1.74 (2.05)	1
Aristotle of Thessaloniki	29	17.24	5.00 (6.04)	9.36 (13.97)	1.04 (1.05)	1
Western Macedonia	23	8.70	7.65 (10.17)	9.91 (19.79)	1.09 (1.28)	1
Ioannina	18	55.56	6.18 (7.25)	15.29 (29.72)	1.35 (1.37)	1
Democritus of Thrace	18	0.00	4.06 (7.34)	7.22 (13.29)	0.89 (0.87)	1
Crete	22	100.00	3.50 (7.08)	7.05 (13.39)	0.82 (1.34)	0
Total	197	48.22	8.81 (11.52)	23.54 (43.17)	1.62 (1.62)	1

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

h-index (1.91). The department of the Aristotle University of Thessaloniki has the most academics (74) while the department of the Democritus University of Thrace has the highest percentage of academic staff who report scientific activity in the department's website.

All in all, the departments of psychology score highest on most indices, followed by the departments of education sciences and early childhood education. For instance, academic staff of the psychology departments have 18.38 papers, 126.49 citations and an h-index of 4.13 on average, while the academics from the departments of education sciences and early childhood education have 8.73 papers, 23.19 citations and an h-index of 1.61.

Table 5. Departments of primary education.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
Thessaly	20	70.00	10.10 (13.40)	29.00 (45.93)	2.10 (1.92)	1.5
Aristotle of Thessaloniki	28	14.29	7.89 (13.91)	30.04 (71.73)	1.86 (2.15)	1.5
Ioannina	21	28.57	6.50 (9.87)	17.00 (35.08)	1.75 (1.81)	1.5
Democritus of Thrace	24	50.00	**12.58** (17.14)	**60.92** (129.30)	**2.21** (2.71)	1
Patras	26	19.23	8.46 (8.70)	26.58 (48.29)	1.62 (1.64)	1
Crete	28	14.29	5.93 (12.29)	26.56 (85.06)	1.33 (2.26)	1
Aegean	21	19.05	4.81 (6.39)	4.19 (6.34)	0.90 (0.97)	1
National Kapodestrian of Athens	40	32.50	4.40 (6.25)	9.28 (29.46)	0.78 (0.96)	0
Western Macedonia	20	10.00	3.90 (7.94)	3.90 (11.46)	0.60 (0.97)	0
Total	228	28.07	7.03 (10.48)	22.86 (52.39)	1.43 (1.69)	1

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

Departments of economics

The Department of Economics in Athens University of Economics and Business scores highest on average citations, average h and median h (Table 8). Taking into account the average publications, the department of the University of Macedonia is on the top of the relevant ranking. The department of the National Kapodestrian University of Athens has the highest number of academic staff (twice as many as the next highest department), while the department of the University of Macedonia has the highest percentage of members who report publications in their department's website. Finally, the departments of economics comprise 231 members of whom 57% report publications.

Table 6. Departments of philosophy.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
National Kapodestrian of Athens (Programme of Psychology)	19	52.63	**12.74** (19.40)	**50.95** (89.83)	**2.47** (2.56)	2
Ioannina	31	58.06	4.00 (2.94)	5.19 (6.62)	1.06 (0.95)	1
Crete	27	74.07	4.30 (5.68)	8.96 (18.64)	1.00 (1.15)	1
Patras	14	57.14	5.71 (12.89)	17.50 (58.70)	1.07 (2.31)	0
National Kapodestrian of Athens	15	0.00	2.87 (4.13)	7.67 (17.04)	0.53 (0.81)	0
Aristotle of Thessaloniki	26	61.54	3.27 (4.48)	3.31 (4.82)	0.68 (0.88)	0
Total	132	54.55	5.23 (7.36)	13.77 (27.41)	1.12 (1.34)	1

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

Departments of pharmacy

The aggregate results for the departments of pharmacy (Table 9) show that the department of Patras has the highest scores in all indicators. In summary, the departments of pharmacy have 90 members and 88.89% of them report publications. The department of the National Kapodestrian University of Athens is the newest and also numbers the most academics.

