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A Comparison of Web of Science and Scopus for Iranian Publications and Citation Impact

M. A. Erfanmanesh, Ph.D.
University of Malaya, Malaysia
Corresponding Author:
amin.erfanmanesh@gmail.com

F. Didegah, Ph.D. Student
University of Wolverhampton, UK
E-mail: fdidgah@gmail.com

Abstract

This study mainly aims to compare the quantity of Iranian publications and their citation impact in the two popular citation databases, Scopus and Web of Science. The documents which specified Iran as their affiliated country published during 1998-2007 were selected as Iran's publications in the two databases. During the examined years, Iran has published 49198 documents in Scopus and 35061 documents in WOS. Based on the results, the number of Iranian publications was higher in Scopus than WOS and also the number of citations per publication in Scopus was rather doubled in comparison with WOS. Although the number of cited publications was increasing in both databases, the percentage of cited publications in Scopus was more than WOS. In contrast, WOS embodies more number of non-cited Iranian publications than Scopus. Engineering was the most productive field as reflected by Iranian publications in Scopus while in WOS the most number of Iranian publications were published in Chemistry. Additionally, the growth rate of publications was calculated in different fields. Molecular Biology and Genetics as well as Biology and Biochemistry areas had the highest growth rate in WOS and Scopus, respectively.

Keywords: Publications, Citation Impact, Scholarly Productivity, Scopus, Web of Science, Iran.

Introduction

The analysis of scientific activity is done based on two criteria, i.e., scientific productivity (the quantity of publications) and citation impact (the quality of publications). Citation indexes have become an indispensable tool for performing bibliometric studies (Williams & Lannom, 1981) and analyzing scientific activity of authors, institutions and countries. For a few decades, the Web of Science was the only citation and bibliographic database for scientometric studies but in 2004 Scopus, a new product from Elsevier Science, started to rival WOS from Thomson-ISI. The competition between the two

providers is intense and has led to the frequent upgrade of the services offered by both databases in the last few years (Vieira & Gomes, 2009). These two databases have gained great popularity in scientific community and constituted the base of a great number of researches in scientometric area. There are many researches which describe and analyze WOS and Scopus individually as available citation databases (Gupta & Dhawan, 2009; Suluimanov, Frolova & Khasenova, 2009). Some studies have compared these two databases (Dess, 2006; Norris & Oppenheim, 2007) and some have analyzed them from scientometric perspective (Jacso, 2005; Laguardia, 2005; Bakalbassi, Baurer, Glover & Wang, 2006; Gorraiz & Schlögl, 2007; Meho & Yang, 2007; López-Illescas, Moya-Anegón & Moed, 2008; Meho & Rogers, 2008; Torres-Salinas, Lopez-Cozar, & Jimenez-Contreras, 2009; Vieira & Gomes, 2009; Bar-Ilan, 2010).

The present study mainly aims to compare the quantity and quality of Iranian publications in these two popular citation indexes. The status of scientific productivity and impact of Iran has been investigated in WOS for many times. Different studies have reported ascending growth rate of Iranian publications in this database (Science-Metrix, 2010; Saboury, 2007; 2006; 2005) but to our knowledge, no study has compared Iranian publications in the two databases. In this study, we offer an investigation of Iranians' publication status in both databases in comparison with each other.

Review of Literature

As discussed earlier, the purpose of this study is to compare scientific productivity and impact of Iranian researchers in Scopus and WOS. A review of the literature was conducted to investigate and summarize previous related studies. In one of these studies, Bakalbassi, Baurer, Glover & Wang (2006) compared citation counts for papers in the areas of Oncology and Condensed Matter Physics published in 1993 and in 2003 in WOS compared with Scopus. The results of the study showed that for Oncology in 1993, WOS returned the highest average number of citations (45.3), while Scopus returned the highest average number (8.9) for Oncology in 2003; and WOS returned the highest number of citations for Condensed Matter Physics in 1993 and 2003 (22.5 and 3.5, respectively). Boldis & Landova (2006) compared Czech and Slovak Agricultural and related disciplines' productivity in WOS and Scopus. They found that Scopus had a better coverage of minor subjects and research fields than WOS. They also found that WOS had an excellent coverage of scientific titles from the United States and Asia, while Scopus focused more on European titles.

