

ASSESSING OF THE RESEARCH OUTPUT USING HIRSCH INDEX IN THE CHEMISTRY GROUP FROM VALAHIA UNIVERSITY OF TARGOVISTE*

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Abstract. *The evaluation of the scientific activity of individual and institutional research outputs has long attracted significant interest. The scientific performances of the Faculty of Sciences and Arts in the Valahia University of Targoviste were analyzed using different scientometric indicators (number of published papers, influence score, impact factor, Hirsch index a.s.o). For Hirsch determination different databases has been used (Advanced Google, Scholar, Scopus, ISI Web of Science, Google Academic). A remarkable finding was the outstanding performance in basic sciences where high level research has been evidenced.*

Keywords: *research, Scientometry, impact factor, influence score, Hirsch index.*

1. INTRODUCTION

Scientific research is the domain that makes the difference in the performance and visibility between the higher education institutions in our country. The scientometric parameters that characterize the research performance of a given group of faculty members can be, for example, the overall number of papers, the total number of citations, the number of highly cited papers published, the mean number of citations per paper, the impact factor, the influence score, the Hirsch index and so on.

The Hirsch index (h) is a simple measurement of both the number of papers published by a faculty member and the number of citations received by those publications [1]. A scientist with a certain “ h ” index has published “ h ” papers, each of them been cited by others at least “ h ” times.

The Hirsch index is influenced by the database used for its calculation (Google Scholar, Scopus, ISI Web of Science, Scifinder etc.) [2] through the number of citing references which can differ [3]. The Hirsch index graphics can be determined manually or automatically (Scopus and ISI Web of Knowledge). Generally, Google Scholar has more citations than Scopus and Web of Science [4].

Different authors have proposed a normalized version of the Hirsch index, such as:

$$h^n = \frac{h}{N_p} \quad (1)$$

where N_p is the total number of papers published by the scientist [5], or:

$$m = h/y \quad (2)$$

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where y is the number of years since the author's first paper [1].

Many other scientometric parameters can be found in the literature [6].

2. EXPERIMENTAL

The number of papers published in the name of Valahia University of Targoviste (UVT), respectively indexed, per year, between 2002 and 2011 has been analyzed using the Ad Astra database [7]. Also, the number and the type of domains approached by the UVT papers published in the aforementioned period have been analyzed, cumulatively computing the influence score and the impact factor. For the same time span, the overall number of papers and the total number of papers published in the specialized foreign journals and authored by the members of Chemistry Department have been analyzed. Also, the Hirsch indexes for ISI Web of Science and Scholar databases have been determined. The "H" values have been graphically computed for two other databases.

3. RESULTS AND DISCUSSION

Table 1 shows the number of annually published papers by UVT teaching staff between 2002 and 2011, while figures 1 and 2 present the graphic version of these data.

Table 1. Evolution of total number of articles published by UVT staff members in ISI Journals between 2002 and 2011

Item no.	Year	Number of published papers	Number of indexed papers
1	2002	10	9
2	2003	14	12
3	2004	25	21
4	2005	22	25
5	2006	34	33
6	2007	31	23
7	2008	47	50
8	2009	55	56
9	2010	113	108
10	2011	30	44

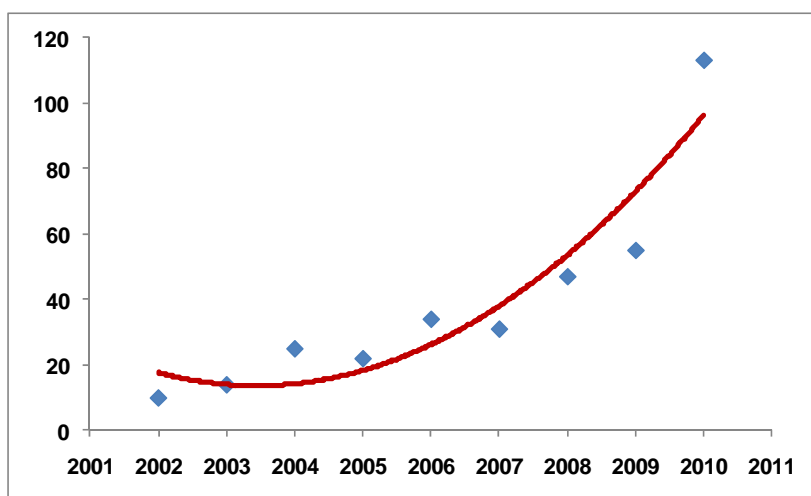


Fig. 1. The total number of papers published per year by UVT staff members during 2002-2011 in ISI ranked journals.

