

SCIENCE METRICS AND INFORMETRICS APPROACHES TO ORGANIZATIONAL AND MANAGEMENT SCIENCE

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ABSTRACT

In modern scholarship, measurement of the performance of certain disciplines, sciences and research centers fundamentally determines the places they take within the universal academic community. Modern science metrics and informetrics are basic methods for assessing the extent of presence in databases. One tool for this is the analysis of database contents and their quantitative description. This study attempts to present the information on organizational and management science found in the professional databases of the world's academic journals (UlrichsWeb, Web of Science, Scopus), based on methods of science and informetrics, and, from these results, to unravel the features of academic literature and its place in academic publications. The focus of the analysis and comparison is the presence and representation of European academic literature on organizational and management science.

1. Introduction

Frederick Winslow Taylor's fundamental book on organizational and management science, *The Principles of Scientific Management*, was published more than 100 years ago in 1911, and became an early 20th century industrial management theory bestseller. In the time since its publication, organizational and management science has been developing dynamically and is an important factor within academics today, while influencing other disciplines as well. This process is well-illustrated by the quickly increasing volume of organizational and management science literature on this topic, and the fact that organizational and management science has appeared in academic work as well as in innovation and all other aspects of everyday life.

The centennial of the publication of Taylor's book provides a great opportunity to examine the features of academic literature on organizational and management science. This paper attempts to present the characteristics of printed and electronic literature on organizational and management science by the methods of science metrics and informetrics and to show the extent to which these disciplines are pre-

sent among academic publications. The empirical research is based on the world's academic journals and academic databases; in other words, it includes elements of the Gutenberg galaxy and of the Neumann galaxy as well. The research has focused on the extent of the presence and representation of European literature on organizational and management science.

Researchers' reservations and prejudices about the methods and results of science metrics and informetrics are well-known, and it must be mentioned that they often cite valid academic reasons. In our opinion, by the exaggeration of the importance of statistics without reason we may go too far, and the amateurish, mechanical application and interpretation of science metrics justly generates such negative reactions. However, it needs to be emphasized that the academic world tends to be dictated by these measurements, the methods of which have been significantly improved lately, and informetric research has also been emerging. These days, the citation and impact factor system of the Web of Science is no longer the only tool at our disposal, as the Hirsch-index and the instrument systems of Eigenfactor and SCImago Journal & Country Rank have also been introduced, and are likely to be followed by new methods in the future. It is important to clarify that neither performance index provides a perfect system for the measurement of academic impact. Still, the diverse systems of performance measurement allow for the making of distinctions among people in academics and the sources of academic publications.

2. Organizational and management science in academic databases

By now, being included in multidisciplinary and specialized academic databases has become the most significant measure of academic work. The basic method of science metrics and informetrics is measuring the extent of database presence for publications. It is done by quantitative analysis and description of database contents. At the same time, it has become clear to both regular database users and participants in academic research and academic administrators that the widespread use of these methods, along with the dominance of measurability, has restructured publication habits and has distorted academic administration and academic research as well. The primary victims of the "publish or perish" attitude, the overstated importance of citation, impact factor and quantitative methods are mostly humanities and social sciences, and especially those disciplines that have great value locally because of their focus on national issues but that are not so valued among the global academic community. This handicap is also true for academic publications in languages other than English and ones published in non-English-speaking countries. From this point of view, European countries are at a disadvantage, as their representation in the databases, which are mostly sponsored by multinational companies with American interests and which are related to English-speaking countries, is quite low and sporadic. The scope of this study does not allow for the analysis of all academic databases in the world, and therefore only

the globally most influential academic databases are analyzed in the present paper, including figures and rates describing their major features.