Schools of sciences

The aggregate results for the departments of mathematics (Table 10) reveal that the universities of Crete and Ioannina come equal first, based on the h median. The latter leads in the percentage of academics that report publications, the average publications and citations. The University of Crete comes first in h-index per academic. The National and Kapodestrian University of Athens numbers more academic staff than all the others.

Table 7. Departments of philology.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
Patras	22	45.45	9.77 (19.26)	55.18 (174.40)	1.91 (3.19)	1
Crete	24	83.33	**10.33** (20.76)	**75.33** (285.87)	**1.71** (3.26)	1
Democritus of Thrace	22	86.36	3.27 (7.71)	13.18 (41.38)	0.77 (1.59)	0
Ioannina	38	0.00	3.79 (6.41)	8.21 (31.64)	0.74 (1.14)	0
Peloponnese	9	33.33	1.11 (1.85)	4.56 (12.19)	0.56 (1.26)	0
National Kapodestrian of Athens	60	41.67	4.27 (9.21)	10.77 (39.97)	0.70 (1.31)	0
Aristotle of Thessaloniki	74	27.03	5.37 (11.13)	17.63 (50.71)	1.10 (1.83)	0
Total	249	38.96	5.39 (10.96)	22.55 (76.59)	1.03 (1.81)	0

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

The aggregate results for the departments of physics (Table 11) show that the University of Crete surpasses all other departments in all indicators. The National and Kapodestrian University of Athens numbers more academics than all the others. The Aristotle University of Thessaloniki is the newest department based on the year of first publication. About one out of four academics (26.5%) report scientific activity on the department's website.

The University of Crete is first, based on all indicators among all the biology departments. It also has an equal percentage of academics who report scientific activity with the University of Patras (Table 12). The Aristotle University of Thessaloniki has more academics than all the rest.

The department at the University of Crete has the highest median h and the biggest average h-index among all the chemistry departments (Table 13). The University of Patras surpasses all other departments, as far as publications and citations are concerned. The Aristotle University of Thessaloniki has more academics than all the others, while the University of Crete has the largest percentage of academics reporting publication on the departments' website.

Table 8. Departments of economics.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
AUEB	22	68.2	51.14 (42.06)	**356.59** (411.58)	**7.27** (4.91)	6.00
Macedonia	26	92.3	**56.31** (62.95)	218.08 (262.87)	6.08 (4.34)	4.50
Patras	14	71.4	32.36 (29.59)	106.07 (115.81)	4.79 (3.23)	4.50
Peloponnese	12	83.3	41.92 (30.73)	97.67 (89.00)	4.33 (2.53)	4.50
Crete	22	81.8	47.50 (49.89)	217.45 (332.51)	5.77 (4.43)	4.00
National Kapodestrian of Athens	52	13.5	41.48 (69.32)	163.02 (290.21)	4.42 (4.13)	4.00
Aristotle of Thessaloniki	29	31.0	29.41 (36.04)	106.55 (179.31)	3.76 (3.40)	3.00
Ioannina	19	84.2	28.26 (57.91)	143.00 (421.48)	3.63 (5.00)	3.00
Thessaly	15	86.7	23.73 (22.92)	57.33 (92.08)	3.40 (2.73)	3.00
Piraeus	20	50.0	15.35 (13.25)	54.05 (90.39)	2.60 (2.40)	2.50
Total	231	57.14	38.10 (46.76)	160.96 (248.40)	4.65 (3.86)	3.00

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

There was a total of 1072 evaluated academics who served in science departments, with an average of 61.89 publications, 402.92 citations and h-index 7.69. The departments of chemistry score the highest median h and average h-index. However, the highest number of per member publications and citations are observed in the physics' departments. Less than half (48.5%) among the 1072 examined academics report scientific activity on the web.

