ORIGINAL PAPER

RESEARCH PERFORMANCE EVALUATION OF CHEMISTRY GROUP FROM VALAHIA UNIVERSITY TARGOVISTE

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Abstract. *This article presents an analysis of the scientific performance obtained by the Chemistry Group members of Department of Science from Valahia University using traditional scientometric indicators, including h-index and a new method for calculating the scientific productivity. The article also includes the results of a study which explores the time-dependence of h-index.*

Keywords: *research, Scientometrics, scientific productivity, Hirsch index.*

1. INTRODUCTION

The development level for a country is determined by both the educational and scientific research performance and the latter's compatibility with the systems existing in the E.U. developed countries. This principle has been included in the Lisbon Agenda [1]. The Hirsch index was used for the scientometric rankings to evaluate the scientific research output of some Eastern-European countries which have been recently admitted to E.U. [2, 3]. Another involved scientometric parameter was the average number of citations per scientific article which shows the impact of information at international level. As for the number of citations per article, Romania ranks 15 out of 23 Eastern European countries, according to Scimago sources for 1996-2010 [3]. The scope of this study has been to evaluate the Department of Science - Chemistry Group - scientific research performance from Valahia University of Targoviste.

2. EXPERIMENTAL

A number of scientometric parameters pertaining to each member of Chemistry Group have been analyzed, namely the total number of ISI papers, the total number of citations, the number of citations per article, the number of citations per year, and the Hirsch index (*h*). For this purpose, the Ad-Astra database has been used [4]. The published papers of the Chemistry Group members have been analyzed according to the papers' theme, including a graphic calculation of productivity, in the form of the paper's publication rate.

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3. RESULTS AND DISCUSSION

Analyzing the total number of ISI papers and total number of citations received by those papers, we have obtained the Hirsch index presented in table 1. The number of papers has been found to be a good predictor of career trajectories [5]. However, according to Long [6], women published fewer articles than men during the first decade of their career, but this difference was reversed later in their careers.

The h-index is based on a list of papers ranked in a descending order by the times cited. The value of the h-index is equal to the number of papers (N) in the list that have N or more citations [7]. The other parameters included in table 1 were citations per articles and citations per year. The majority of the articles are contributed by multiple authors.

There are some reasons which account for the low international impact of Romanian articles, of which we can list the absence of the articles in journals such as Nature, Science a.s.o., low number of citation per paper which shows a scientific isolation, tendency to publish in low score rated journals a.s.o [1].

Table 1. Scientometric indicators to characterize the scientific output of UVT Chemistry Group members (database: ISI Web of Knowledge).

Code	Total number of ISI papers	Total citations number	Average citations per paper	Average citations per year	Hirsch index (h)
P1	157	665	4.21	36.94	11
P2	100	534	5.34	29.67	11
P3	56	337	6.02	18.72	10
C1	56	147	2.62	14.70	7
C2	43	91	2.11	3.33	6
C3	27	66	2.44	1.50	6

P – Professor; C – Associate Professor

Phillips [8] created a multiple regression, using years since PhD to predict one's expected citations and the resulting equation was:

$$\text{Expected citations} = -12.5 + 32.5 \cdot \text{Years since PhD} \quad (1)$$

A valid classification of the first 20 institutions involved in the Chemistry domain for the 1997-2007 period - according to the number of citations per paper -, shows that the first 9 ranks have been taken by U.S.A. institutions. Among these, Harvard University had a value of 32.49 citations per paper for this parameter, while the last rank of the classification was occupied by the technical University of Munich, Germany, with 15.60 citations per article [9]. This ranking is based on citations per paper among those institutions that have collected 50,000 or more citations in Chemistry. In another classification of the countries, according to the number of citations per paper, valid for 1999-2009, the highest number of citations per paper is recorded by Switzerland and U.S.A. (~ 15 citations per paper) while Russia, India and China score lowest (~ 5 citations per paper) [10].

A ranking of universities in Canada [11] shows that the University of Toronto holds the best position with 11.42 citations per paper while the University of Lethbridge, Alberta, comes last with only 8.28 citations per article. Studies by several authors indicate that the maximum number of citations per paper is usually available after 2 or 3 years since the

publication of the paper [12]. The values presented in table 1 are well in accordance with the values discussed above.

