The Rainbow over the Greek Departments of Computer Science/Engineering: a Bibliometric Study

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ABSTRACT

Various scientometric indices have been proposed in an attempt to express the quantitative and qualitative characteristics of scientific output. In this paper, we revisit several scientometrics indicators and apply the Rainbow Ranking method [1] [2] to categorize the academic personnel of the Departments of Informatics (Computer Science and Engineering) of Greek Universities. The dataset consists of ~700 Greek university professors along with all the relevant data and metadata about their publications and citations as identified in Microsoft Academic Search.

KEYWORDS

Scientometrics; bibliometrics; ranking; skyline; rainbow ranking

1 INTRODUCTION

A very commonly used quantitative criterion for the research evaluation of a scientist is the number of his/her published articles (*P*). Apparently, this is an indicator of his/her productivity but this does not necessarily illustrate the quality of his/her work. In bibliometrics, the number-one criterion to assess the quality of a researchers work is the total number of citations (*C*) that his/her publications received. Another criterion in this direction is the number of citations per publication (*C/P*), which reflects the average quality of his/her publications.

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In 2005, Jorge Hirsch introduced the *h-index* that measures quantity and quality at the same time, in a single two-dimensional number [3]. Several other indices have been proposed in the literature as alternative ones or supplementary to *h-index*, such as *g-index* [4], *A-index* [5], *R-index and AR-index* [6], *h2-index* [7], *hg-index* [8], among others. Another family of indices embedded the time dimension in the *h-index*, such as the *contemporary h-index* and *trend h-index* [9].

Each one of the above indices focuses into different aspects of academic performance. Saying that a particular index is better than another; does not have an absolutely sound basis. On the contrary, an individual's performance should be evaluated by using a set of indices. To this end, the Skyline operator has been proposed to identify top scientists based not only on one, but on a set of such bibliometric indicators [10]. Finally, in [1] [2] have been introduced the Rainbow Ranking as a further tool to boost the concept of categorizing with the skyline operator.

In the sequel we make a summarization of skyline operator and Rainbow Ranking. In the next section the experiments are presented and finally we conclude the article.

1.2 Skyline Operator

As discussed in the previous, given a set of methods that assess scientific performance, the *skyline operator* extracts the scientists that cannot be surpassed by any other in the dataset. The concept of skyline, calculated by the respective operator [11], has been utilized in the Computer Science field for decades and dates back to the definition of the *Pareto frontier* in economics [12]. However, the skyline set does not refer to ranking or scoring; rather it provides a multi-criteria selection of distinguished scientists.

Several experiments have been performed to properly select the dimensions that will serve as input attributes to the skyline calculation [1] [10]. The results of the analysis reported in the above works comply with findings in the literature, which demonstrated that there exist highly correlated scientometric indicators [13]. Therefore, the skyline frontiers do not vary

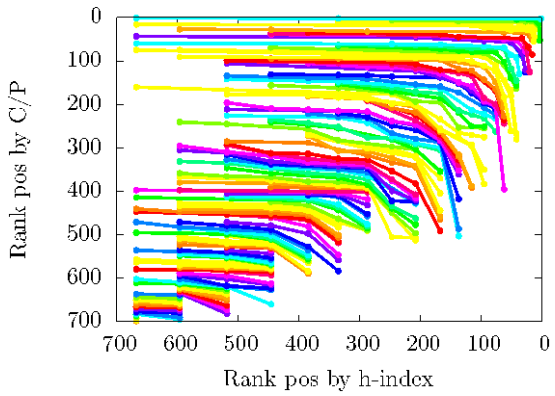

Figure 1: Rainbow Ranking example plot.

significantly with different combinations of dimensions, as long as they are derived from cluster with correlated indices.