2.1 Ulrichsweb, Global Serials Directory

The Ulrich's Periodicals Directory, published in print since 1932, has been available in electronic format since 1993 and has been accessible online* since 1999. By now, it has grown into a significant means of searching periodicals as well as a measurement tool for evaluating journals and studying supplies of periodicals. The Ulrichsweb has not only been a list of journals with worldwide significance, but it is also an indicator of quality for academic work and of the periodicals representing it. It currently includes 300 000 periodicals in as many as 900 fields in all disciplines so it encompasses the global academic work. It reflects the world's periodical supply appropriately and proportionately. It incorporates academic and scientific journals, e-journals and peer-reviewed publications, as well as popular magazines, newspapers, and newsletters. Of the 300 000 periodicals of Ulrichsweb, 64 796 focus on organizational and management science. As mentioned above, organizational and management science has become the most important element and research topic of theory and practice of all disciplines with a wide range of application. This means that most of the nearly 65 000 articles on the topic are not published in journals strictly concerned with organizational and management science, but they discuss the organizational and management aspects of other disciplines. The list of titles reveals that nearly half (29 300 publications) are published in journals of medical and health sciences that also incorporate organizational and management science. The second largest group consists of journals on humanities and social sciences with over 16 000 items, while in third place, with 14 263 publications, are the disciplines of government, law and administration. Interestingly, journals on economics and economic science representing some ten thousand titles are placed at only number four.

It is also illuminating to have a look at the languages and countries of publication for journals of organizational and management science.**

* Ulrichsweb Global Serials Directory: <http://ulrichsweb.serialssolutions.com> (2012. 05. 12.)

** The data sources: Ulrichsweb Global Serials Directory: <http://ulrichsweb.serialssolutions.com> (2012. 05. 12.). Collected and edited by the author.

Table 1: Periodicals by language

ENGLISH	43124
NON-ENGLISH	21672
OF NON-ENGLISH	
GERMAN	4189
CHINESE	4122
SPANISH	3823
FRENCH	3515
ITALIAN	1193
PORTUGUESE	1088
HUNGARIAN	114

Table 2: Periodicals by country

USA	19857
UNITED KINGDOM	7969
CHINA	4114
GERMANY	3809
THE NETHERLANDS	2538
JAPAN	2163
FRANCE	2003
CANADA	1926
ITALY	1449
AUSTRALIA	1286

Table 3: Periodicals in other European countries

ALBANIA	7
AUSTRIA	431
BELARUS	19
BELGIUM	403
BOSNIA- HERZEGOVINA	29
BULGARIA	103
CROATIA	95
CZECH REPUBLIC	321
DENMARK	368
ESTONIA	21
FINLAND	252
GREECE	125
HUNGARY	139
IRELAND	241
LATVIA	8
LICHTENSTEIN	2
LITHUANIA	59

LUXEMBURG	110
MACEDONIA	15
MALTA	9
MOLDOVA	1
MONACO	15
MONTENEGRO	4
NORWAY	298
POLAND	694
PORTUGAL	246
ROMANIA	267
RUSSIAN FEDERATION	806
SERBIA	117
SLOVAKIA	107
SLOVENIA	71
SPAIN	1256
SWEDEN	604
SWITZERLAND	818
UKRAINE	153
VATICAN	5
TOTAL	8219

The tables above reflect the dominance of English-language documents: two-thirds of the nearly 65 000 periodicals are published in English, while journals in all the other languages amount to only one-third of the publications. Moreover, while the number of publications in German, Spanish and French is insignificant compared to that of English language ones, it is surprising and deserving of attention that the number of periodicals in Chinese is close to the number of those in German.

The distribution of journals according to countries also show great disproportion: nearly one-third of the periodicals on organizational and management science are published in the United States, followed by the United Kingdom with 12% of all relevant journals. Eight other countries follow these two, but their aggregated number of publications (19 288) does not reach the number produced by the United States alone. It is noteworthy that China is in third while the Netherlands is in fourth place in this ranking; the latter is probably due to the fact that the headquarters of the Elsevier publishing company can be found there. The 36 European countries that follow the first ten countries in the number of publications on organizational and management science are listed in a separate table. They together provide only 13% of such periodicals, hardly more than the United Kingdom's share.

2.2 Web of Science, Impact Factor

The products of the Institute for Scientific Information, a provider of academic information, have become the most prestigious and best-known online information source since the early 1960s. The database group of the Web of Science* watches and analyzes over 12 000 journals and 120 000 conference publications. The popularity and recognition of WOS is due primarily to the establishment and spread of the citation index as well as the introduction of impact factor indicators.

