

COMPARATIVE ANALYSIS OF SCIENTIFIC PRODUCTIONS OF 5 TOP INDUSTRIAL UNIVERSITIES OF IRAN IN WEB OF SCIENCE DURING 2000-2009

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Abstracts

The purpose of this research is to compare the status of world scientific productions of top industrial universities of Iran in Web of Science during 2000-2009. This research is a type of scientometrics which uses indicators as the number of scientific productions, document types, language types, subject areas, the most important cooperating countries to analyze scientific productions of Sharif University of Technology, Isfahan University of Technology, Amir kabir University of Technology, Iran University of Science and Technology, Khaje nasir toosi University of Technology that are indexed during 2000- 2009 in WOS. The results show that the share of scientific productions of these Universities was 19/67 percent from the total of scientific productions of Iran. Base on the rate of scientific productions, Sharif University of Technology has ranked above the other universities. Most scientific productions of these universities of Technology published in "English" language and in "article" form. In analyzing subject areas, the results indicated that Sharif University of Technology in Material science, Multidisciplinary, and Amir kabir University of Technology in Polymer Science ranked higher than other Universities of this research. Dehghan, M was most active author with 242 productions and 26 h-index amongst authors of these industrial universities. The researchers of Sharif University had 1240 articles in collaboration with reserachers of other countries. These universities had most scientific collaboration with America, Canada and England.

The results show that scientific productions are increasing in fields of Technical-engineering. If the rate of scientific productions continue to increase in the future, will lead to raise funds, scientific collaboration, information exchange with top Universities of other countries.

Keywords: Scientific production, scientometric, Industrials Universities of Iran, Sharif University of Technology, Amir kabir University of Technology, Isfahan University of Technology, Iran University of Science and Technology, Khaje Nasir Toosi University of Technology .

Introduction

One of the most important factors of development and constant infrastructure of the countries is science and technology. Therefore, to assess and recognize the current status of science and technology is essential for changing and improving the conditions of each country. The universities and higher education institutions as the centers of providing scientific information play a major role in development and improvement of the countries and create a convenient arena to promote science and technology. (Zolfigol, 2004)

One of the most common ways to study and assess the situation of providing scientific information of the countries is scientometrics that has gained its position as an appropriate tool for evaluating scientific activities and obtained their efficiency by counting the number of scientific productions in various fields and analyzing them (Shahkhodabande, S.; Biglu, M.H.; Asadi, M. 2010). To assess the effect of research on individual, organizational or national levels, we need resources which can provide accurate and complete citation reports. WOS is a citation database that is widely applied for investigation of citation reports.(Garsia- Peres , 2011)

This database is considered by experts for international comparisons in various fields of science. Since the position and scientific status of each country in the world is based on the rate of scientific productions of the universities and higher education and research institutions. Emphasizing on researches and increasing research activities of this group cause development, improvement and independence of the country. So in this article, we try to compare scientific productions of Iranian top industrial universities in WOS database and determine their positions.

Methodology

Present research was a descriptive-analytical research which compared and analyzed scientific productions of industrial universities in the country over a ten year period from 2000 to 2009 based on WOS database indicators. This study is conducted through scientometrics to survey the number of scientific productions, document type, language, subject areas, Contributors organizations and prolific authors. Hence, the data was collected through library method to assess and compare the results base on comparative studies.

The data was collected from web of science to analyze scientific productions of five top universities of Iran comprising Sharif university of technology, Isfahan university of technology, Amir kabir university, Iran university of science and technology and Khajeh Nasir university of Technology which have been indexed in it from 2000 to 2009.

The data was collected from February 20 to March 22, 2011 from Web of Science database. First of all to be ensure the integrity of data, all Iranian productions were searched by using the word cu=Iran in its advanced search box during this period. All Iranian productions were analyzed applying system analyzer based on institutions name from the year 2000 to 2009. After studying institutions name, scientific productions of each industrial university were extracted. The universities were indexed with various names and this was one of the problems in this part. For example scientific productions of Amir Kabir University of technology were recorded by five different names which all of them considered in future calculations. So, the name of these universities compared with our checklist to achieve the results with high accuracy.