Schools of engineering

The Chemical Engineering Department at University of Patras leads on all indicators (Table 14). The National Technical University of Athens (NTUA)

Table 9. Departments of pharmacy.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
Patras	22	100.00	**73.27** (48.81)	**798.00** (1204.88)	**11.86** (5.91)	10.50
National Kapodestrian of Athens	41	85.37	70.49 (54.86)	401.73 (339.79)	9.88 (3.78)	10.00
Aristotle of Thessaloniki	27	85.19	46.85 (35.60)	279.93 (245.26)	8.56 (4.40)	8.00
Total	90	88.89	64.08 (47.60)	462.06 (522.90)	9.97 (4.48)	10.00

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

has the most academics. All academics in the Chemical Engineering Department at Aristotle University of Thessaloniki report their publications in the department's website.

As far as the departments of architecture are concerned, the University of Patras scores highest on median h (Table 15). The University of Thessaly comes first in publication and citation average as well as h-index. NTUA has more academic staff than all the others while the department at the University of Crete has the largest percentage of academic staff reporting scientific activity.

Across all the mechanical engineering departments, the one with the highest h median and the highest percentage of academics reporting scientific activity is the University of Thessaly (Table 16). The NTUA leads in the citations' and h-index average. The Aristotle University of Thessaloniki comes first in the average number of publications. The University of Patras has more academics than all the others.

The data collected for the departments of electrical and computer engineering (Table 17) show that the Computer Engineering and Informatics Department at the University of Patras leads in the median h (13.00), per-scholar publications (150.41) and h-index (12.45). The University of Crete also has the highest citations' average. NTUA has the most academics, while the Department at the Aristotle University has the largest percentage of academic staff who report scientific activity.

Table 10. Departments of mathematics.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
Crete	17	64.71	36.24 (31.00)	187.06 (191.44)	**6.12** (4.28)	6.00
Ioannina	34	97.06	**46.56** (52.10)	**215.88** (262.56)	6.06 (4.43)	6.00
National Kapodestrian of Athens	74	24.32	30.84 (38.40)	163.76 (318.29)	4.84 (4.21)	4.00
Patras	49	34.69	30.59 (57.99)	185.37 (525.21)	4.49 (5.22)	3.00
Aristotle of Thessaloniki	39	92.31	24.36 (42.28)	91.54 (197.81)	3.64 (3.49)	3.00
Aegean	18	55.56	13.61 (12.72)	53.61 (50.41)	2.94 (2.22)	3.00
Total	231	54.11	31.06 (42.68)	156.95 (303.43)	4.69 (4.19)	4.00

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

Civil engineering at the University of Thessaly has the highest median h (Table 18). However, none of its academics report publications on the department's web site. The University of Patras, comes first for average publications, citations and h-index. It has also the largest percentage of academics who report scientific activity. The Aristotle University of Thessaloniki has more academics than all the others.

There were, in total, 1087 evaluated members serving in departments of technological sciences, with, on average, 53.02 publications, 284.18 citations and h-index 5.54. The departments of electrical and computer engineering lead on all indicators. Surprisingly, only 35.23% of the academics serving in technological sciences' departments report their scientific activity on the departments' website.

Investigating the relation between scientific activity reporting and average h-index

The data presented previously suggest that a significant percentage of the academics do not report their research activity on the web. Specifically, only

Table 11. Departments of physics.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
Crete	33	48.48	**152.09** (111.48)	**817.82** (1014.35)	**12.94** (7.54)	13.00
Ioannina	55	16.36	98.80 (153.61)	667.75 (1098.85)	9.49 (8.82)	8.00
National Kapodestrian of Athens	97	25.77	94.86 (135.48)	700.46 (1492.98)	9.09 (9.32)	7.00
Aristotle of Thessaloniki	93	23.66	82.69 (95.73)	345.18 (515.53)	7.39 (6.20)	6.00
Patras	54	29.63	54.22 (82.51)	309.50 (728.01)	6.31 (6.24)	4.50
Total	332	26.51	91.18 (116.35)	543.60 (981.89)	8.61 (7.68)	7.00

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

45.83% of the 874 academics in social sciences and humanities departments report their research activity on their personal web page (or the department's website); 35.23% of the 1087 members of departments of engineering; and 48.51% of the 1072 members of the science departments. These results were not expected since, according to Greek Law 3374/2005 from 2005, it is obligatory for academics to report scientific activity on the department's website.