The Skyline operator selects the best performing scientific entities based on multiple criteria, but does not assign a meaningful and comparable ranking score to every scientist in the dataset. Therefore, *Rainbow-Ranking* was introduced in [1] [2] to apply the Skyline operator iteratively until all scientists of a dataset have been classified into a skyline level. More specifically, given a set of scientists $A=X_1$, the first call of skyline produces the first Skyline level. We denote this first set of scientists as set S_1. In the next step, we compute set $X_2=X_1-S_1$ which contains the scientists in the dataset that were not classified in the first skyline set S_1. For the set X_2 the Skyline operator is applied again to derive the second skyline level (S_2). This process continues until all the scientists of the dataset have been assigned a value that corresponds to the skyline level they have been ranked in.

Figure 1 shows a graphical representation of the skyline levels for the Rainbow Ranking with two dimensions: the citations per paper (*C/P*) and the *h-index*. Every point in the plot corresponds to a scientist. The x-axis represents ranking positions of each scientist according to his *h*-index, whereas on the y-axis the respective ranking positions according to the citations per paper. Each line connects the points corresponding to a particular skyline level. Apparently, a score value should be assigned to each rank level. If this score was simply the skyline level number, then it would rather provide limited intuition about the ranking of particular scientist in relation to his/her peers. Thus, a kind of normalization for this value is necessary.

Given a set of scientists A and a set of rank dimensions (criteria) *dims*, we define the RR-index of a scientist a based on *dims* as:

$$RR(a, dims) = 100 - 100 * \left(\frac{|A_{above}(a, dims)|}{|A|} + \frac{|A_{tie}(a, dims)|}{2 * |A|} \right)$$

In the above equation, $|A|$ is the total number of scientists in our dataset, $|A_{above}(\alpha,dims)|$ is the number of scientists who are ranked in higher levels compared to scientist α based on *dims*. Note that level 1 is considered higher than level 2 in a rank table. Additionally, $|A_{tie}(\alpha,dims)|$ is the number of scientists ranked in the same level with scientist α, not including that scientist α. Consequently, the following relation holds for the RR-index:

$$0 < RR(a, dims) \leq 100$$

The case when $RR(a,dims)=100$ means that scientist α is ranked in the first skyline level alone.

The key components for the calculation of the RR-index are the skyline dimensions. By selecting different bibliometric indices as skyline dimensions, the calculated RR-index can be fully customizable. However, as bibliometric indices are highly correlated with each other, selecting highly correlated indices interchangeably would yield analogous results in the final RR ranking.

2 EXPERIMENTS

2.1 Dataset

Our dataset was acquired from Microsoft Academic Search[1] (MAS). In particular, we identified the Greek Universities academic staff by using each department's website[2]. For each person we kept track of his/her rank and department. Then, for each one, we identified his/her ID in MAS by using their web interface. After finding the IDs, we acquired the data by using the API (v.1) provided by MAS. For each author we acquired the full list of his/her publications, whereas for each publication we fetched the full list of the papers citing it as reported by MAS. At this point, we notice that multiple author profiles were found in many cases. Attempts were made to clear all kinds of duplicates. Also, not all academic staff has been identified in MAS, since there were missing profiles. To conclude, our dataset is not complete as it does not include the whole academic community of the Departments of Informatics of the Greek Universities; however, it is more than indicative and includes the vast majority of this community.

In Table 1 we show an overview of our dataset characteristics. In total, 659 Greek CS academicians were identified in MAS. They are totaling 36K of publications, which have received about 167K citations.

2.2 Experimental Results

Figure 2 illustrates the number of members of each university rank as well as their corresponding average number of publications. As expected, Honorary, Emeritus/Former Professors have the highest number of publications, full professors the next one and so on.

[1] We appreciate the offer of Microsoft to gratis provide their database API. The API used in this work has been discontinued by Microsoft during the summer of 2016.

[2] This part of work was performed during 2013, so the professor ranks are behindhand. Also, the departments were identified before the department merges performed by project Athena.

Table 1: Database Characteristics.