Another goal of this paper has been to determine the scientific productivity in the research domains approached by our Chemistry Group. The domains presented by AdAstra and discussed in the paper [7] are governed by the profile of the ISI journal in which the author published and not by the theme of the paper.

The scientific productivity can be defined as the number of ISI papers that are published by a researcher annually [13, 14]. The performance requirement in the E.U. is 1 paper per year per researcher [15].

Figs. 1-9 illustrates the linear dependences of the cumulative number of papers published over a certain period corresponding to each domain under consideration. The slope of these straight lines represents an average rate of the scientific productivity in the meaning given above. The highlighted correlation coefficients have acceptable values. Table 2 presents the slope values (scientific productivity) and correlation coefficients for the straight lines in the figures mentioned.

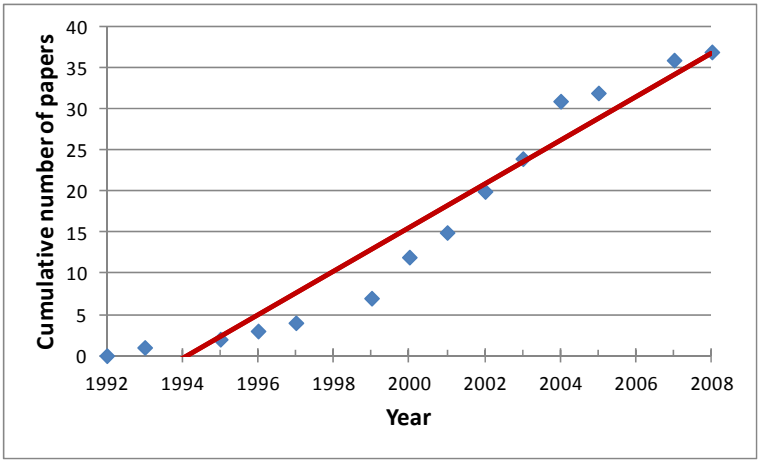

Fig. 1. The dependence of the cumulative number of papers concerning to antioxidants, photostabilizers and antirad agents (at publication moment).

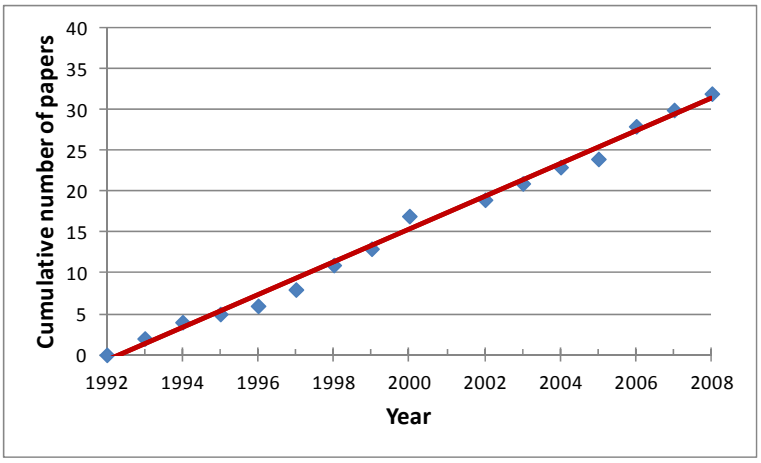

Fig. 2. The dependence of the cumulative number of papers concerning to chemiluminescence, oxiluminescence and lyoluminescence phenomena (at publication moment).