The research hypothesis investigated was the existence, or not, of a significant difference in the h-index of the academic staff who report scientific activity about their research on the department's website and those who do not. A non-parametric test (Mann–Whitney *U*) was applied for each evaluated department. As derived from the data analysis, a significant h-index difference ($p < 0.05$) between academics that report scientific activity on the departments' website was observed in 12 out of 16 departments (Table 19). In the departments of philosophy, philology, mechanical engineering and architecture no significant difference was observed (Table 19).

Conclusions and future work

The goal of this study was to evaluate a significant proportion of major Greek university departments using the h-index. In the reported study 3354 academics members (approximately one out of three) serving in Greek

Table 12. Departments of biology.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
Crete	24	91.67	**76.96** (75.47)	**1100.22** (1178.40)	**14.39** (7.34)	15.00
Patras	48	91.67	40.75 (34.33)	269.35 (315.19)	7.73 (4.72)	7.50
Aristotle of Thessaloniki	62	32.26	39.75 (33.35)	297.26 (480.19)	7.56 (4.49)	7.00
National Kapodestrian of Athens	59	20.34	33.68 (35.90)	301.54 (455.61)	6.61 (5.69)	6.00
Total	193	50.78	42.77 (39.61)	391.48 (518.46)	8.16 (5.27)	7.00

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

universities were evaluated. In particular, 93 university departments were evaluated with a representative sample from the departments of social sciences and humanities, natural sciences, technological sciences and economics. Classifications and accompanying calculations were made by department, school and at a national level. The importance of the reported data is increased by taking into consideration the absence of similar large-scale studies. The resulted knowledge could help young students select the department in which to study, as well as to provide a basis for estimating which university has competitive departments in specific fields, as there are no specific evaluation data in Greece.

A subsequent goal was to examine the applicability and efficiency of the proposed approach. The total time to record and analyse the presented data is estimated at three person-months. Specifically, it is estimated that the proposed procedure requires about one hour to record and to calculate the relevant data using the tool Publish or Perish for 10 researchers. Therefore, the process of recording scientific indices for all academics for a country with characteristics similar to Greece is feasible, requiring relatively limited human resources. However, during the data collection process some problems were encountered. One of these was the difficulty of recording the academics' names in Latin characters when no related data were presented under the departments' website. In a few cases, synonymity was observed even to scholars who were found to be active in the same scientific field.

Table 13. Departments of chemistry.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
Crete	23	95.65	76.52 (38.12)	498.91 (340.47)	**11.57** (4.13)	11.00
Patras	45	80.00	**93.18** (120.99)	**590.64** (1327.07)	10.16 (6.48)	9.00
Aristotle of Thessaloniki	112	64.29	57.77 (54.39)	390.73 (708.09)	8.46 (5.80)	8.00
Ioannina	61	65.57	58.85 (51.59)	370.61 (710.09)	7.95 (5.23)	7.00
National Kapodestrian of Athens	75	52.00	61.81 (118.34)	469.60 (1301.80)	7.67 (7.82)	6.00
Total	316	66.14	65.34 (77.33)	441.91 (910.78)	8.64 (6.14)	8.00

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

Table 14. Departments of chemical engineering.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
Patras	28	92.86	**75.96** (65.49)	**702.18** (863.82)	**11.57** (7.79)	10.50
Aristotle of Thessaloniki	32	100.00	55.38 (62.85)	321.91 (545.70)	8.06 (5.92)	6.00
NTUA	87	21.84	42.28 (46.46)	231.78 (395.81)	6.62 (4.93)	6.00
Total	147	52.38	51.54 (53.66)	341.00 (517.58)	7.88 (5.69)	7.00