Number of Authors	659
Number of publications	36451
Average Publications per Author	55,3
Average Citations per Author	380,4
Average Citations per Publication	4,6
Average h-index	7,1
Max h-index	76

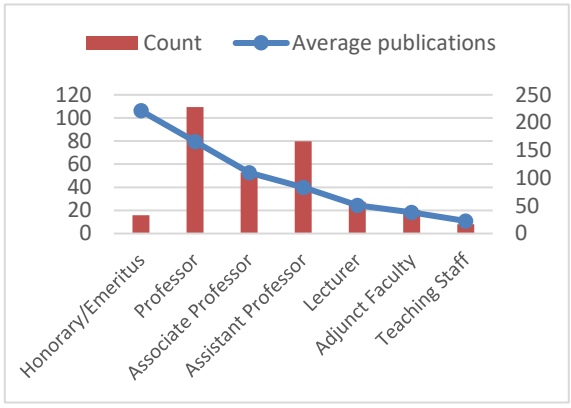

Figure 2: Number of Authors based on academic rank.

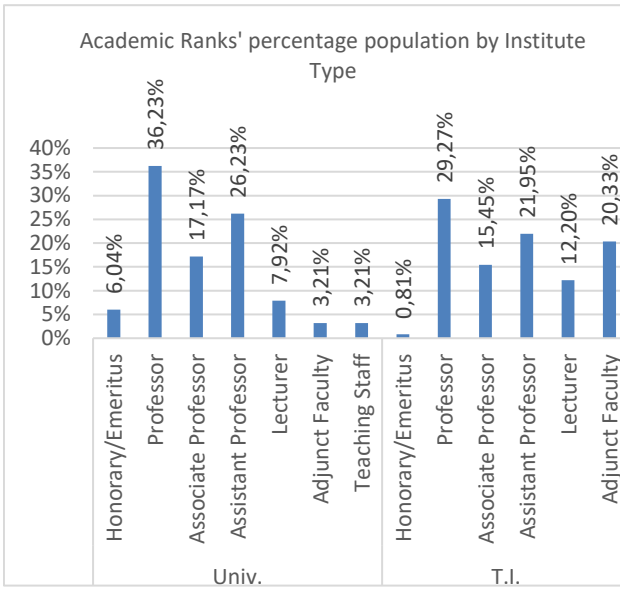

Figure 3: Academic Rank percentages by Institute Type.

At this point, we notice that the rank labeled "Lecturer" includes both lecturers and "Application Professors" serving at Technological Institutes. Also, the category "Adjunct Faculty" includes any kind of temporal teaching personnel (i.e. contract professor by law PD407 in Universities or Scientific/Laboratory

Table 2: Average scores per rank.

Rank	Avg C	Avg C/P	Avg h-index	Min h-index	Max h-index	Avg RR	Min RR	Max RR
Honorary/Emeritus	1564.9	5.8	10.6	1	76	56.5	7.1	100.0
Professor	547.5	5.4	9.1	0	42	59.1	2.0	99.6
Associate Professor	282.4	4.6	7.3	0	20	53.3	2.0	97.6
Assistant Professor	206.6	4.5	6.3	0	27	48.6	2.0	97.6
Lecturer	104.7	3.3	4.4	0	15	36.3	2.0	90.9
Adjunct Faculty	52.6	2.5	2.9	0	14	27.2	2.0	88.2
Teaching Staff	29.9	2.7	1.9	0	8	21.3	2.0	69.4
Grand Total	383.6	4.6	7.2	0	76	50.3	2.0	100.0

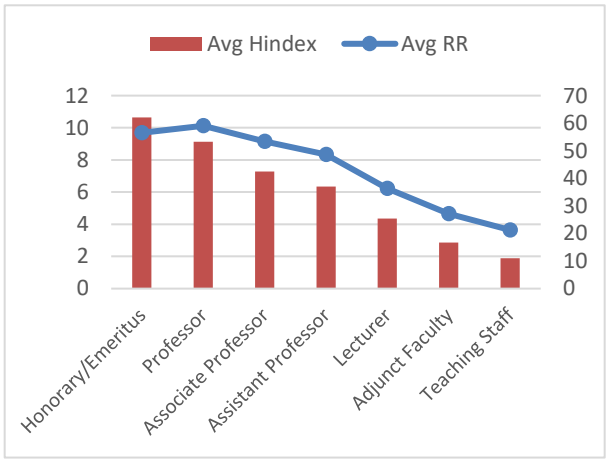

Figure 4: **h-index vs. RR-index per Academic Rank.**

Fellow in Technological Institutes). Finally, the category "Teaching Staff" includes any other kind of teaching personnel.