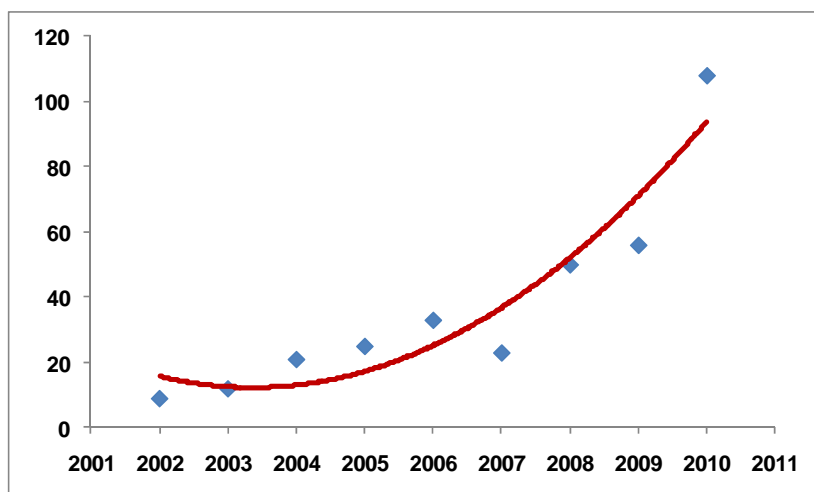


Fig. 2. The total number of papers indexed per year for UVT, during 2002-2011.

Of the total published papers (380), single authored papers amount to 17.63% followed by two authors forming 13.42%, while 15.79% of the contributions have three authors. Four authored papers were 13.16%, 19.21% of the contributions were by five authors and 8.42% of the contributions are published by a number of six authors. More than six author's papers represented 12.37%. This can be visualized from the table 2.

Table 2. The number of authors of the papers published by UVT staff members.

Number of authors	Number of contributions	Percentage
Single author	67	17.63
Two authors	51	13.42
Three authors	60	15.79
Four authors	50	13.16
Five authors	73	19.21
Six authors	32	8.42
More than six authors	47	12.37
Total	380	100

It must be pointed out that 18% of total number of the published papers has been produced with foreign scientific cooperation. The foreign co-authors were from France (14), Portugal (8), Algeria (5), Italy (4), Finland (4), Brazil (3), Switzerland (3), United Kingdom (2), Russia (2) and so on.

As these data reveal, the evolution in time of the total number of ISI papers is ascending and, thus, the likely prediction of an outstanding scientific performance is provided.

The scientific domains approached in the papers published by UVT staff members are shown in Table 3. The analysis of the papers covered by the 20 domains was done on the basis of the cumulated influence score and impact factor.

The influence score is a rating which reflects, for a certain scientific journal, the average influence of a paper from that journal over the first five years after publication by considering the number of citations received by the journal papers in relation with the influence of the journal which cite the papers.

The impact factor is calculated by the ratio between the numbers of citations to the papers published over a certain period of time. Both the influence score and the impact factor are ratings calculated by Thomson Reuters and are published in Journal Citation Reports.

Table 3. The domains covered by the papers published by UVT staff members.

Domain	Number of papers	Influence score	Impact Factor
Chemistry	105	64.4	58.1
Materials Science	123	50.6	43.5
Physics	88	48.6	35.4
Mathematics	39	31.6	33.7
Chemical Engineering	73	23.1	29.5
Informatics	17	14	13.4
Multidisciplinary Engineering	9	12.2	12.1
Electronics, Telecommunications and Electrical Engineering	6	11.3	6.4
Nuclear Technology	8	8.7	8.8
Biology	8	6.5	4.3
Medicine and Pharmacy	4	1.6	2.4
Environmental Science	11	1.4	4.6
Industrial Engineering	2	1.3	2.3
Culture, Folklore	1	0.9	0.9
Economics and Affairs	2	0.7	1.9
Automatics, Robotics	5	0	1.2
Miscellaneous	4	0	0
Sociology, Political Sciences, Journalism	2	0	1
Philosophy	2	0	1
Civil Engineering and Construction	1	0	0.2

The data presented show an appropriate agreement between the two scientometric parameters analyzed for the published papers, simultaneously acknowledging once again the existence of a superior value for the basic sciences as illustrated in figure 3.