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

Table 15. Departments of architecture.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
Patras	15	0.00	17.00 (29.37)	58.60 (96.79)	2.27 (2.79)	1.00
Thessaly	19	10.53	**44.58** (79.62)	**162.21** (306.47)	**4.37** (5.80)	0.00
NTUA	88	2.27	11.94 (30.88)	62.26 (222.23)	1.59 (3.34)	0.00
Aristotle of Thessaloniki	74	2.70	21.07 (114.67)	88.95 (443.07)	1.68 (4.07)	0.00
Democritus Thrace	18	0.00	7.06 (12.89)	11.06 (20.66)	1.12 (1.53)	0.00
Crete	10	30.00	14.50 (33.81)	77.20 (220.68)	2.00 (4.71)	0.00
Total	224	4.02	17.79 (61.28)	75.86 (277.66)	1.88 (3.67)	0.00

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

However, the synonymity frequency seems to be quite rare in Greek names compared to academic staff from English speaking countries (Tselios & Altanopoulou, 2011).

In addition, it was found that the majority of the academic staff do not report scientific activity on the departments' website. In 12 out of the 16 evaluated subjects, a significant difference in h-index was observed between academics who report scientific activity on the departments' web site and those who do not. In addition, the majority of the academics do not report scientific activity on the departments' website. The significant correlation between web reporting practices and h-index is notable, requiring further investigation. The academics' h-index is characterised by significant differences between different scientific domains due to different publication practices. Moreover, there are significant differences between the same subject departments in different universities. In addition, there are significant variations in publication outcome both in average h-index and publication per academic in different schools. The average h-index in departments of social sciences and humanities is 1.52 (with 7.58 publications and 29.61 citations per scholar), in economics it is 4.65 (with 38.10 publications and 160.96 citations), in engineering 5.54 (with 53.02 publications and 284.18

Table 16. Departments of mechanical engineering.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
Thessaly	20	100.00	62.05 (39.19)	378.95 (330.54)	8.85 (4.86)	9.00
Aristotle of Thessaloniki	33	12.12	**79.06** (110.38)	346.52 (639.77)	7.55 (5.80)	7.00
NTUA	42	45.24	78.05 (86.66)	**808.29** (3111.84)	**9.10** (10.46)	6.00
Patras	44	50.00	68.00 (69.78)	372.48 (563.18)	7.73 (6.20)	6.00
Western Macedonia	13	76.92	45.31 (45.06)	221.54 (247.64)	6.46 (4.68)	5.00
Total	152	49.34	70.45 (77.12)	475.20 (1226.44)	6.47 (6.98)	6.00

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

citations), in sciences 7.69 (with 61.89 publications and 402.92 citations) and in pharmacy 9.97 (with 64.08 publications and 462.06 citations). The proportion of academics who outperform the corresponding national general h-index in social sciences and humanities is 33%, in economics 40%, in engineering 42%, in sciences 45% and in pharmacy 52%.

Other related research efforts for Greek departments are focused on specific disciplines. For instance, Katsaros *et al*. (2008) focus exclusively on Greek computer science departments examining 552 academics using Google Scholar and Publish or Perish. Lazaridis (2010) presented an evaluation of chemistry, materials science, chemical engineering and physics Greek university departments. He assessed 601 academics using the h-index as calculated from the Web of Science scientific database. While comparing the findings of the presented study with the results provided by Lazaridis (2010), it was found that despite the differences in journal and conference coverage between Web of Science and Google Scholar, which vary for each scientific domain, the presented results are in line with the evaluation reported in this article. Moreover, the department's ranking by the average publications, citations and h-index was the same. This is an encouraging result, which further reassures the viability of the adopted method for measuring and ranking the scientific performance of higher education departments.

Table 17. Departments of electrical and computer engineering

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
Patras (Computer Engineering & Informatics)	29	75.86	**150.41** (117.96)	735.79 (650.18)	**12.45** (5.24)	13.00
Crete	24	79.17	110.63 (71.42)	**819.04** (758.44)	12.17 (6.18)	11.00
NTUA	91	48.35	114.20 (99.07)	587.43 (899.69)	9.67 (6.12)	9.00
Patras	51	45.10	87.90 (80.27)	353.98 (423.48)	7.78 (4.88)	8.00
Aristotle of Thessaloniki	42	83.33	81.36 (95.15)	414.19 (651.11)	8.38 (6.02)	7.00
Democritus Thrace	45	51.11	63.38 (69.79)	204.36 (246.25)	5.78 (4.26)	5.00
Total	282	58.87	99.86 (90.01)	493.25 (634.59)	9.01 (5.50)	8.00