In Figure 3 we present the percentage of each academic rank grouped by institution type (University vs. Technological Institute). It can be seen that the distributions of the academic ranks "Professor", "Associate Professor", "Assistant Professor" and "Lecturer" show a similar behavior in both types of institutions. The rank of Professor is the most populous rank with second the Assistant Professor. Concerning the "Honorary, Emeritus/Former" group, it can be seen that the Universities have a much greater number in comparison to the Technological Institutes. A final remark is that the rank of Adjunct Faculty was very populated in the Technological Institutes until 2013 or probably the Universities did not publish systematically their names in their websites.

For each academic rank, Table 2 depicts the following aggregate values: average number of total citations, average number of citations per publication, average h-index, minimum and maximum h-index as well as average, minimum and maximum values of Rainbow Ranking Index. It can be seen that

the Honorary/ Emeritus/Former Professors have a much larger number of citations than other groups. All the average values are justifiable since they follow the academic rank. It is noticeable that the minimum value for h-index is zero for all groups. This means that do exist scientists with zero citations in all ranks. The most possible reason for that is the incompleteness of data provided by MAS or the incomplete author identification made manually.

In Figure 4 it is shown that the average value for RR does not necessarily follow the average value of h-index. Honorary/Emeritus or Former group do have the highest value in h-index but not the highest one in RR.

Table 3 shows the first 8 skyline levels. As expected, distinguished researchers exist in the first places. Christos Papadimitriou (UC Berkeley) and Christos Faloutsos (Carnegie Mellon University) are Honorary Professors of the University of Macedonia and the Aristotle University of Thessaloniki, respectively.

Also, it can be seen that in each skyline level, no one prevails any other in all dimensions. For example, in skyline level 4, Costas Courcoubetis excels according to the A-index, Yannis Ioannidis according to h-index, whereas Dimitrios Gunopulos according to the Contemporary h-index.

Table 4 shows the lists of the departments that the experiment concerns. We have included all computer Science Departments as well as Electrical Engineering. In the sequel, for brevity reasons we use the URL/domainname of each

Table 3: Rank Table for the first 8 Skyline levels.

Name	P	C	C/P	h-index	A-index	h^C-index	skyline	RR
Papadimitriou Christos	601	24951	41.5	76	234.3	30	1	100.0
Faloutsos Christos	460	17374	37.8	64	208.2	31	2	99.8
Tassiulas Leandros	302	7755	25.7	38	163.7	22	3	99.6
Pitas Ioannis	484	6134	12.7	42	88.1	17	3	99.6
Courcoubetis Costas	153	4938	32.3	30	139.8	12	4	99.2
Ioannidis Yannis	199	4420	22.2	38	89.9	16	4	99.2
Gunopulos Dimitrios	192	5359	27.9	36	112.4	19	4	99.2
Theodoridis Sergios	177	2401	13.6	15	138.5	8	5	98.6
Koutsoupias Elias	69	2170	31.4	20	96.0	12	5	98.6
Maragos Petros	221	3065	13.9	27	81.1	11	5	98.6
Vazirgiannis Michalis	147	2661	18.1	24	86.2	13	5	98.6
Tollis Ioannis	157	2467	15.7	21	88.6	8	5	98.6
Garofalakis Minos	153	3702	24.2	35	80.8	18	5	98.6
Theodoridis Yannis	129	2336	18.1	26	75.7	13	6	97.6
Dertouzos Michael	33	520	15.8	5	102.4	3	6	97.6
Vassalos Vasilis	56	1204	21.5	13	83.8	7	6	97.6
Polyzos George	187	2466	13.2	24	79.5	11	6	97.6
Achlioptas Dimitris	95	1917	20.2	27	52.0	12	6	97.6
Maglaris Basil	69	1060	15.4	10	94.6	6	6	97.6
Manolopoulos Yannis	288	2792	9.7	24	74.6	11	7	97.0
Kazarlis Spiridon	7	478	68.3	6	79.5	4	7	97.0
Georgiou D.	32	534	16.7	7	75.7	5	7	97.0
Parsopoulos Konstantinos	60	1577	26.3	19	73.7	11	8	96.3
Kotidis Yannis	85	1652	19.4	20	73.3	12	8	96.3
Kollias Stefanos	280	2141	7.6	22	63.0	11	8	96.3
Markatos Evangelos	132	1846	14.0	23	60.2	12	8	96.3
Christodoulakis Stavros	147	2107	14.3	24	66.4	11	8	96.3
Androutsopoulos Ion	57	1215	21.3	14	74.1	8	8	96.3