Meho & Sugimoto (2007) studied the citations to a group of 42 Library and Information Science researchers to examine the differences between WOS and Scopus. The researchers concluded that to accurately map the impact of the study sample, one has to employ both databases because they complement each other. In another study, Gorraiz &

Schloegl (2008) examined the suitability of Scopus for bibliometric analysis of Pharmacology and Pharmacy journals in comparison with the WOS. They found that all of the 100 highest impact WOS-covered journals were indexed in Scopus and that Scopus covered some additional high impact journals not indexed by WOS. They concluded that both databases had a good coverage of high impact journals in the field of Pharmacology and Pharmacy. Markusova (2008) described tendencies of Russian scientists' to publishing activity in the period from 1993 to 2006 according to the WOS and Scopus. An important result of the research is that about 50% of the papers written by Russian authors were published in foreign journals used to prepare the WOS. This demonstrates that Russian science is highly integrated into international science.

Meho & Rogers (2008) compared Scopus and WOS for 22 top human-computer interaction researchers. Results of the study showed that Scopus provided significantly more coverage of human-computer interaction literature than WOS. Jasco (2005) discussed the results of recent experiments in determining the h-index at the country level for the 10 Ibero-American countries of South America in WOS and Scopus. The results show that in spite of the significant differences in the content of the two databases in terms of their source base and the extent of cited reference enhancement of records, the rank correlation of the ten countries based on the h-index values returned by WOS and Scopus is very high. In another study Levine-Clark & Gil (2009) presented the results of a comparative study of WOS, Scopus and Google Scholar for a set of 15 Business and Economics journals. Citations from the three sources were analyzed to determine whether one source is better than another or whether a new database such as Scopus or a free database such as Google Scholar could replace WOS. The authors concluded that scholars might want to use alternative tools collectively to get a more complete picture of the scholarly impact of an article. In another study conducted by Baykoucheva (2010), WOS and Scopus were compared for their ability to retrieve drug literature. Significant difference was found in the journal coverage and the number of papers each database retrieved with Scopus significantly outperforming WOS.

Most of the studies reviewed here indicate that the question of whether to use WOS or Scopus may be domain or country-dependant and that more studies are needed to verify which database is appropriate for what research domain or country. As a result, the current study compares WOS and Scopus for Iranian publications and citation impact. Examining differences in scholarly productivity and impact assessment between Scopus and WOS is important because it allows one to compare the consistency of the database in such assessments.

Research Objectives

The main aim of this study is to investigate Iranian publications and make a

comparison of the two databases, i.e., WOS and Scopus. Furthermore, the current study aims to analyze the growth rate of Iranian publications in both databases, the frequency of citations, the average number of citations per paper, the percentage of cited and non-cited documents, the most productive and weak subject areas of research in Iranian publications in WOS and Scopus and the share of international collaborative publications of Iran in both databases.

Research Methodology

For extracting data from WOS (all three citation indexes) and Scopus, a number of searches were conducted in December 2010 in each of the databases simultaneously. Those documents which specified Iran as their affiliated country published during 1998-2007 were selected as Iran's publications in the two databases. During the examined years, Iran has published 49198 documents in Scopus and 35061 documents in WOS. Investigating subject categories devoted to the total number of Iranian publications in WOS showed that the publications embodied about 182 subfields. Additionally, Scopus has categorized the entire literature into some broad subjects each of which is divided to some sub-fields. To compare the number of Iranian publications in different subject areas in both databases and to prevent subject dispersion, the sub-fields of the publications were mapped into 22 broad fields which are covered by Thomson Reuters' Science Watch. Exponential regression test was used to calculate the growth rate of publications during the examined years.

Results

Over the period under consideration, 49198 documents in Scopus and 35061 in WOS were published by Iranian researchers. The yearly growth rate of publications can be described by an exponential function: $y = ne^{kt}$, where y denotes the number of publications, n is a constant value and k is the growth rate of publications in t (year). R^2 for a nonlinear least squares regression shows the significance level of the results of the test. As can be seen in Figure 1, the number of Iranian publications is increasing over the examined years. The results of the exponential regression report showed a 28.7% growth rate for Iranian publications in Scopus and a 24.2% growth rate in WOS. Overall, number of Iran's publications in Scopus is about 1.5 times higher than that of WOS. However, number of publications is ascending equally in both databases over the ten years.