These results are in perfect accordance with the individual performances of the academic teaching staff [8]. The situation presented in Table 4 evidences the number of ISI papers between 2002 and 2011 (on Ad Astra data) authored by the Chemistry Department members.

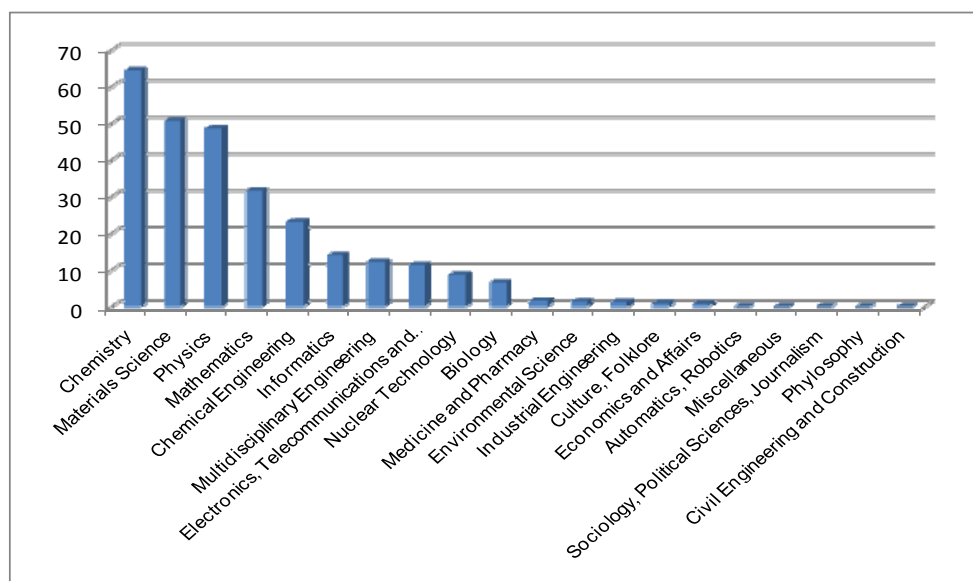
**Fig. 3. Cumulated influence score variation with the domain of ISI papers publication.**

Table 4. The number of papers published by Chemistry Department members between 2002 and 2011.

Chemistry Department member	Total of ISI papers	ISI papers in foreign academic journals
P1	111	38
P2	64	26
P3	30	11
C1	45	12
C2	34	3
C3	39	6
L1	19	3
L2	11	1
A1	11	1
A2	17	3
A3	8	1

P – Professor; C – Associated Professor; L – Lecturer; A – Teaching Assistant

The Hirsch index attempts to measure the productivity of publishing scientific papers by a person as well as the impact of the published papers. Table 5 presents the h-index automatically determined for some professors and associate professors in Chemistry Department, using ISI Web of Science databases, respectively Scholar.

Table 5. Comparison of h-indices derived from ISI Web of Science and Scholar.

Chemistry Department member	h-index generated by ISI Web of Science	h-index generated by Scholar
P1	11	8
P2	11	8
P3	10	5
C1	7	4
C2	5	2
C3	6	2

P – Professor; C – Associate Professor

These data show that an $h \geq 7$ index is respectable at European level and very good at national level [9]. It can be also noted that the database, by the differently recorded number of citations, exerts a considerable influence on the condition of this scientometric parameter. The h-index can be determined by using Google Scholar, Scopus, ISI Web of Science, Scifinder a.s.o. as databases.

In the following figures we present the differences between the Hirsch index values in the case of some graphic determinations (manual), using various databases (e.g. Google Academic, ISI Web of Science, Scopus and Advanced Google Scholar) (Figs. 4 – 7).