Table 4: Departments URLs used for abbreviation.

URL	Department Name, Institution
csd.uoc.gr	Dept. of Computer Science – University of Crete
di.uoa.gr	Dept. of Informatics & Telecommunications – National & Kapodistrian University of Athens
ece.tuc.gr	School of Electrical & Computer Engineering – Technical University of Crete
cs.aueb.gr	Dept. of Informatics – Athens University of Economics & Business
cs.uoi.gr	Dept. of Computer Science & Engineering – University of Ioannina
ee.auth.gr	Dept. of Electrical & Computer Engineering – Aristotle University of Thessaloniki
csd.auth.gr	Dept. of Informatics – Aristotle University of Thessaloniki
ece.ntua.gr	School of Electrical & Computer Engineering – National Technical University of Athens
ceid.upatras.gr	Dept. of Computer Engineering & Informatics – University of Patras
ds.unipi.gr	Dept. of Digital Systems – University of Piraeus
inf.uth.gr	Dept. of Electrical & Computer Engineering – University of Thessaly
ece.upatras.gr	Dept. of Electrical & Computer Engineering – University of Patras
cs.unipi.gr	Dept. of Informatics – University of Piraeus
dit.uop.gr	Dept. of Informatics & Telecommunications – University of Peloponnese
di.ionio.gr	Dept. of Informatics – Ionian University
icsd.aegean.gr	Dept. of Information & Communication Systems Engineering – University of the Aegean
ee.duth.gr	Dept. of Electrical & Computer Engineering – Democritus University of Thrace
icte.uowm.gr	Dept. of Informatics & Telecommunications Engineering – University of Western Macedonia
dib.uth.gr	Dept. of Computer Science & Biomedical Informatics – University of Thessaly
uom.gr	Dept. of Applied Informatics – University of Macedonia
dit.hua.gr	Dept. of Informatics & Telematics – Harokopio University
epp.teicrete.gr	Dept. of Electronic Engineering – Technological Educational Institute of Crete
inf.teilam.gr	Dept. of Informatics – Technological Educational Institute of Sterea Ellada
ce.teiep.gr	Dept. of Informatics – Technological Educational Institute of Epirus
informatics.teicm.gr	Dept. of Informatics – Technological Educational Institute of Central Macedonia
it.teithe.gr	Dept. of Informatics – Alexander Technological Educational Institute of Thessaloniki
informatics.teiwm.gr	Dept. of Informatics – Technological Educational Institute of Western Macedonia
amaliada.teipat.gr	Dept. of Informatics in Administration & Economics – Technological Educational Institute of Amaliada
cied.teiwest.gr	Dept. of Informatics – Technological Educational Institute of West Hellas
cs.teiath.gr	Dept. of Informatics – Technological Educational Institute of Athens
infomm.teipat.gr	Dept. of Informatics & Media – Technological Educational Institute of West Hellas
cs.teilar.gr	Dept. of Computer Science & Engineering – Technological Educational Institute of Larisa (now Thessaly)
teikav.edu.gr	Dept. of Informatics – Technological Educational Institute of East Macedonia & Thrace
cs.teikal.gr	Dept. of Informatics – Technological Educational Institute of Peloponnese

department.

