کارگاه‌های آموزشی مرکز اطلاعات علمی

مقاله نویسی علوم انسانی

اصول تنظیم قراردادها

آموزش مهارت‌های کاربردی در تدوین و چاپ مقاله
Science growth in Iran over the past 35 years

Shabnam Kharabaf,1 Mohammad Abdollahi2

1 Library and Scientometrics Center, Pharmaceutical Sciences Research Center, Tehran University of Medical Sciences, Tehran, Iran. 2 Professor, Department of Toxicology and Pharmacology, Faculty of Pharmacy and Pharmaceutical Sciences Research Center, Tehran University of Medical Sciences, Tehran, Iran.

Background: This study was carried out to evaluate activities in different branches of science in Iran compared to other countries over the past 35 years. Materials and Methods: Essential Science Indicators (ESI) and Web of Science from (Thomson Reuters ISI) and SCImago Journal & Country Rank (SJR) were searched for scientometrics data. ESI indicated place of Iran among other countries in all 22 scientific categories based on the publication and citation rates. SJR parameters, such as publication rate, citable publications, citation rate, citations per publication and the H-index were used to record the rank of Iran among the world’s countries.

Results: A progressive quantitative and qualitative growth of Iranian publications was evident. The field of chemistry in Iran was the most prolific in terms of the number of publications (16982) whereas economics and business was the least prolific (156). A growth in the quality of works of Iranian authors was evident by gaining higher H-index in the recent years.

Conclusions: If this scientific growth of Iran continues, it would not be surprising to see Iran as one of the most powerful countries in the field of science in the World.

Key words: Iran, science growth, ranking in the world

INTRODUCTION

Progress in science and technology is a key driver of social development all over the world. Investing in research and development is a top priority for most developed and developing countries. As recently reviewed, Iran allocates around 0.5% of its gross domestic product (GDP) to research and development, which is of course less than that of some industrialized countries on average of 1.4%.[1]

Though scientometric indicators, such as publication and citation rates, are not specific enough, these are increasingly used for analyzing scientific activities and their relationship with economics and social development. Research output measures such as publication and citation rates differ between various fields of science, universities and nations. The quantity and quality of articles indexed by sound databases are important for a country’s contribution to science and its status in international academic rankings.

To ascertain place of Iran and its growth trend in science, scientometric analysis of relevant databases was conducted.

METHODS

We used the term "Iran" to search through online databases. Web of Science (ISI) was searched over the period of 1975-2010.[2] Information on top authors, institutions, subject areas, and journals was extracted from ISI, as well as publication number, citations, citation per paper, and H-index for Iran year by year. Parameters of a total of 233 countries were analyzed based on the SCImago Journal & Country Rank (SJR)[3] for number of publications, citable publications, citations, self-citations, citation per publication, and the H-index for all 233 countries. By use of Essential Science Indicators (ESI), 10 years activities of the world top countries in 22 subject categories were specified.[4] These included chemistry, engineering, clinical medicine, physics, plant and animal sciences, materials science, mathematics, biology/biochemistry, pharmacology/toxicology, agricultural sciences, computer science, geoscience, environmental/ecology, social sciences/general, neuroscience/behavior, molecular biology/genetics, microbiology, immunology, psychiatry/psychology, multidisciplinary, space science, and economics/business.

Results

Given the ISI data, it was apparent that scientific productivity in Iran has substantially improved over the past decade, with a record of 20610 publications indexed in 2010. The same trend of growth was obvious in number of citations, and H-index (Table 1).

As shown in table 2, Tehran University with a total of 12462 published articles tops the list of Iranian academic institutions, followed by Sharif University of
Technology (8047 articles). Table 3 lists top 15 journals indexed by ISI where most Iranian papers were published. Asian journal of chemistry with 850 published papers was on the top followed by other international journals. Table 4 presents SJR country ranking taking into account cumulative data over the period of 1996-2010. Iran with a total of 118396 papers, 115044 citable publications, 434990 citations, 7.20 citations per paper, and the H-index of 101 took the 31st place among 233 countries. According to ESI (Table 5), chemistry was the most productive field of science in Iran with 16982 papers listed in ISI, followed by engineering (12145) and clinical medicine (9740). Economics and business was the least productive field with only 156 papers.

| Year | No. of Articles | No. of Citations | Citation per paper | H-index |
|------|----------------|------------------|--------------------|---------|
| 1975 | 372            | 2587             | 6.95               | 26      |
| 1976 | 460            | 3618             | 7.87               | 28      |
| 1977 | 583            | 3286             | 5.64               | 27      |
| 1978 | 670            | 4309             | 6.43               | 28      |
| 1979 | 499            | 3902             | 7.82               | 28      |
| 1980 | 343            | 2683             | 7.62               | 24      |
| 1981 | 266            | 1986             | 7.47               | 22      |
| 1982 | 163            | 1211             | 7.43               | 20      |
| 1983 | 151            | 1053             | 6.97               | 16      |
| 1984 | 142            | 918              | 6.46               | 16      |
| 1985 | 138            | 867              | 6.28               | 16      |
| 1986 | 184            | 1114             | 6.05               | 16      |
| 1987 | 165            | 1074             | 6.51               | 18      |
| 1988 | 165            | 1030             | 6.24               | 17      |
| 1989 | 154            | 1491             | 9.68               | 21      |
| 1990 | 190            | 1305             | 6.87               | 18      |
| 1991 | 235            | 2325             | 9.89               | 26      |
| 1992 | 260            | 2426             | 9.33               | 26      |
| 1993 | 416            | 3996             | 9.61               | 29      |
| 1994 | 488            | 3878             | 7.95               | 29      |
| 1995 | 603            | 5333             | 8.84               | 33      |
| 1996 | 718            | 6214             | 8.65               | 34      |
| 1997 | 980            | 8350             | 8.52               | 40      |
| 1998 | 1231           | 11086            | 9.01               | 47      |
| 1999 | 1310           | 15436            | 11.78              | 52      |
| 2000 | 1749           | 16088            | 9.20               | 47      |
| 2001 | 2088           | 19276            | 9.23               | 50      |
| 2002 | 2845           | 23960            | 8.42               | 52      |
| 2003 | 3922           | 32965            | 8.41               | 59      |
| 2004 | 5142           | 35978            | 7.00               | 54      |
| 2005 | 6868           | 42550            | 6.20               | 59      |
| 2006 | 9221           | 50389            | 5.46               | 61      |
| 2007 | 13377          | *                | *                  | *       |
| 2008 | 17256          | *                | *                  | *       |
| 2009 | 19823          | *                | *                  | *       |
| 2010 | 20610          | *                | *                  | *       |