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

The useful results obtained suggest that such an approach could be used in a broader context. For instance, it could be applied to all university departments to better reflect current scientific practices. The procedure could be standardised and be used to continuously assess the quality of universities internationally, thus providing a rigorous and objective worldwide evaluation criterion. Not surprisingly, the British government announced that future university funding will be based on evaluations based on h-index and its variants (Ball, 2007). A forthcoming research goal is to implement such a web service in order to have data for each academic, department, school and university. A related service which allows the estimation of scientific indicators at a national level is available (SCImago, 2007). The service uses data from the Scopus database. For instance, according to the aforementioned service, Greece ranks, by h-index, 29th out of 236 reported countries. Moreover, research goals are to measure error rate due to synonymity, academic self-citation practices and incompleteness of the Google Scholar database. Finally, it could be applied to a large scale to achieve a comparison across the universities of Europe and the United States and possibly set a new classification standard.

Table 18. Departments of civil engineering.

University	Academics No.	Academics reporting scientific activity (%)	Publications per academic (SD)	Citations per academic (SD)	Mean h (SD)	Median h
Thessaly	20	0.00	25.20 (25.87)	80.70 (89.46)	3.60 (2.75)	3.50
Patras	34	70.59	**34.41** (62.72)	**216.09** (518.40)	**4.47** (5.56)	2.50
NTUA	73	15.07	28.29 (52.26)	120.52 (294.95)	3.41 (4.31)	2.00
Aristotle of Thessaloniki	102	9.80	22.70 (48.88)	88.33 (293.07)	2.93 (3.87)	2.00
Democritus Thrace	53	20.75	21.60 (37.84)	69.51 (147.16)	2.74 (3.08)	2.00
Total	282	19.86	25.53 (47.71)	107.99 (278.86)	3.25 (3.96)	2.00

Notes. Academics No.: number of academics serving in each department; Academics reporting scientific activity (%): percentage of academics who report scientific activity on the department's website; Publications per academic (SD): lifetime Google Scholar's publications per academic (standard deviation in brackets); Mean h: total of academics' h-index subsequently divided by the total of academics; Median h: numerical value separating the higher half of academics' h-index values. Figures in **bold** font indicate the highest value in each column.

Table 19. Significance of the difference in the h-index of the academic staff who report scientific activity about their research on the departments' website and those who do not.

Department	Significance of the difference ($\alpha = 0.05$)
Psychology	$p = 0.002$, s
Education sciences and early childhood education	$p = 0.001$, s
Primary education	$p = 0.044$, s
Philosophy	$p = 0.146$, ns
Philology	$p = 0.467$, ns
Economics	$p = 0.038$, s
Pharmacy	$p = 0.023$, s
Mathematics	$p = 0.001$, s
Physics	$p = 0.003$, s
Biology	$p = 0.003$, s
Chemistry	$p = 0.0003$, s
Chemical engineering	$p = 0.0003$, s
Architecture	$p = 0.786$, ns
Mechanical engineering	$p = 0.225$, ns
Electrical and computer engineering	$p = 0.00043$, s
Civil engineering	$p = 0.003$, s