Table 5 ranks the departments according to the average total number of citations per author. Again, the University of Athens, the Aristotle University and the University of Crete stand in the first three places. Also, the Alexander Technological Institute of Thessaloniki is the first department of Technological Institutes.

Figure 5 shows the full list of the departments ordered by the average Rainbow Rank Index. It can be seen that the University of Athens stands in the first place, whereas the University of Crete and the Technical University of Crete take the second and the third ones. In the same table, we can see that the National Technical University of Athens is the most populated department with more than 70 members, whereas the second department in this respect is University of Patras. These two departments are the oldest informatics related departments in Greece.

Table 5: Rank table with Departments.

Department	Avg C	Avg C/P	Avg P	Avg h-index	Avg A-index	Avg RR	#Members
di.uoa.gr	918	8.6	90.1	13.1	37	71.8	33
csd.auth.gr	753	4.9	106.0	11.3	27	62.1	23
csd.uoc.gr	696	7.8	74.0	11.8	34	70.8	18
cs.aueb.gr	691	8.2	58.3	9.6	35	62.5	32
ece.tuc.gr	556	7.4	58.5	9.5	32	65.3	22
inf.uth.gr	551	5.6	45.4	7.6	27	53.0	20
cs.uoi.gr	442	6.9	57.7	9.5	27	62.4	22
ece.ntua.gr	400	4.1	86.1	8.6	23	59.2	65
ceid.upatras.gr	375	3.8	84.1	9.2	19	57.7	21
cs.unipi.gr	332	4.4	64.4	7.9	20	53.7	17
ee.auth.gr	224	6.6	53.3	7.6	22	60.7	9
ds.unipi.gr	212	3.8	66.5	6.8	19	54.6	22
ece.upatras.gr	204	3.5	54.8	6.1	19	52.3	41
dit.uop.gr	197	4.8	33.9	6.5	17	50.7	14
dib.uth.gr	164	3.3	37.4	5.6	14	41.2	12
ee.duth.gr	158	3.1	43.8	5.5	15	43.3	39
it.teithe.gr	145	4.3	21.3	4.7	13	35.7	17
inf.teilam.gr	142	3.8	33.4	5.8	15	45.7	8
icte.uowm.gr	129	2.9	39.7	5.8	13	41.5	9
icsd.aegean.gr	127	3.0	45.7	5.9	13	43.6	20
epp.teicrete.gr	118	3.8	38.6	5.3	16	48.3	9
teikav.edu.gr	116	1.7	21.5	3.0	8	21.8	4
informatics.teicm.gr	106	8.1	18.3	4.0	15	36.3	13
di.ionio.gr	97	4.0	30.4	4.4	16	45.6	19
ce.teiep.gr	78	2.4	23.8	3.8	12	37.1	8
dit.hua.gr	71	2.8	24.4	3.8	9	30.6	19
cs.teiath.gr	61	2.4	21.8	3.0	8	25.9	32
uom.gr	61	2.3	24.0	3.1	13	34.2	21
cied.teiwest.gr	43	1.7	19.8	2.8	8	26.6	13
amaliada.teipat.gr	30	4.1	7.5	1.8	9	26.8	6
cs.teilar.gr	25	1.6	16.0	2.3	6	22.4	9
informatics.teiwm.gr	25	2.1	18.0	2.0	10	31.4	2
infomm.teipat.gr	20	1.4	15.8	1.8	7	23.3	6
cs.teikal.gr	19	1.5	13.0	2.0	6	18.7	1
Grand Total	318	4.5	52.6	6.9	20	49.7	626

Figure 6 is similar to the previous one, but in a more illustrative format. It presents the departments ordered by the average h-index value. Again, the University of Athens is at the first place, University of Crete at the second, whereas the Aristotle University is placed third. In this plot, the average number of publications per person is depicted as well. We can see that the Aristotle University has the greatest value with respect to the number of publications, whereas the University of Athens is placed second with the National Technical University of Athens at the third place. At this point, we mention that in all cases we have excluded all the Honorary, Emeritus and Former Professors from the aggregates per department to unbias the results.