We transferred the data to excel files and analyzed them. Then, five top universities identified according to their scientific productions and the related results extracted in tables and statistic diagrams. In this research the abbreviated names of these universities were used as follows: Sharif University of Technology= SUT, Amir kabir University of Technology=AKUT, Isfahan University of Technology= IUT, Iran University of Science and Technology= IUST, Khaje Nasir Toosi University of Technology =KNTUT

Purpose of the Study

The most important objective of this research is to survey and compare the status of Iranian industrial universities in terms of indexed scientific productions in WOS database in the period from 2000 to 2009. Therefore, identifying the status of science production in each industrial university of Iran and to evaluate and compare the differences, similarities, traits and their strengths and weaknesses in WOS database based on indexes such as the number of scientific productions, document type, language type, the most subject groups, the most important participating (participant) countries are of the most important objectives of this research.

Significance of the Study

The position and scientific situation of each country in the world can be evaluated base on scientific productions of universities and higher education institutions. The importance of research and the increase of research activities in this group improve development, improvement and independence of the country. Review of previous researches showed that the universities in comparison with other iranian institutions and scientific centers have gained the first rank in the rate of scientific productions indexed in ISI database. (Hayati & Ebrahimi, 2009; Sabori, 2006; Noroozi chakoli, Hassanzadeh, Nourmohammadi, 2008)

To indicate the importance of these universities in production of science across Iran. So, we can find Iran universities, specially the universities which are progressing in the field of science and technology that their name starts with " industrial universities" phrase in Web of Science database and then evaluate and study their performances and show their international positions comparably. University officials can use the results of this research in policy, proper planning, targeting the research and scientific activities, determining research preferences, relationship between research and education, strengthening the weaknesses and taking the most appropriate decisions and selecting the best solutions for the problems.

Results Analysis

How was the number and rate of scientific production of five top industrial universities of Iran indexed in WOS database during the years 2000-2009 qualitatively and quantitatively?

Table1. Comparison between scientific publications of 5 top industrial universities of iran in Web of Science during 2000-2009

<i>rank</i>	<i>universites</i>	<i>Record Count</i>	<i>% of iran65138</i>
1	Sharif University of Technology (SUT)	4287	6/58
2	Amir kabir university of Technology (AKUT)	3094	4/74
3	Isfahan University of Technology (IUT)	2213	3/39
4	Iran Universirty of Science and Technology (IUST)	2133	3/26
5	Khaje Nasir Toosi University of Technology (KNTUT)	1010	1/55
	<i>Total</i>	<i>12737</i>	<i>19.52</i>

The figures of table 1 indicated total production of five top industrial universities of Iran in WOS database during ten years from 2000-2009. Share of science productions of these five universities of total scientific outputs in the country during this period was 12737 papers and in ration of total scientific production of Iran (65138 papers) means 19.52. Meanwhile, Sharif university of technology placed is in the first rank with 4287 papers Amir kabir university of technology placed in the second rank with 3094 papers and Isfahan University of Technology with 2210 papers, Iran Universirty of Science and Technology with 2129 papers and Khaje Nasir Toosi University of Technology with 1010 papers were in the next ranks.

Table2. Scientific publications of 5 top industrial universities of iran separated by publication year in Web of Science during 2000-2009

	<i>SUT</i>		<i>AKUT</i>		<i>IUT</i>		<i>IUST</i>		<i>KNTUT</i>	
	<i>Record Count</i>	<i>Growth%</i>								
2000	136	-	72	-	80	-	32	-	20	-
2001	140	9.37	93	47.61	102	37.83	49	68.96	22	15.78
2002	209	49.28	122	31.18	130	27.45	49	0	13	-40.90
2003	274	31.3	171	40.16	137	5.38	89	81.63	43	230.76
2004	289	5.47	208	21.63	157	14.59	119	33.7	45	4.65
2005	403	39.44	263	26.44	179	14.01	153	27.57	71	57.77
2006	489	21.33	335	27.37	229	27.93	250	63.39	119	67.6
2007	621	26.99	426	27.16	270	17.9	357	42.8	144	21.08
2008	772	24.31	590	38.49	408	51.11	436	22.12	208	44.44
2009	954	20.33	814	32.71	521	23.77	599	32.11	325	52.88
TOTAL	4278		3094		2213		2133		1010	