The number of citations received by Iranian publications was also extracted from the two databases. Based on the results, Iranian publications in Scopus have received citations more than publications in WOS. Moreover, the number of citations per publication in Scopus is 4.1 but 2.49 in WOS. As shown in Table 1 and Figure 2, except for the last year, the number of citations per publication is almost higher in Scopus than WOS. The number of citations per publication in both databases is decreasing over the ten years as this value

declined to 1.65 in Scopus and 1.79 is WOS at the end of the period for publications (Table 1, Figure 2).

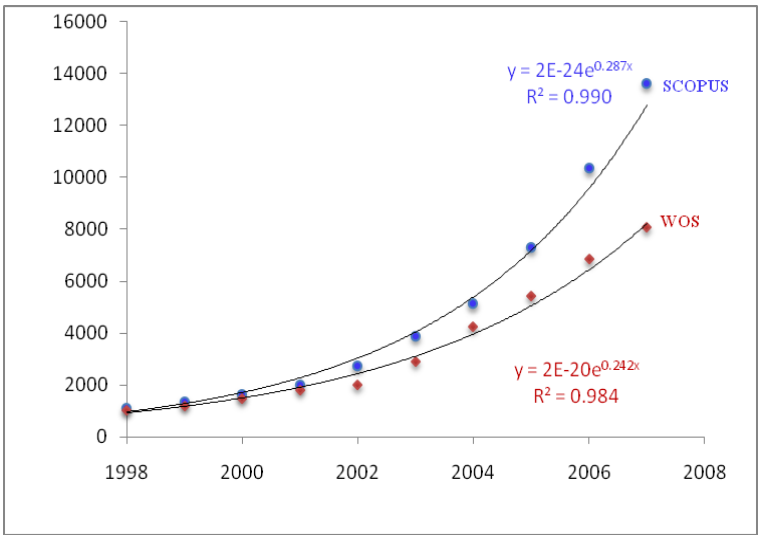

Figure 1. The growth rate of Iranian publications in Scopus vs. WOS

Table 1

Frequency and Percentage of Citations and Publications

Frequency of citations and publications						
Year	Scopus			WoS		
	No. of Citations	No. of Publications	Citations per Publication	No. of Citations	No. of Publications	Citations per Publication
1998	10550	1117	9.44	5399	1049	5.15
1999	13089	1341	9.76	7166	1190	6.02
2000	14135	1642	8.61	6583	1481	4.44
2001	16163	2002	8.07	6050	1801	3.36
2002	19614	2759	7.11	5351	2005	2.67
2003	26952	3904	6.9	12695	2917	4.35
2004	26645	5129	5.19	13209	4273	3.09
2005	29406	7329	4.01	11145	5420	2.06
2006	30154	10351	2.91	6474	6852	0.94
2007	24454	13624	1.79	13345	8073	1.65
Total	**201667**	**49198**	**4.1**	**87417**	**35061**	**2.49**