3. CONCLUSIONS

This study introduces the concept of Rainbow Ranking, which is a powerful method to categorize researchers according to a customizable set of independent assessment indicators, and not according to a single index which may focus on particular aspects.

We have applied this concept to the set of academic staff of the Departments of Computer Science/Engineering of Greek Universities. This set has been built with data acquired form the Microsoft Academic Search.

We have provided ranking on individuals and departments as well. The two first positions of individual researchers are taken by two Honorary Professors, i.e. Christos Papadimitriou and Christos Faloutsos. Subsequently, it is Leandros Tassiulas of the University of Thessaly and Ioannis Pitas of the Aristotle University that take the next individual places.

At aggregate level, it is a few departments which demonstrate a high performance according to assorted criteria, the RR-indexing in particular. Among these departments we mention, the University of Athens, the University of Thessaloniki, the University of Crete and the Technical University of Crete.

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REFERENCES

[1] G. Stoupas, *Citation Graph Analysis and Application of Prototype Evaluation and Ranking Methods,* Master Thesis: Alexander Technological Institute of Thessaloniki, 2017.

[2] G. Stoupas, A. Sidiropoulos, A. Gogoglou, D. Katsaros and Y. Manolopoulos, "A Rainbow at the Skyline after the Storm of Indicators for Ranking Scientists," in *Proceedings of 16th International Society of Scientometrics & Informetrics Conference (ISSI), submited.*

[3] J. E. Hirsch, "An index to quantify an individual's scientific

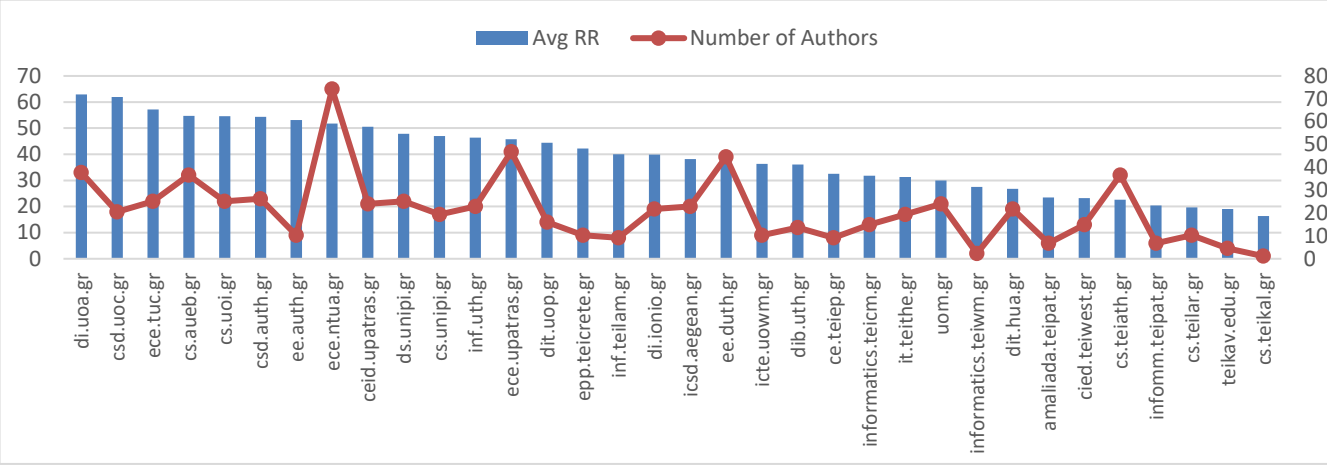

Figure 5: **Departments ordered by average RR (left axis) and number of members for each department (right axis).**