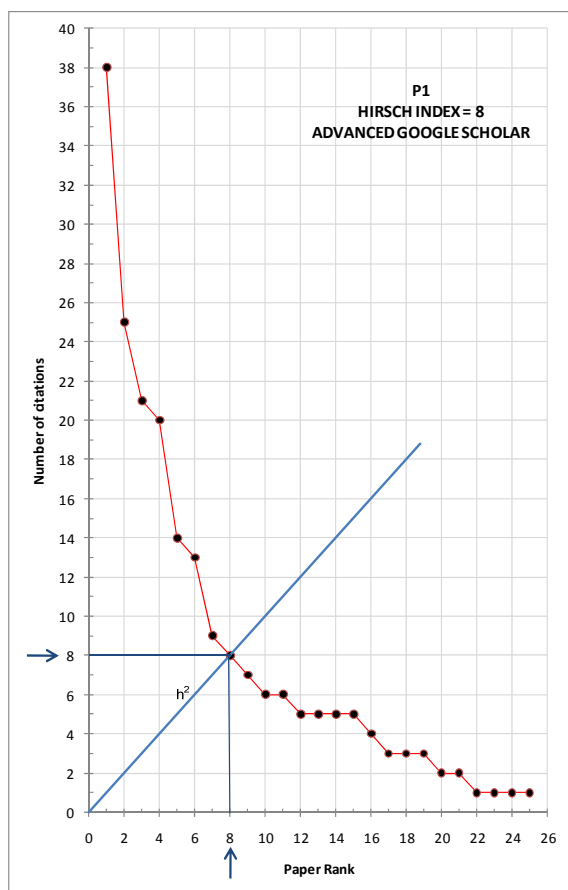


Fig. 4. Hirsch index graphic determination using Advanced Google Scholar database.

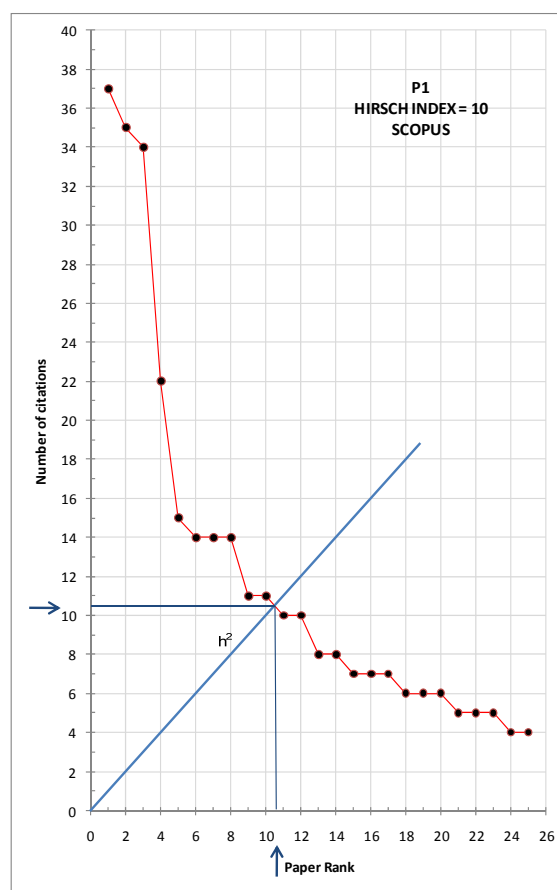


Fig. 5. Hirsch index graphic determination using Scopus database.

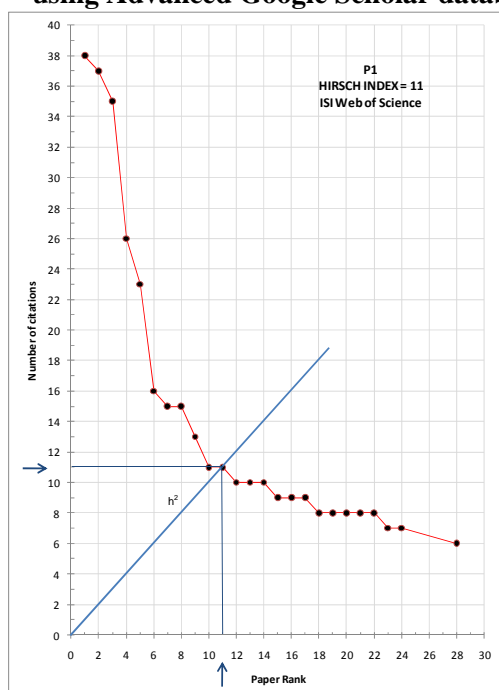


Fig. 6. Hirsch index graphic determination using ISI Web of Science database.