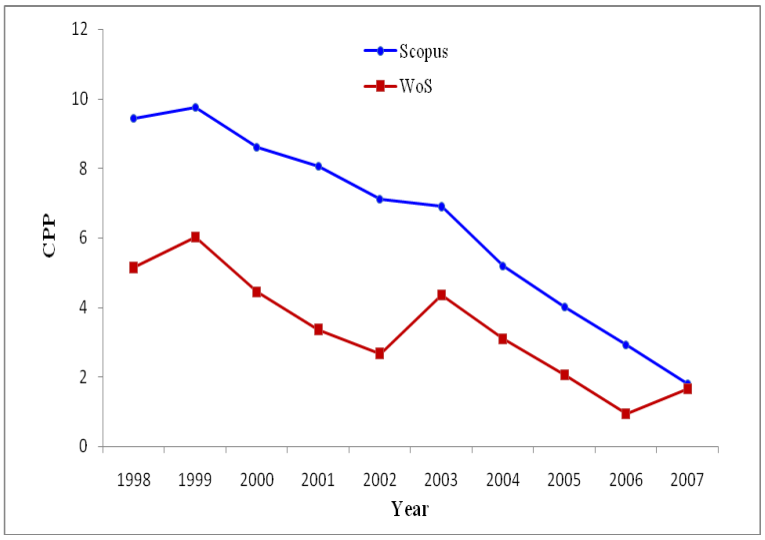

Figure 2. Number of citations per publication in Scopus vs. WOS

We also investigated the percentage of cited and non-cited publications. Based on the findings, the number of cited publications in Scopus and WOS is rising over the examined years (See Figure 3). The results revealed that the number of cited publications in Scopus is higher than that in WOS. Moreover, about 65% out of the total Iranian publications in Scopus are cited while this percentage in WOS is about 53%. Some papers have not received any citation since their publication time. This status is called non-citation which shows how many publications in a field, country or institution and belonging to an author have no impact among their related community. As can be seen in Figure 4, the number of non-cited publications is increasingly growing in both databases. The counts of Table 2 reveal that the number of non-cited Iranian publications is higher in WOS than Scopus. In 2004, about 97% of publications in Scopus have received citations and just about 3% were non-cited. Overall, about 35% of total publications in Scopus are non-cited while this percentage in WOS is about 47% (Table 2).

Table 2

Frequency and Percentage of Cited and Non-cited Publications

Cited and non-cited publications								
	Scopus				WOS			
Year	Cited publications	% of total publications	Non-cited publications	% of total publications	Cited publications	% of total publications	Non-cited publications	% of total publications
1998	859	76.90	258	23.10	678	64.63	371	35.37
1999	1047	78.08	294	21.92	848	71.26	342	28.74
2000	1306	79.54	336	20.46	978	66.04	503	33.96
2001	1536	76.72	466	23.28	1180	65.52	621	34.48
2002	2045	74.12	714	25.88	1205	60.10	800	39.90
2003	2972	76.13	932	23.87	2035	69.76	882	30.24
2004	4972	96.94	157	3.06	2458	57.52	1815	42.48
2005	4703	64.17	2626	35.83	2920	53.87	2500	46.13
2006	5826	56.28	4525	43.72	2286	33.36	4566	66.64
2007	6462	47.43	7162	52.57	3906	48.38	4167	51.62
Total	**31728**	**64.49**	**17470**	**35.51**	**18494**	**52.75**	**16567**	**47.25**