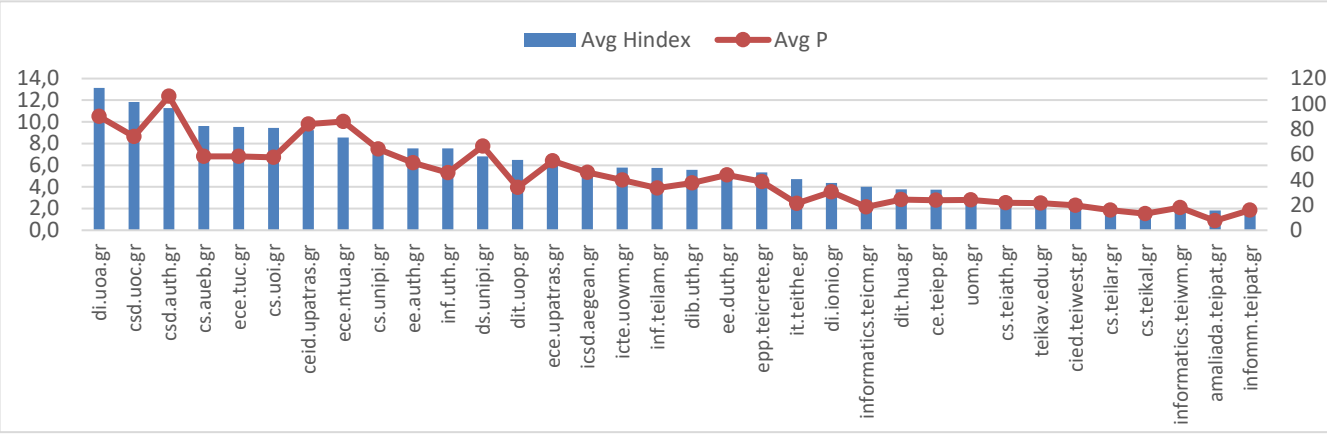

Figure 6: **Departments ordered by average h-index (left axis) and average number of publications per member (right axis).**

research output," *Proceedings of the National Academy of Sciences of the United States of America*, vol. 102, no. 46, pp. 16569-16572, 2005.

[4] L. Egghe, "Theory and practise of the g-index," *Scientometrics*, vol. 69, no. 1, 2006.

[5] Q. L. Burrell, "On the h-index, the size of the Hirsch core and Jin's A-index," *Journal of Informetrics*, vol. 1, no. 2, 2007.

[6] B. Jin, L. Liang, R. Rousseau and L. Egghe, "The R- and AR-indices: Complementing the h-index," *Chinese Science Bulletin*, vol. 52, no. 6, 2007.

[7] M. Kosmulski, "A new Hirsch-type index saves time and works equally well as the original h-index," *ISSI Newsletter*, vol. 2, no. 3, pp. 4-6, 2006.

[8] S. Alonso, F. J. Cabrerizo, E. Herrera-Viedma and F. Herrera, "hg-index: a new index to characterize the scientific output of researchers based on the h- and g-indices," *Scientometrics*, vol. 82, no. 2, pp. 391-400, 2010.

[9] A. Sidiropoulos, D. Katsaros and Y. Manolopoulos, "Generalized Hirsch h-index for disclosing latent facts in citation networks," *Scientometrics*, vol. 72, no. 2, pp. 253-280, 2007.

[10] A. Sidiropoulos, A. Gogoglou, D. Katsaros and Y. Manolopoulos, "Gazing at the Skyline for Star Scientists," *Journal of Informetrics*, vol. 10, no. 3, pp. 789-813, 2016.

[11] S. Börzsönyi, D. Kossmann and K. Stocker, "The skyline operator," *Proceedings of the IEEE International Conference on Data Engineering (ICDE).*, pp. 421-430, 2001.

[12] M. Voorneveld, "Characterization of Pareto dominance.," *Operations Research Letters*, vol. 31, no. 1, pp. 7-11, 2003.

[13] L. Wildgaard, J. Schneider and B. Larsen, "A review of the characteristics of 108 author-level bibliometric indicators," *Scientometrics*, vol. 101, no. 1, pp. 125-158, 2014.