As it can be seen, Sharif university of technology had the highest growth of scientific production in 2002 (49.28 percent) and the lowest growth in 2009 (5.47 percent). This matter was surveyed for other countries; Amir kabir university of technology had the highest growth of productions in 2001 (47.28 percent) and the lowest growth in 2004 (21.63 percent); Isfahan university of technology had the highest growth of scientific productions 2008 (51.11 percent) and the lowest growth in 2003 (5.38 percent); University of Science and Technology had the highest growth of scientific productions in 2003 (81.63 percent) and the lowest growth in 2002 (0 percent); and Khaje Nasir Toosi University of Technology had the highest growth of scientific production in 2003 (76.230 percent) and the lowest growth in 2002 with a negative growth (-40.90 percent). Scientific productions process of these universities' researchers were ascending (graph1).

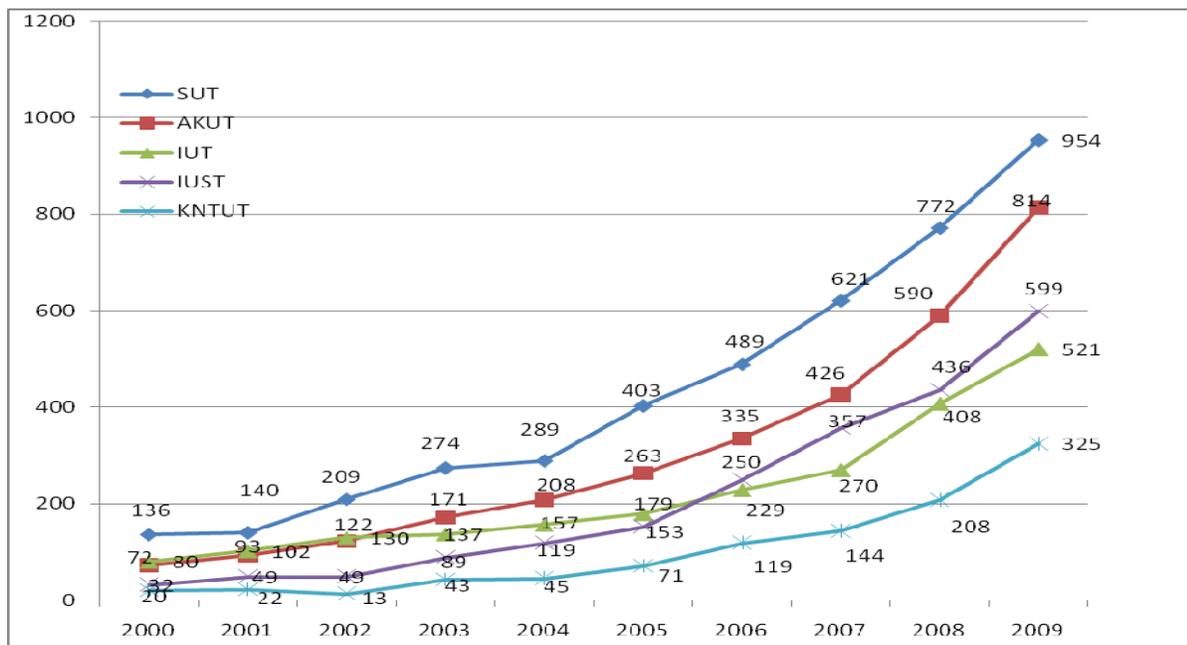


Figure 1. : comparison of the rate of scientific productions' growth in 5 top iranian industrial universities base on publication year in WOS during 2000-2009

This figure indicated that the process of scientific productions in these universities were ascending during 2000-2009 in WOS. SUT had high growth than others, and AKUT, IUT, IUST, KNTUT have placed after it.

which forms (document type) and languages was used in scientific productions of five top universities of Iran indexed in WOS database during the years 2000-2009 were published?