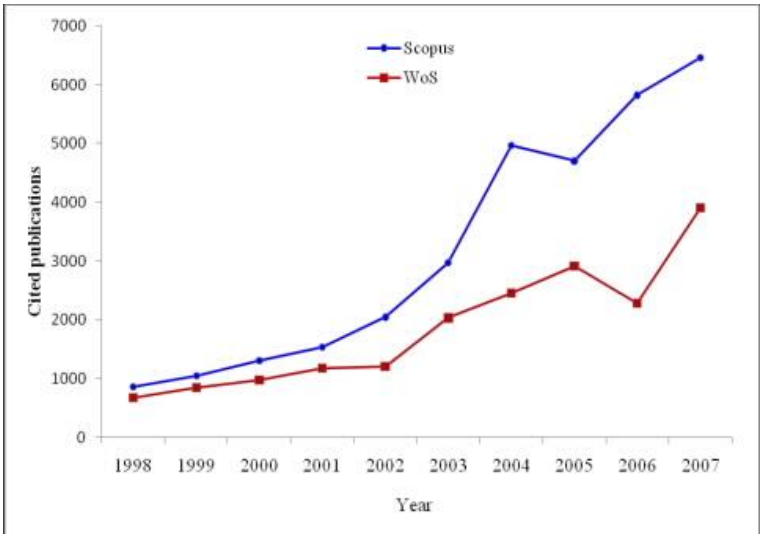

Figure 3. Number of cited publications in Scopus vs. WOS

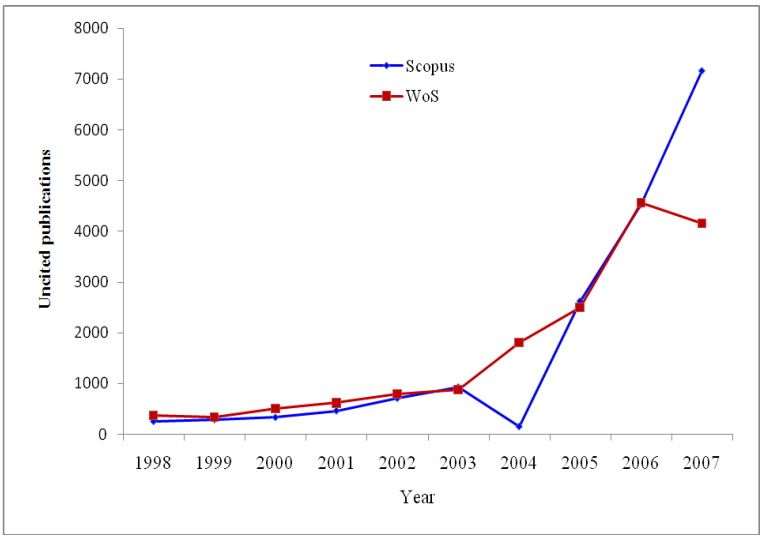

Figure 4. Number of non-cited publications in Scopus vs. WOS

International collaboration was also investigated in Iran's publications in both databases. As Table 3 and Figure 5 show, during the first five years, the number of publications with international author teams was very equal in both databases but for the later five years, the number of these publications was higher in Scopus than WOS. As it is shown, international collaborative publications are rising sharply during 2003-2007 in Scopus while this trend is steadily climbing in WOS.

Table 3

Frequency and Percentage of International Collaborative Publications

International collaboration				
	Scopus		WOS	
Year	No. of publications with international author teams	% of total publications	No. of publications with international author teams	% of total publications
1998	362	32.41	302	28.79
1999	331	24.68	295	24.79
2000	376	22.9	377	25.46
2001	402	20.08	450	24.99
2002	531	19.25	482	24.04
2003	994	25.46	721	24.72
2004	1359	26.5	920	21.53
2005	1921	26.21	1223	22.56
2006	2379	22.98	1380	20.14
2007	3055	22.42	1688	20.91

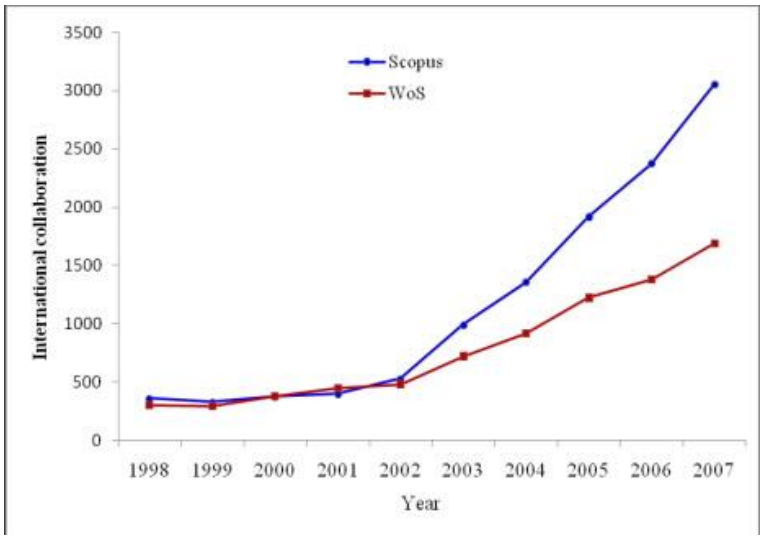

Figure 5. Number of international publications in Scopus vs. WOS

The number of Iranian publications was also investigated in different 22 fields. The results show that in WOS, Chemistry is the most productive field while this field reaches the third rank of productions in Scopus. In fact, Engineering researchers are the most productive authors in the Scopus. As can be seen in Table 4, Clinical Medicine is the second most productive field in the two databases. Social Sciences ranks fourth in Scopus while in WOS it is on the 9th place of publications. The least number of publications in both databases belongs to Economics & Business. All in all, there is more numbers of publications in each of the examined fields in Scopus than in WOS (Table 4, Appendices 1 and 2).