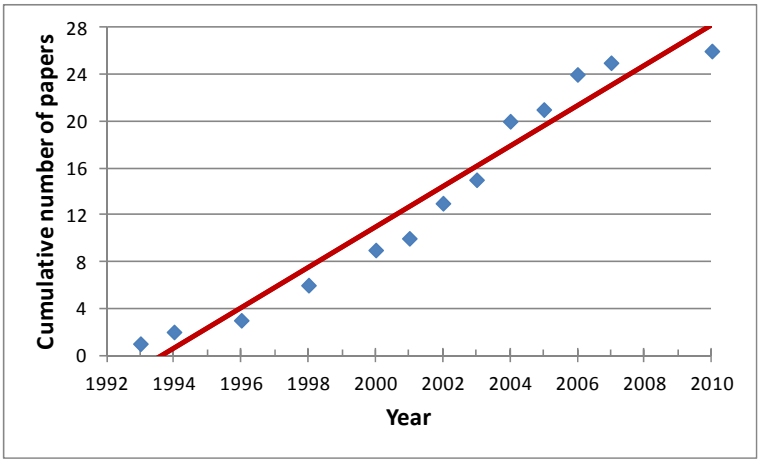

Fig. 3. The dependence of the cumulative number of papers concerning to use the chemiluminescence in the thermooxidative degradation of polymers (at publication moment).

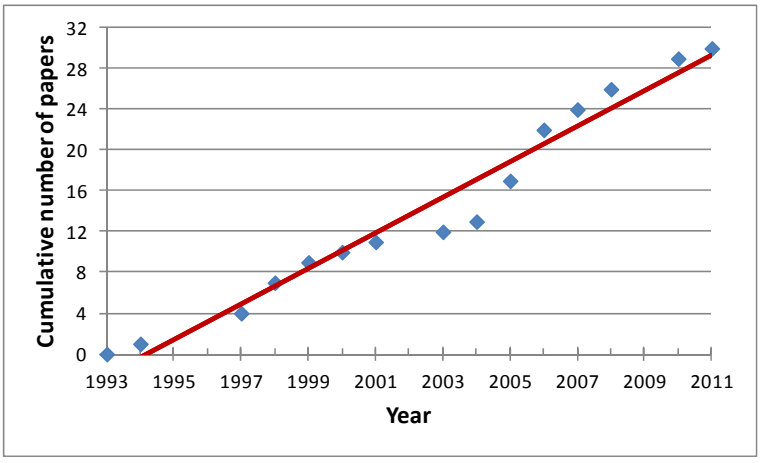

Fig. 4. The dependence of the cumulative number of papers concerning to use of chemiluminescence in the radiation- and photo-degradation of polymers (at publication moment).

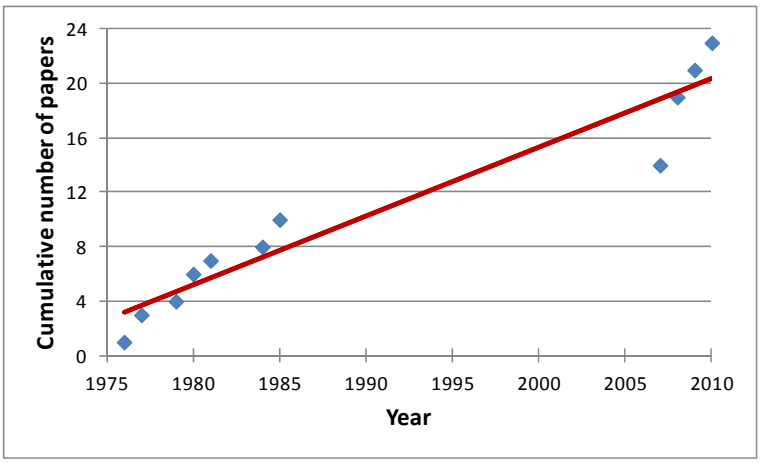

Fig. 5. The dependence of the cumulative number of papers concerning to thermoluminescence and RTL dosimetry (at publication moment).