The comparison of scientific productions of five top universities in Iran showed that these productions were published in seven scientific forms. From total of 12737 papers of scientific productions of industrial universities, 11711 titles (91.94 percent) was related to article and the others respectively was related to proceeding papers (649 titles), review (101 titles), meeting abstract (88 titles), editorial material (57 titles) and letter (45 titles), correction (37 titles) were indexed in WOS database.

Moreover, the results showed that 12724 titles (99.90%) of total scientific productions of five top industrial universities in WOS database have been in English. Among all industrial universities, scientific productions of Sharif University of technology had more language diversity, 10 papers published in French, German and Italian languages Isfahan University of Technology also published two papers in French and German languages and Khaje Nasir Toosi University of Technology one paper in German language.

which subject areas of three industrial universities indexed in WOS achieved the most scientific productions during 200-2009?

Table 3. Scientific publications of 5 top industrial universities of iran separated by subject areas in Web of Science during 2000-2009

	<i>row</i>	<i>Subject area</i>	<i>Record Count</i>	<i>% of 4287</i>
SUT	1	MATERIALS SCIENCE, MULTIDISCIPLINARY	592	13.8092%
	2	ENGINEERING, ELECTRICAL & ELECTRONIC	417	9.7271%
	3	MECHANICS	322	7.5111%
	4	PHYSICS, APPLIED	261	6.0882%
	5	CHEMISTRY, PHYSICAL	249	5.8083%
AKUT	1	POLYMER SCIENCE	304	9.83%
	2	ENGINEERING, ELECTRICAL & ELECTRONIC	287	9.28%
	3	ENGINEERING, CHEMICAL	275	8.89%
	4	MATHEMATICS, APPLIED	269	8.69%
	5	MECHANICS	204	8.69%
IUT	1	MATERIALS SCIENCE, MULTIDISCIPLINARY	244	11.0407%
	2	POLYMER SCIENCE	216	9.7738%
	3	CHEMISTRY, ANALYTICAL	146	6.6063%
	4	CHEMISTRY, ORGANIC	141	6.3801%
	5	CHEMISTRY, MULTIDISCIPLINARY	126	5.7014%
IUST	1	ENGINEERING, ELECTRICAL & ELECTRONIC	263	12.3062%
	2	MECHANICS	194	9.1123%
	3	ENGINEERING, MECHANICAL	182	8.5486%
	4	MATERIALS SCIENCE, MULTIDISCIPLINARY	179	8.4077%
	5	MATHEMATICS, APPLIED	175	8.2198%
KNTUT	1	ENGINEERING, ELECTRICAL & ELECTRONIC	104	10.30%
	2	CHEMISTRY, MULTIDISCIPLINARY	91	9.01%
	3	MATERIALS SCIENCE, MULTIDISCIPLINARY	81	8.02%
	4	PHYSICS, APPLIED	68	6.73%
	5	MATHEMATICS, APPLIED	66	6.54%

Scientific productions of top industrial universities of Iran were indexed based on five top subject areas and each of them was presented based on universities names separately in table 3 during 2000-2009 which had the utmost scientific production in WOS database.

Table 4. Ranking Scientific publications of 5 top industrial universities of iran and their toppest subject areas in Web of Science during 2000-2009

<i>row</i>	<i>Subject area</i>	<i>SUT</i>	<i>AKUT</i>	<i>IUT</i>	<i>IUST</i>	<i>KNTUT</i>	<i>Total</i>
1	CHEMISTRY, ANALYTICAL	111	40	146	38	47	382
2	CHEMISTRY, MULTIDISCIPLINARY	169	93	126	47	91	526
3	CHEMISTRY, ORGANIC	128	4	141	13	63	349
4	CHEMISTRY, PHYSICAL	249	102	123	67	33	574
5	ENGINEERING, CHEMICAL	232	275	102	153	45	807
6	ENGINEERING, ELECTRICAL & ELECTRONIC	417	287	98	263	104	1169
7	ENGINEERING, MECHANICAL	241	182	66	182	57	750
8	MATERIALS SCIENCE, MULTIDISCIPLINARY	592	196	244	179	81	1292
9	MATHEMATICS, APPLIED	189	269	61	175	66	760
10	MECHANICS	322	204	95	194	63	875
11	PHYSICS, APPLIED	261	104	86	128	68	647
12	POLYMER SCIENCE	133	304	216	25	13	691