Table 4

Number of Iranian Publications in 22 Broad Fields in Scopus vs. WOS

No. of publicaions in 22 broad fields				
Scopus			WOS	
Fields		No. of publications	Fields	No. of publications
1	Engineering	9899	Chemistry	10991
2	Clinical Medicine	9822	Clinical Medicine	5138
3	Chemistry	8360	Physics	4250
4	Social Sciences, General	6170	Engineering	3395
5	Materials Science	4285	Materials Science	2490
6	Biology & Biochemistry	4179	Mathematics	2132
7	Physics	3566	Plant & Animal Science	1788
8	Space Sciences	3566	Pharmacology	1685
9	Mathematics	3387	Social Sciences, General	1683
10	Agriculture Sciences	2941	Agriculture Sciences	1535
11	Computer Science	2376	Computer Science	1500
12	Environment/Ecology	2370	Molecular Biology &Genetics	1431
13	Pharmacology	1610	Neuroscience & Behavior	1090
14	Geosciences	1335	Biology & Biochemistry	987
15	Immunology	1187	Geosciences	971
16	Microbiology	1187	Environment/Ecology	898
17	Molecular Biology &Genetics	987	Immunology	878
18	Plant & Animal Science	687	Microbiology	731
19	Multidisciplinary	581	Multidisciplinary	513
20	Neuroscience & Behavior	495	Psychiatry/Psychology	346
21	Psychiatry/Psychology	161	Space Sciences	238
22	Economics & Business	147	Economics & Business	45

The growth rate of Iranian publications was also examined in different 22 fields. Based on the results, the growth rate of publications varies in some fields and is rather the same in some others in the two databases. As shown in Table 5 and Figure 6, the growth rate of publications in Agricultural Sciences, Biology and Biochemistry and Environment and Ecology published by Scopus is much less than that of WOS. In the fields of Molecular Biology and Genetics, the growth rate of publications is doubled in Scopus than WOS.

Additionally, the annual growth rate of multidisciplinary publications is about 27% in Scopus but about 4% in WOS. The growth rates of publications in some fields like Chemistry, Economics and Business and Materials Science are much the same in both databases.

Table 5

The Growth Rate of Iranian Publications in 22 Broad Fields in Scopus vs. WOS

Growth rate of publications in 22 broad fields				
	Scopus		WOS	
Fields	**Growth rate (%)**	**R^2**	**Growth rate (%)**	**R^2**
Agriculture Sciences	6	0.24	33.5	0.95
Biology & Biochemistry	29.3	0.98	59.4	0.93
Chemistry	22.7	0.99	22.3	0.98
Clinical Medicine	35.1	0.97	27.4	0.94
Computer Science	30.1	0.97	31.7	0.45
Economics & Business	25	0.74	25.1	0.63
Engineering	27.8	0.99	31.6	0.97
Environment/Ecology	29.7	0.97	40.6	0.81
Geosciences	25.5	0.96	27.4	0.96
Immunology	29.1	0.98	34	0.93
Materials Science	28.4	0.99	28.3	0.9
Mathematics	28.5	0.97	26.1	0.92
Microbiology	35.1	0.97	34.6	0.94
Molecular Biology & Genetics	59.4	0.93	27.4	0.95
Multidisciplinary	26.8	0.8	4.1	0.18
Neuroscience & Behavior	28.8	0.98	29.9	0.87
Pharmacology	21.9	0.9	19.9	0.91
Physics	25.7	0.96	23	0.97
Plant & Animal Science	20.5	0.83	24.9	0.87
Psychiatry/Psychology	25	0.81	26.1	0.78
Social Sciences, General	25	0.95	32.6	0.93
Space Sciences	25.7	0.96	31.9	0.84