References

Aksnes, D., 2003, 'A macro study of self-citation', *Scientometrics*, 56(2), pp. 235–46.
Ball, P., 2005, 'Index aims for fair ranking of scientists', *Nature*, 436(7053), p. 900.
Ball, P., 2007, 'Achievement index climbs the ranks', *Nature*, 448, p. 737.
Ball, R. & Tunger, D., 2006, 'Science indicators revisited: Science Citation Index versus SCOPUS: a bibliometric comparison of both citation databases', *Information Services & Use*, 26(4), pp. 293–301.
Bartneck, C. & Kokkelmans, S., 2011, 'Detecting h-index manipulation through self-citation analysis', *Scientometrics*, 87(1), pp. 85–98.
Bar-Ilan, J., 2008a, 'Informetrics at the beginning of the 21st century: a review', *Journal of Informetrics*, 2(1), pp. 1–52.
Bar-Ilan, J., 2008b, 'Which h-index? A comparison of WoS, Scopus and Google Scholar', *Scientometrics*, 74(2), pp. 257–71.
Bar-Ilan, J., Levene, M. & Lin, A., 2007, 'Some measures for comparing citation databases', *Journal of Informetrics*, 1(1), pp. 26–34.
Batista, P.D., Campiteli, M.G., Kinouchi, O. & Martinez, A.S., 2006, 'Is it possible to compare researchers with different scientific interests?', *Scientometrics*, 68(1), pp. 179–89.
Bauer, K. & Bakkalbasi, N., 2005, 'An examination of citation counts in a new scholarly communication environment', *D-Lib Magazine*, 11(9). Available online at: http://www.dlib.org/dlib/september05/bauer.html (accessed 10 January 2010).
Belew, R.K., 2005, 'Scientific impact quantity and quality: analysis of two sources of bibliographic data', *arXiv*:cs.IR/0504036 v1, 11 April.
Cronin, B. & Meho, L., 2006, 'Using the h-index to rank influential information scientists', *Journal of the American Society for Information Science and Technology*, 57(9), pp. 1275–8.
Egghe, L., 2006, 'An improvement of the h-index: the g-index', *ISSI Newsletter*, 2 (1), pp. 8–9.
Egghe, L., 2010, 'The Hirsch-index and related impact measures', *Annual Review of Information Science and Technology*, 44, pp. 65–114.
Falagas, M.E., Pitsouni, E.I., Malietzis, G.A. & Pappas, G., 2008, 'Comparison of PubMed, Scopus, Web of Science, and Google Scholar: strengths and weaknesses', *The FASEB Journal*, 22(2), pp. 338–42.
García-Aracil, A. & Palomares-Montero, D., 2010, 'Examining benchmark indicator systems for the evaluation of higher education institutions', *Higher Education*, 60(2), pp. 217–34.
Glänzel, W., 2006, 'On the opportunities and limitations of the H-index', *Science Focus*, 1(1), pp. 10–1.
Harvey, L., 2008, 'Editorial: rankings of higher education institutions: a critical review', *Quality in Higher Education*, 14(3), pp. 187–208.
Harzing, A., 2008, 'Google Scholar: a new data source for citation analysis'. Available online at: http://www.harzing.com/pop_gs.htm (accessed 22 February 2012).
Harzing, A., 2009, 'Publish or perish'. Available online at: http://www.harzing.com/pop.htm (accessed 22 February 2012).
Harzing, A. & van der Wal, R., 2008, 'A Google Scholar h-index for journals: a better metric to measure journal impact in economics and business?', paper presented at *Academy of Management Annual Meeting*, Anaheim, CA, 8–13 August.
Hicks, D., 2009, 'Evolving regimes of multi-university research evaluation', *Higher Education*, 57(4), pp. 393–404.