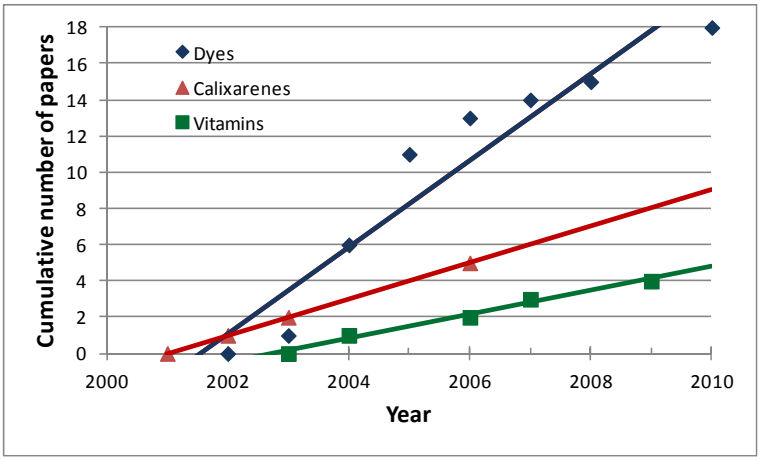

Fig. 6. The dependence of the cumulative number of papers concerning to dyestuff, calixarenes and vitamins (at publication moment).

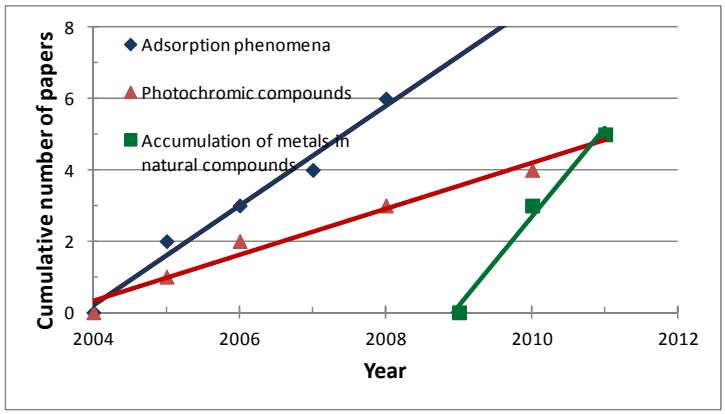

Fig. 7. The dependence of the cumulative number of papers concerning to adsorption phenomena, photochromic compounds and metal accumulation in natural compounds (at publication moment).

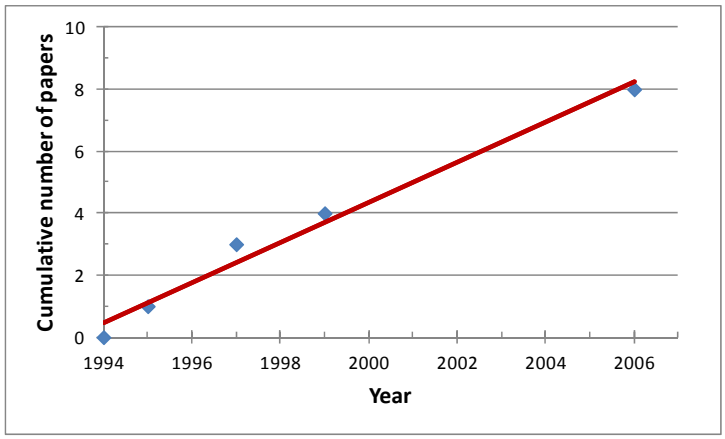

Fig. 8. The dependence of the cumulative number of papers concerning to molecular ferromagnetism from pyrolysis (at publication moment).

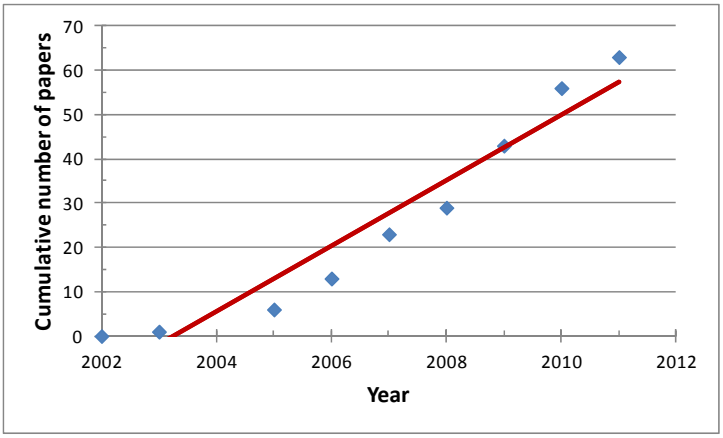

Fig. 9. The dependence of the cumulative number of papers concerning to ICT in teaching Science (at publication moment).