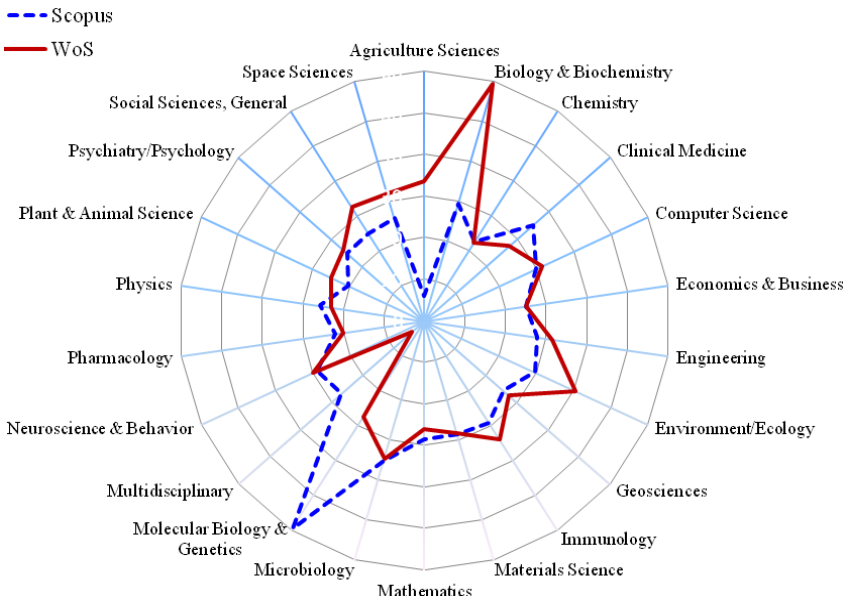

Figure 6. The growth rate of Iranian publications in different 22 fields in Scopus vs. WOS

Discussion and Conclusion

The present study aims to compare Iranian researchers' productivity and impact in WOS and Scopus. According to the results, Scopus includes a more expanded spectrum of Iranian publications than WOS. A total number of 49198 papers from Iranian researchers have been indexed by Scopus during 1998-2007, while the number of publications which have been indexed by WOS is 35061. The growth rate of Iranian publications in Scopus is also more than WOS. The results of the exponential regression test show a 28.7% yearly growth rate for Iranian publications in Scopus and a 24.2% yearly growth rate in WOS. A possible explanation for this finding could be that Scopus covers substantially more journals than WOS. The larger number of journals covered by Scopus is due in large part to the fact that Scopus is internationally oriented (Bosman, Mourik, Van Rasch, Sieverts & Verhoeff, 2006). Based on the results of the study, the number of citations per publication in Scopus is 4.1 but for WOS it is 2.49 citations per publication. This finding is somewhat consistent with that of Vieira & Gomes (2009) who reported higher citedness value for Scopus compared to WOS. Unfortunately, the findings reveal that the number of citations per publication is declining in Scopus and WOS during the ten years. With regard to the percentage of cited publications, about 65% of total Iranian publications in Scopus are cited while this percentage in WOS is about 53%. It should be noted that the number of cited publications is increasing in both databases over the examined years. Additionally, the number of non-cited publications is increasingly growing in both databases.

International collaboration of Iranian researchers in WOS and Scopus was also investigated in this study. Based on the findings, the percentage of publications with

international author teams in both examined databases does not exceed 32 percent per year which shows small tendency of Iranian authors to collaborate with international partners. Consistent with this finding, Hayati & Didegah (2010) found that Iranian researchers, especially those who are working in Iranian universities and research centers, have little tendency to collaborate with researchers from other countries. Investigating the number of Iranian publications in different subject fields showed that the most number of publications in WOS were published in Chemistry while in Scopus Engineering was the most productive field. In a research on Iran's publications in WOS, Osareh & Wilson (2005) also came to the conclusion that Chemistry is the most productive field in this database. The least number of publications in both databases were published in Economics and Business area. In addition, the growth rate of publications was calculated in different fields using an exponential regression test. Biology and Biochemistry had the highest growth rate in WOS, while in Scopus the highest growth rate belonged to Molecular Biology and Genetics. The least growth rate belonged to Agricultural Sciences and Multidisciplinary fields in Scopus and WOS, respectively.