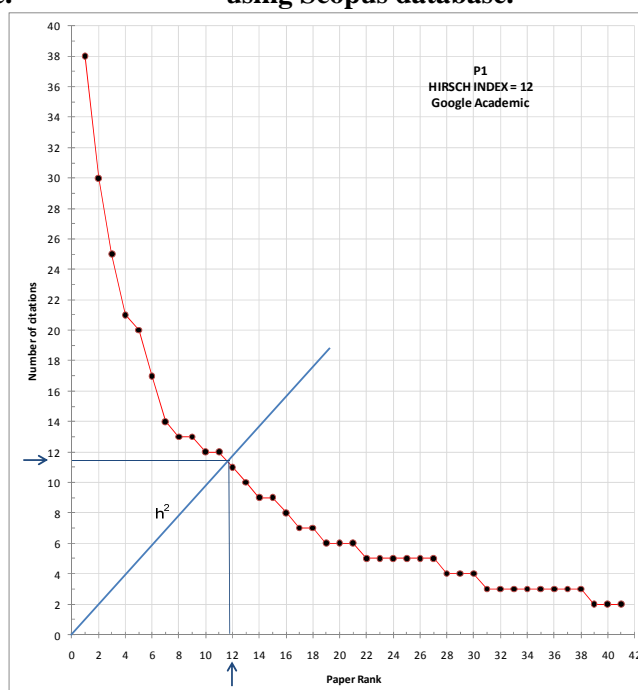


Fig. 7. Hirsch index graphic determination using Google Academic database.

The data from the figures above demonstrate the existence of considerable differences in the Hirsch index values once the database has been changed. Table 6 puts together these data and compares them with the calculated value using Hirsch relation [1]:

$$h = \sqrt{\frac{N_{c,tot}}{a}} \quad (3)$$

where $N_{c,tot}$ is the total number of citations and a is a proportional constant whose value ranges between 3 and 5. The values for this constant reported by Garcia – Pérez [10] are in reasonable agreement with those indicated by Hirsch [1] and also with those reported by Salgado and Páez [11]. According to Schreiber's study [12] this constant is ranging between 2.37 and 5.41 (average 3.53) and the above relation is not well fulfilled.

In spite of all the existing differences generated by the databases in collecting citations, Hirsch index remains an important parameter since it is directly associated with the real data without the need of transforming or processing the latter [13].

Table 6. Hirsch index values determined by different graphically methods and analytic method based on relation (3)

Hirsch index graphically determined using databases				Hirsch index calculated using ...		
Advanced Google Scholar	Scopus	ISI Web of Science	Google Academic	a = 3	a = 4	a = 5
8	10	11	12	~ 15	~ 13	~ 11

A value for Hirsch index of about 10-12 might be enough to be a full professor in USA and a value for h-index between 15 and 20 could mean a fellowship in the American Scientific Society [14, 15]. Nevertheless, the Hirsch index will represent, in the future, an objective way of comparing the scientific performances of the faculty members in order to recognize their value.

4. CONCLUSIONS

The total number of ISI papers published by UVT members' staff between 2002 and 2011 shows an ascending trend which proves a consolidation of the scientific research activity.

The articles published in the mentioned period of time are framed in 20 scientific domains, first of which correspond to fundamental sciences. This conclusion is based not only on the number of articles framed in each domain but also on the influence score and the impact factor. No matter the determination method (manually or automatically), the Hirsch index value is influenced by the database used for finding of the total number of citations of an author (Google Scholar, Scopus, ISI Web of Science, Scifinder etc.) By constantly using a single database (e.g. ISI Web of Science), the Hirsch index represents the most objective scientometric parameter for the scientific performances evaluation of the academic staff members.

The Scientometry based on articles published in ISI ranked journals serves today to the modern academic world for ranking the prestigious universities [16], while for some Eastern Europe countries this is still in balance with past ideas detoxification [17].

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