Ranking and evaluating five top industrial universities in term of five top subject areas of each university in WOS database showed that each university had different ranks in various and special subject areas.

Among industrial universities of the country, Sharif University of technology had the first rank in seven subject areas, these fields are: Materials Science and Multidisciplinary with 592 titles, Engineering, Electronical & Electronic with 417 titles, Mechanics with 322 titles, Chemistry, Physical with 261 titles, Physics, Applied with 249 titles, Engineering, Mechanical with 241 titles and Chemistry, Multidisciplinary with 169 titles

Amir Kabir university of technology allocates the first rank of three subject areas in Engineering, Chemical ; Applied, Mathematics and Polymer Science with 275, 265, 304 papers respectively.

Isfahan University of Technology in thematic fields of Analytical, Chemistry; Organic, Chemistry had 146 and 141 papers respectively. Iran University of Science and Technology and Khaje Nasir Toosi University of Technology did not gain the first and second ranks in any fields, just in few fields they gain the third rank of scientific production.. Iran University of Science and Technology in the field of Chemical, Engineering with 153 titles, Electrical & Electronic, Engineering with 263 titles, Mechanical, Engineering with 182 titles, Applied, Mathematics with 175 titles, Mechanics with 194 titles and Applied, Physics with 128 titles and Khaje Nasir Toosi University of Technology in the field of Chemistry, Organic with 63 titles have gained the third rank.

Top subject areas among industrial universities included the following: Materials Science, Multidisciplinary with 1292 titles, Engineering, Electrical & Electronic with 1162 titles, Mechanics with 875 titles.

Who were (top) authors of five top industrial universities in WOS database during 2000 to 2009?

Table 5. The top authors of top industrial universities of iran in WOS during 2000-2009

Row	Authorss	Record Count	Adress	timecited	متوسط استنادات	h-index	university
1	DEHGHAN, M	242	Dept Appl Math	2,277	9.41	26	AKUT
2	HAIPOUR, AR	179	Coll Chem	2077	11.6	25	IUT
3	MALLAKPOUR, S	143	Dept Chem	1217	8.51	19	IUT
4	ENSAFI, AA	102	Dept Chem	981	9.62	18	IUT
5	KAVEH, A	96	Dept Civil Engn	436	4.54	11	IUST
6	MALLAKPOUR, SE	88	Coll Chem	1489	16.92	23	IUT
7	RUOHO, AE	83	Coll Chem	757	9.12	16	IUT
8	MODARRESS, H	80	Dept Chem,	359	4.49	10	AKUT
9	POURJAVADI, A	76	Dept Chem	786	10.34	16	SUT
10	SAIDI, MR	70	Dept Chem	1.273	18.19	21	SUT

In the above table, the names of ten researchers of top industrial universities which indexed most in WOS database were presented. As it is seen in table 8, M, Dehghan from Amir kabir university of technology with 242 documents was in the first rank and Ar, Hajipour with 179 documents in the second rank and S. Mallakpour with 143 documents is in the third rank. from Isfahan University of Technology. In regard to quantitative dimension, the most citations belonged to M, Dehghan's papers from Amir Kabir university of technology, mathematics faculty with 2277 citation. According to the above table, this author had H index 26 and allocated highest index in this field to himself.

Which countries have collaborated in scientific productions with top industrial university of Iran in WOS database during the years 2000-2009?