Considering the quantity (number of publications) and quality (number of citations per publication) of publications, it seems that Iranian researchers have performed much better in Scopus than WOS. To sum up, it sounds these two databases can complement each other in indexing and analyzing Iran's publications. While a database has a weak function in some subject fields, the other one is extensively covering the same fields. As the results showed, although Web of Science does not cover a large number of publications in Space Science, there are a remarkable number of publications available in this area in Scopus. Hence, using these two citation and bibliographic tools together helps users to have a more complete and precise information retrieval and provides the possible grounds for doing a more comprehensive assessment of quantity and quality of publications. Our findings corroborate results found in many previous studies regarding the inappropriateness of using WOS exclusively as a source of bibliometric analysis. The use of Scopus in addition to WOS reveals a more comprehensive and complete picture of the extent of the scholarly productivity of the country. Future studies should examine samples from other countries in order to better assess the effects, values and necessity of using multiple citation databases in developing maps of productivity and impact.

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Appendix 1. No. of publications in 22 broad fields in Scopus

Fields	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Total
Agriculture Sciences	84	121	129	132	222	269	351	493	1125	15	2941
Biology & Biochemistry	82	116	136	182	242	333	395	535	879	1279	4179
Chemistry	236	318	373	499	604	833	928	1214	1469	1886	8360
Clinical Medicine	168	170	209	288	492	741	869	1592	2354	2939	9822
Computer Science	53	55	82	83	107	216	248	372	527	633	2376
Economics & Business	6	4	9	3	6	11	12	21	35	40	147
Engineering	220	260	366	459	628	907	1243	1446	1982	2388	9899
Environment/Ecology	53	63	60	85	163	201	251	314	472	708	2370
Geosciences	33	34	72	64	84	141	158	183	248	318	1335
Immunology	24	32	40	50	71	110	110	167	262	321	1187
Materials Science	88	111	151	207	272	394	501	661	878	1022	4285
Mathematics	75	106	111	135	173	246	395	546	716	884	3387
Microbiology	24	32	40	50	71	110	110	167	262	321	1187
Molecular Biology & Genetics	2	5	4	21	15	108	134	176	204	318	987
Multidisciplinary	14	23	23	13	33	30	49	46	138	212	581
Neuroscience & Behavior	9	15	17	22	31	45	47	62	106	141	495
Pharmacology	59	75	77	59	104	117	168	221	323	407	1610
Physics	106	115	130	144	228	271	380	440	771	981	3566
Plant & Animal Science	33	31	34	26	32	56	67	94	149	165	687
Psychiatry/Psychology	2	7	11	8	10	23	18	17	28	37	161
Social Sciences, General	189	212	248	239	383	478	631	802	1303	1685	6170
Space Sciences	106	115	130	144	228	271	380	440	771	981	3566

Appendix 2. Number of publications in 22 broad fields in WOS

Fields	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Total
Agriculture Sciences	25	37	44	39	57	116	183	282	360	392	1535
Biology & Biochemistry	2	5	4	21	15	108	134	176	204	318	987
Chemistry	327	428	508	667	701	1006	1355	1711	2044	2244	10991
Clinical Medicine	162	148	146	197	255	423	517	791	1114	1385	5138
Computer Science	25	96	48	15	6	134	209	287	325	355	1500
Economics & Business	0	4	1	1	2	2	3	11	11	10	45
Engineering	70	71	95	133	148	290	397	556	723	912	3395
Environment/Ecology	16	17	7	11	17	79	121	140	225	265	898
Geosciences	20	26	44	45	48	109	127	133	194	225	971
Immunology	13	17	19	43	27	87	94	169	128	281	878
Materials Science	54	58	83	113	140	237	347	169	573	716	2490
Mathematics	58	77	79	100	91	123	239	382	462	521	2132
Microbiology	6	16	31	33	37	52	73	138	165	180	731
Molecular Biology & Genetics	24	48	54	96	82	111	151	263	265	337	1431
Multidisciplinary	27	37	40	59	35	84	101	55	41	34	513
Neuroscience & Behavior	32	26	29	28	51	59	168	213	231	253	1090
Pharmacology	80	54	80	105	109	149	250	214	305	339	1685
Physics	143	157	180	210	281	334	514	647	831	953	4250
Plant & Animal Science	68	43	84	78	69	149	198	365	313	421	1788
Psychiatry/Psychology	12	9	13	7	23	26	76	52	58	70	346
Social Sciences, General	28	32	64	44	85	113	262	167	383	505	1683
Space Sciences	7	2	8	10	13	24	35	35	50	54	238