In the case of this database, the data on processed publications was not analyzed, but rather the relevant amount of all bibliographical records present in the WOS and their ratios were compared. Organization and management were used as keywords to filter information in three databases from 1975; the result was 1 238 587 documents relevant to the topic. It is worth noting how hits are distributed among the three elements of the WOS: most academic publications, over 1 million, were found in the Science Citation Index Expanded, the database processing journals on natural and applied sciences. About 300 000 items are included in the Social Sciences Citation Index database for literature on social sciences, while the Arts and Humanities Citation Index has 17 000 periodicals.

Furthermore, analysis was done on how the content of databases has changed over time, and more exactly, how the amount of publications on organizational and management science has changed since 1975.**

* http://apps.webofknowledge.com/WOS_GeneralSearch_input.do?product=WOS&search_mode=GeneralSearch&SID=Q1BnNHKMnNO7F9oC6of&preferencesSaved=&highlighted_tab=WOS (2012. 05. 14.)

** The data sources: Web of Science http://apps.webofknowledge.com/WOS_GeneralSearch_input.do?product=WOS&search_mode=GeneralSearch&SID=Q1BnNHKMnNO7F9oC6of&preferencesSaved=&highlighted_tab=WOS (2012. 05. 14.). Collected and edited by the author.

Table 4: Increase in the number of publications between 1975 and 2011

YEAR	NUMBER OF PUBLICATIONS	RATE OF INCREASE COMPARED TO PREVIOUS PERIOD
1975	3878	1,0
1980	5804	1,5
1985	7059	1,2
1990	8709	1,2
1995	31109	3,5
2000	43817	1,4
2005	61516	1,4
2010	96548	1,6
2011	101906	1,1

The information in the table indicates that the number of topics in organizational and management science show a huge increase in the WOS databases between 1975 and 2011. However, this increase is unlikely to be the result of the growing volume of academic literature on this topic alone; it is probably due to a more sophisticated database management as well. The numbers also imply that following a steady increase of previous periods, the rate of increase was quite great between 1990 and 1995; the number of relevant publications grew three and a half times in five years. Following this drastic boost, relatively stable, proportionate and dynamic growth returned.

The analysis of hits based on languages and countries in the WOS databases also points towards new notable results and correspondence within the body of academic literature.

Table 5: The distribution of results by countries

The first ten countries with the most hits		
1.	USA	479.036
2.	United Kingdom	122.901
3.	Germany	71.014
4.	Canada	69.649
5.	France	64.265
6.	Australia	54.104
7.	Italy	46.187
8.	Japan	38.943
9.	The Netherlands	34.626
10.	Spain	33.115
THE TEN COUNTRIES ALTOGETHER		1.013.840
38.	Hungary	3.482

Table 6: The distribution of relevant results by languages

The first ten languages with the most hits		
1.	English	1.163.792
2.	German	24.533
3.	French	21.656
4.	Spanish	9.544
5.	Russian	5.619
6.	Portuguese	4.394
7.	Italian	1.401
8.	Czech	1.235
9.	Polish	988
10.	Japanese	955
THE TEN LANGUAGES ALTOGETHER		1.234.117
15.	Hungarian	380

Out of the 1 238 587 results received for the search phrase “organizational and management science”, the first ten countries have 1 013 840 (81%) hits, and the rest of the results, 19.5%, are shared by the world’s other countries. Further analysis of the ratios reveals that the United States and the United Kingdom together have nearly half of the hits, while the other half is shared by the world’s other countries. It is also interesting that the difference between the countries in the first two places and the country in third, Germany, is huge: over 50 000 bibliographical records. The outcomes based on language show a similar distribution. The first ten languages have 99.63% of the hits, while publications in English take up 93.96% of all results. English language publications and journals published in the United States and the United Kingdom have an even greater share of the results in these databases than seen in case of Ulrichsweb.

Another service of the Institute for Scientific Information is the impact factor index*, the ISI Journal Citation Reports, which has great prestige in the international ranking of academic journals. In the past ten years, altogether, 11 051 periodicals were published that include the results of academic research in each discipline. Out of these, 120 contains titles of organizational and management science. The periodicals that have received the highest impact factor are concerned with theoretical issues of organizational and management science, as well as with other disciplines applied organizational and management science. The titles of these periodicals include the Academy of Management Review (IF 7.8), and the Academy of Management Journal (IF 6.5) published in the United States, the Journal of Operations Management (IF 75.1) published by Elsevier Publisher, and the Bulletin of the World Health Organization (IF 5.5) on health science management, published by the WHO. The IF numbers are significantly lower in the case of other periodicals – none of their impact factor values reach 3.