In regard to collaborations in international level, the researchers of Sharif University of technology with 1240 articles had the highest participation. The highest collaborations were among these universities and America, Canada and England. Sharif university of technology has provided 1240 papers in cooperation with 59 countries, this university has had highest common productions with the USA. While, Amir kabir university of technology in cooperation with 36 countries, Isfahan University of Technology with 50 Iran University of Science and Technology with 38 and Khaje Nasir Toosi University of Technology with 22 countries provided 193,182,77 and 47 scientific document titles respectively, the highest scientific cooperation of Amir kabir and Isfahan University of Technology have been with the USA, Iran University of Science and Technology with Canada and Khaje Nasir Toosi University of Technology with England. As a result: as the research results showed that more cooperation with other countries were effective in more production of science. Thus, Sharif university of technology and Isfahan University of

Technology, which have had cooperation with more countries, their common scientific productions were also more than other universities.

Conclusion

The purpose of this study was a comparative assessment of scientific production in five top industrial universities of Iran in WOS database during the years 2000-2009 based on the indicators such as the number of scientific productions, document type, language type, most important subject areas and the most important cooperating countries. Seventeen industrial universities in Iran worked under ministry of science and by surveying their scientific productions, five universities which have had the highest scientific productions were studied and compared. The share of scientific productions of these five universities from total scientific productions of Iran was 12737 papers during this period, and total productions of the university from total productions of Iran (65138 papers) 19.52 percent. Meanwhile Sharif University of technology with 4287 papers is in the first rank, Amir kabir university of technology placed in the second rank with 3094 papers, and Isfahan University of Technology with 2210 papers, Iran University of Science and Technology with 2129 papers and Khaje Nasir Toosi University of Technology with 1010 were in the next ranks.

Scientific productions process of these universities' researchers were ascending. The results of Belin et al (2007), Bjorn et al (2008) and Wen et al (2007) researches also pointed to the growing in scientific productions. (Belinchon , Ramos, Bellver, 2007; Bjorn, Hundrup, Wagne 2008; Wen, HC & et al. 2007)

Also, the results showed that 99.90% of these university scientific productions were published in English and 91.94% in article form. Among industrial universities, scientific productions of Sharif university of technology had more language diversity, this indicated that more ability and interaction of researchers of this university with other countries. The achievements showed that top subject areas among industrial universities were Materials Science and Multidisciplinary with 1292 papers, Engineering, Electronical & Electronic with 1162 papers and Mechanics with 875 papers.

Most of articles of Sharif university of technology and Isfahan University of Technology were in subject areas of Materials Science, Multidisciplinary, Amir kabir university of technology in Polymer Science, Iran University of Science and Technology and Khaje Nasir Toosi University of Technology in Electrical & Electronic and Engineering. Also, ranking of universities based on the themes showed that Sharif university of technology in seven subject areas Materials Science and Multidisciplinary; Engineering, Electronical & Electronic; Mechanics; Chemistry, Physical; Physics, Applied; Engineering, Mechanical and Chemistry, Multidisciplinary and Amir kabir university of technology in three subject areas: Engineering, Chemical; Mathematics, Applied and Polymer Science, Isfahan University of Technology in two subject areas Chemistry Analytical and Chemistry Organic were in the first rank among other industrial universities of the country.

In regard to cooperation in international level, the researchers of Sharif University of technology with 1240 articles had the highest co-authorship. The highest cooperation were among these universities and America, Canada and England.

M. Dehghan from Amir kabir university of technology with 242 documents and having the highest index H (26) was top author in industrial universities. Generally, considering to the research achievements, it can be said that science production in engineering and technical fields

are increasing and the continuation of this process depended on co-authorship and information exchange with top universities of the world, increasing research budgets, determining research preference and allocating appropriate budgets in the fields that provide the less articles than other fields, praising prolific writers, using unit names for university researchers, introducing top authors to new researchers and observing the integrity in writing the author's name. So, research officials of industrial universities considering to this research achievements should try to increase the production of science and promoting these universities ranks in the country and the world and taking advantage of encourage policies, encourage the researchers to publish the article in journals which are indexed by reliable database. Thus, this is recommended that, for continuous training courses: the methods of writing scientific articles and research methods, familiarity with databases, more familiarity with English language and necessary programming to be done.

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