Hirsch, J.E., 2005, 'An index to quantify an individual's scientific research output', *Proceedings of the National Academy of Sciences, USA*, 102(46), pp. 16569–72.
Holmes, A. & Oppenheim, C., 2001, 'Use of citation analysis to predict the outcome of the 2001 Research Assessment Exercise for Unit of Assessment (UoA) 61: Library and information management'. *Information Research*, 6(2). Available online at: http://informationr.net/ir/6-2/paper103.html (accessed 15 September 2010).
Huang, M.H. & Lin, W.Y.C., 2011, 'Probing the effect of author self-citations on h index: a case study of environmental engineering', *Journal of Information Science*, 37(5), pp. 453–61.
Imperial, J. & Rodriguez-Navarro, A., 2007, 'Usefulness of Hirsch's h-index to evaluate scientific research in Spain', *Scientometrics*, 71(2), pp. 271–82.
Jacso, P., 2005a, 'As we search: comparison of major features of the Web of Science, Scopus, and Google Scholar citation-based and citation-enhanced databases', *Current Science*, 89(9), pp. 1537–47.
Jacso, P., 2005b, 'Google Scholar: the pros and the cons', *Online Information Review*, 29(2), pp. 208–14.
Jacso, P., 2006, 'Deflated, inflated, and phantom citation counts', *Online Information Review*, 30(3), pp. 297–309.
Katsaros, D., Matsoukas, V. & Manolopoulos, Y., 2008, 'Evaluating Greek departments of computer science & engineering using bibliometric indices', paper presented at *The Panhellenic Conference on Informatics* (PCI), Samos Island, Greece, 28–30 August.
Kelly, C.D. & Jennions, M.D., 2006, 'The h-index and career assessment by numbers', *Trends in Ecology and Evolution*, 21(4), pp. 167–70.
Lazaridis, T., 2010, 'Ranking university departments using the mean h-index', *Scientometrics*, 82(2), pp. 211–6.
Martin, B.R., 1996, 'The use of multiple indicators in the assessment of basic research', *Scientometrics*, 36(3), pp. 343–62.
May, R.M., 1997, 'The scientific wealth of nations', *Science*, 275(5301), pp. 793–6.
Meho, L.I., 2007, 'The rise and rise of citation analysis', *Physics World*, 20(1), pp. 32–6.
Meho, L.I. & Yang, K., 2007, 'Impact of data sources on citation counts and rankings of LIS faculty: Web of Science versus Scopus and Google Scholar', *Journal of the American Society for Information Science and Technology*, 58 (13), pp. 2105–25.
Moed, H.F., 2008, 'UK research assessment exercises: informed judgments on research quality or quantity?', *Scientometrics*, 74(l), pp. 153–61.
Norris, M. & Oppenheim, C., 2007, 'Comparing alternatives to the Web of Science for coverage of the social sciences' philology', *Journal of Informetrics*, 1(2), pp. 161–9.
Norris, M. & Oppenheim, C., 2010, 'The h-index: a broad review of a new bibliometric indicator', *Journal of Documentation*, 66(5), pp. 681–705.
Oppenheim, C., 2007, 'Using the h-index to rank influential British researchers in information science and librarianship', *Journal of the American Society for Information Science and Technology*, 58(2), pp. 297–301.
Rad, A.E., Shahgholi, L. & Kallmes, D., in press, 'Impact of self-citation on the H index in the field of academic radiology', *Academic Radiology*. Available online at: http://dx.doi.org/10.1016/j.acra.2011.11.013
Rousseau, R., 2007, 'The influence of missing publications on the Hirsch-index', *Journal of Informetrics*, 1(1), pp. 2–7.

Saad, G., 2006, 'Exploring the h-index at the author and journal levels using bibliometric data of productive consumer scholars and business-related journals respectively', *Scientometrics*, 69(1), pp. 117–20.

Schreiber, M., 2007, 'Self-citation corrections for the Hirsch-index', *European Physics Letters*, 78, Art. No. 30002, pp. 1–6.

SCImago, 2007, 'SJR – SCImago Journal & country rank'. Available online at: http://www.scimagojr.com (accessed 23 February 2010).

Sidiropoulos, A., Katsaros, D. & Manolopoulos, Y., 2006, 'Generalized Hirsch h-index for disclosing latent facts in citation networks', *Scientometrics*, 72(2), pp. 253–80.

Tselios, N. & Altanopoulou, P., 2011, 'Evaluation of Greek education university departments using Google Scholar's h index', paper presented at the 2nd *Panhellenic conference, Integration and usage of ICT in education*, Patras, Greece, pp. 867–76, 28–30 April [in Greek].

Van Raan, A.J., 2006, 'Comparison of the Hirsch-index with standard bibliometric indicators and with peer judgment for 147 chemistry research groups', *Scientometrics*, 67(3), pp. 491–502.

Vanclay, J.K., 2007, 'On the robustness of the h-index', *Journal of the American Society for Information Science and Technology*, 58(10), pp. 1547–50.

Vinkler, P., 2007, 'Eminence of scientists in the light of the h-index and other scientometric indicators', *Journal of Information Science*, 33(4), pp. 481–91.