2.3 Scopus, SCImago Journal & Country Rank

The Scopus database** published by Elsevier Publisher has been operating since November 2004, and it includes 46 million refereed bibliographical records that are the results of the study and analysis of 19 500 journals. The Business, Management and Accounting topic includes 1081 publications out of all the resources processed by the database that have been refereed since 1974. Filtering the entire database by search words relevant to the topic,

1 506 794 items were found. This number is a bit higher than the result received in case of the Web of Science database, but the difference is not significant. The

* The data sources: Impakt faktor kereső <http://aok.pte.hu/library/> (2012. 05. 10.). Collected and edited by the author.

** Scopus http://www.scopus.com/search/form.url?display=basic&clear=t&origin=searchadvanced&txGid=G5F8UdM_6w7NG34RZBa5Ygb%3a4 (2012. 05. 10.)

further analysis of the results also indicates that the ratios of the hits are quite similar to those of the Web of Science database discussed above.

Table 7: Increase in the number of publications between 1975 and 2011

YEAR	NUMBER OF PUBLICATIONS	RATE OF INCREASE COMPARED TO PREVIOUS PERIOD
1975	6320	1,0
1980	10265	1,6
1985	21599	2,1
1990	29166	1,7
1995	31968	1,1
2000	40833	1,8
2005	81871	2,1
2010	100846	1,2
2011	98378	0,98

Table 8: The distribution of results by countries

The first ten languages with the most hits		
1.	English	1.350.971
2.	German	39.430
3.	French	28.333
4.	Chinese	17.866
5.	Russian	13.214
6.	Spanish	12.007
7.	Japanese	7.365
8.	Dutch	5.854
9.	Portuguese	5.216
10.	Italian	4.879
THE TEN LANGUAGES ALTOGETHER		1.485.235
16.	Hungarian	1.122

Table 9: The distribution of relevant results by languages

The first ten countries with the most hits		
1.	USA	303.238
2.	United Kingdom	91.749
3.	China	78.330
4.	Germany	50.525
5.	Canada	42.644
6.	Australia	35.301
7.	France	33.026
8.	Japan	24.033
9.	Italy	23.711
10.	The Netherlands	22.617
THE TEN COUNTRIES ALTOGETHER		705.174
40.	Hungary	2.300

The ratios show a similar distribution in case of different disciplines. The results indicate that with 547 277 titles, organizational and management science is mostly applied in medical science, followed by engineering, environmental science, and computer science. The distribution of relevant publications by language shows a quite insignificant difference – these journals are also dominated by articles written in English (91%). At the same time, 99% of the publications were written in the database's ten most frequently used languages, which leaves 1% of publications written in languages other than these ten.

Moreover, comparing the two big databases it is also clear that there are quite different ratios in the distribution according to countries. The first ten countries produce less than half of Scopus results, whereas in the WOS database this ratio is 82%. It is also significant that China has not only made it into the first ten countries but it takes third place in the Scopus database, and that the number of publications in Chinese is in fourth place in this database.

Table 10: Ranking of Western European countries by the number of publications between 1996 and 2010, based on the SJR

	Country	Documents	Citable documents	Citations	Self-Citations	Citations per Document	Hirsch index
1	United Kingdom	28 244	26 914	239 925	71 454	10,64	118
2	Germany	11 091	10 582	47 119	9 682	4,88	70
3	Netherlands	6 371	6 154	70 785	12 075	15,01	89
4	France	5 162	4 937	43 773	4 302	13,51	79
5	Spain	5 065	4 939	31 324	7 304	8,74	54
6	Italy	3 721	3 574	24 402	3 919	9,74	55
7	Sweden	3 191	3 112	27 692	4 555	12,34	64
8	Switzerland	2 914	2 757	20 014	1 893	8,86	54
9	Finland	2 445	2 388	18 316	3 315	12,41	52
10	Belgium	2 070	1 985	18 682	2 060	12,56	54
11	Denmark	1 867	1 791	16 119	1 687	12,3	48
12	Norway	1 782	1 738	13 916	1 859	11,74	47
13	Greece	1 659	1 618	9 354	1 410	9,37	37
14	Austria	1 593	1 538	9 897	1 152	7,69	39
15	Ireland	1 121	1 079	6 717	707	8,62	34
16	Portugal	1 086	1 055	5 389	795	6,78	28
17	Cyprus	262	258	2 662	164	17,16	24
18	Luxembourg	76	73	183	15	3,36	8
19	Iceland	58	55	191	21	4,05	9
20	Malta	25	25	238	8	10,99	7
21	Liechtenstein	22	20	47	7	6,67	3
22	Monaco	5	4	3	0	0,6	1
23	San Marino	5	5	36	2	9	2
24	Faroe Islands	1	1	0	0	0	0
25	Gibraltar	1	1	0	0	0	0