From the analysis of the respective data, it can be seen that the average scientific productivity is as high as 2.2 papers per year, a value that exceeds the performance requirement in the E.U. countries.

Table 2. Scientific productivity in research domains of the UVT Chemistry Group (Department of Science).

Domain	Scientific productivity (papers/year)	Correlation coefficient
Antioxidants, photostabilizers, antirad agents	2.65	0.935
Chemiluminescence, oxiluminescence and lyoluminescence phenomena	2.00	0.993
Chemiluminescence in the thermooxidative degradation of polymers	1.72	0.953
Chemiluminescence in the radiation- and photo-degradation of polymers	1.74	0.963
Thermoluminescence and RTL dosimetry	0.50	0.921
Dyestuff	2.39	0.915
Calixarenes	1.00	1.000
Vitamins	0.65	0.987
Adsorption phenomena	1.40	0.980
Photochromic compounds	0.65	0.969
Metal accumulation in natural compounds	2.50	0.987
Molecular ferromagnetism from pyrolysis	0.65	0.981
ICT in teaching Science	7.38	0.927

Scientometrics represents a useful means for rapid selection of native values and their relation to the European ones in the domain of scientific research; 36% of the UVT Chemistry Group members have a Hirsch index higher than or equal with 7, such an index being honorable at European level and quite good at national level [16] while the rest of members have a Hirsch index higher than or equal with 3. In a previous paper, related to the determination of this scientometric parameter [17], we presented several methods of calculation. According to Nielsen [18], the h-index can be computed with a good approximation from the total number of citations, using the following relationship:

$$h \approx \frac{\sqrt{total\ number\ of\ citations}}{2} \qquad (2)$$

The Hirsch index increases in time [19] as figure 10 illustrates, where the relationship above has been applied. In the interval of 245 days, the Hirsch index increased by 4%, while the total number of citations increased by 8%.

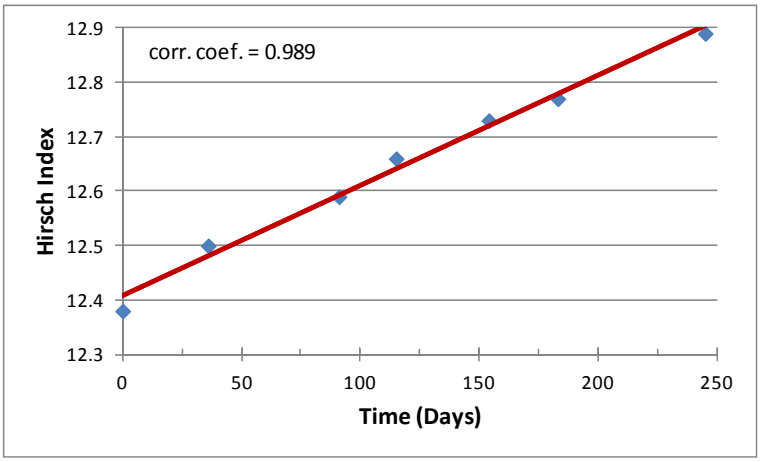

Fig. 10. The Hirsch index increase in time (for Professor P1 using Nielsen relationship [18]).

In a ranking made according to the Hirsch index, that assess the impact produced by their research output on the scientific community, in Romania there are only 5 scientific institutes whose h-index is in two figures, in the conditions under which this parameter can be also in three figures [20].

The Hirsch index is an objective measure for the comparison of the researchers' scientific performance in order to recognize their value [21]. Romania's entry to the E.U. requires the compliance of its scientific research with the quality standards in these countries.

4. CONCLUSIONS

The paper includes an analysis of the main scientometric parameters, such as the total number of ISI articles, the total number of citations, the citations average per paper, the citation average per year and the Hirsch index for the UVT Chemistry Group members from Department of Science.

The scientific productivity in the domains in which the UVT Chemistry Group members published papers was graphically determined.

Different data from the specialized literature on the values of the scientometric parameters have been presented and discussed in order to assess accurately the performance of UVT Chemistry Group members.

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