As the focus of the paper is European publications, the data from the countries in this region is discussed in detail using the indicators of the SCImago Journal & Country Rank* (published by Elsevier Publisher) relevant to publications in the Scopus database. Besides providing rankings that present a more detailed picture, one of the basic concepts of science metrics is applied: countries with different academic culture are compared with countries in the same category.**

Table 11: Ranking of Eastern European countries by the number of publications between 1996 and 2010, based on the SJR

	Country	Documents	Citable documents	Citations	Self-Citations	Citations per Document	Hirsch index
1	Poland	1 565	1 547	3 801	1 126	2,66	20
2	Russian Federation	1 425	1 415	1 794	146	1,72	18
3	Romania	961	939	424	128	0,72	7
4	Lithuania	831	811	3 112	2 277	4,94	19
5	Croatia	819	809	971	424	1,43	11
6	Slovenia	804	798	2 583	608	3,39	19
7	Czech Republic	601	572	972	223	1,85	12
8	Hungary	417	408	927	81	3,2	12
9	Bulgaria	298	297	191	21	0,85	7
10	Slovakia	280	277	403	183	1,72	8
11	Serbia	172	171	63	21	0,4	4
12	Estonia	127	126	396	96	3,72	9
13	Ukraine	83	79	149	10	1,54	7
14	Latvia	70	68	154	9	2,72	8
15	Macedonia	43	43	64	41	1,7	4
16	Bosnia and Herzegovina	38	37	38	3	2,36	3
17	Georgia	32	31	130	1	7,61	6
18	Belarus	26	26	44	10	2,1	4
19	Albania	13	12	17	3	2	3
20	Armenia	9	8	6	0	0,71	2
21	Azerbaijan	8	8	12	3	1,75	2
22	Moldova	4	3	2	0	0,5	1
23	Montenegro	3	3	4	0	1,5	2

* SCImago Journal & Country Rank <http://www.scimagojr.com/> (2012. 05. 05.)

** The data sources: SCImago Journal & Country Rank <http://www.scimagojr.com/> (2012. 05. 05.). Collected and edited by the author.

3. Summary

The comparison of academic production of countries on different continents and in different regions, such as Eastern and Western European countries, clearly indicates enormous differences. While the results of the research are not at all surprising, as the stratification of the academic world by regions, languages and countries is well-known, the extent of the discrepancy is still noteworthy. The question is whether the results and ratios detailed above are due to the quality of academic productivity or lack thereof, or whether other factors also influence the recognition of the accomplishments of researchers working in countries of less productive regions. The present paper is of the opinion that – while allowing for the greater academic productivity of more developed regions – science metrics and informetrics results reflect other factors, too, such as the economic and social maturity which influence the real academic potential, as well as implicit stereotypes.

Another result of the present research is that it has confirmed that organizational and management science as well as their literature has become a significant part of the system of disciplines and of general academics. At the same time, organizational and management science have also become a part of other disciplines as they are applied in more and more different fields. Research and publication in this topic has especially been prevalent in medical science, engineering science, environmental sciences, computer science and social sciences. However, the latest research results of organizational and management science are not only present in academics but in innovation and practical pursuits as well.

The scope of this study does not allow for further comparisons while only a few observations could be discussed in detail in this paper. The goal of the present study was to call attention to the fact that the analysis and comparison of academic databases based on similar aspects can provide useful insight into academics, academic administration, academic management and other contexts.

LITERATURE

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