Data were obtained from http://apps.webofscience.com accessed 25 September 2011.
*Data could not be obtained because number of publications were more than the limitation of ISI (10000).
### Table 2. Top 15 Iranian Universities based on scientific productivity according to the Institute for Scientific Information (ISI)

| Grade | University                                      | Number of Publication |
|-------|------------------------------------------------|-----------------------|
| 1     | University of Tehran                           | 12462                 |
| 2     | Sharif University of Technology                | 8047                  |
| 3     | Islamic Azad University                        | 7448                  |
| 4     | Tehran University of Medical Sciences          | 7074                  |
| 5     | Shiraz University                              | 5239                  |
| 6     | Tarbiat Modarres University                    | 4613                  |
| 7     | Iran University of Science and Technology      | 4229                  |
| 8     | Amirkabir University of Technology             | 4220                  |
| 9     | Isfahan University of Technology               | 3514                  |
| 10    | Shiraz University of Medical Sciences          | 2666                  |
| 11    | Ferdowsi University Mashhad                    | 2451                  |
| 12    | Tabriz University                              | 2054                  |
| 13    | Khajeh Nasir Toosi University of Technology    | 1843                  |
| 14    | Shahid Beheshti University                     | 1614                  |
| 15    | Shahid Beheshti University of Medical Sciences | 1579                  |

Data were obtained from http://apps.webofknowledge.com accessed 03 August 2011.

### Table 3. Journals where most Iranian papers were published according to the Institute for Scientific Information (ISI)

| Grade | Journal’s title                                           | Number of published articles |
|-------|----------------------------------------------------------|-----------------------------|
| 1     | Asian Journal of Chemistry                              | 850                         |
| 2     | Applied Mathematics and Computation                     | 653                         |
| 3     | Phosphorus Sulfur and Silicon and the Related Elements | 623                         |
| 4     | Acta Crystallographica Section E-Structure Reports Online | 613                         |
| 5     | Synthetic Communications                                | 562                         |
| 6     | Lecture Notes in Computer Science                       | 547                         |
| 7     | Iranian Polymer Journal                                 | 542                         |
| 8     | Journal of Applied Polymer Science                     | 521                         |
| 9     | International Journal of Psychology                    | 447                         |
| 10    | Iranian Journal of Science and Technology               | 422                         |
| 11    | Iranian Journal of Chemistry and Chemical Engineering-International English Edition | 416 |
| 12    | Acta Horticulturae                                      | 408                         |
| 13    | Transplantation Proceedings                            | 400                         |
| 14    | Archives of Iranian Medicine                           | 394                         |
| 15    | Journal of Chemical Research-S                         | 392                         |

Data were obtained from http://apps.webofknowledge.com accessed 03 August 2011.

### Table 4. The rank of Iran among 233 countries of the world sorted by H-index based on Scientific Journal Rankings (SJR)

| Rank | Country                     | Total number of publications | Citable publications | Total citations | Citations per publication | H-index |
|------|-----------------------------|-----------------------------|----------------------|-----------------|---------------------------|---------|
| 1    | United States               | 5285514                     | 4934052              | 94410591        | 19.11                     | 1190    |
| 2    | China                       | 1837943                     | 1819917              | 6549901         | 5.27                      | 300     |
| 3    | United Kingdom              | 1522264                     | 1382080              | 22915219        | 16.48                     | 721     |
| 12   | Russian Federation          | 479095                     | 474317               | 2288869         | 4.87                      | 274     |
| 21   | Turkey                      | 229932                      | 217509               | 1257466         | 7.06                      | 167     |
| 31   | Iran                        | 118396                      | 115044               | 434990          | 7.20                      | 101     |
| 32   | Singapore                   | 108522                      | 104747               | 988263          | 11.02                     | 209     |
| 40   | Egypt                       | 64153                       | 62827                | 333781          | 6.30                      | 110     |
| 50   | Saudi Arabia                | 36466                       | 34751                | 182765          | 5.98                      | 101     |

Data were obtained from http://www.scimagojr.com accessed 03 August 2011.
Table 5. Ranking of different subject categories in Iran based on Essential Science Indicators (ESI)

| Field                        | Papers | Citations | Citations per publication |
|------------------------------|--------|-----------|---------------------------|
| Chemistry                    | 16982  | 103384    | 6.09                      |
| Engineering                  | 12145  | 40236     | 3.31                      |
| Clinical Medicine            | 9740   | 35345     | 3.63                      |
| Physics                      | 5385   | 23953     | 4.45                      |
| Materials Science            | 4828   | 16244     | 3.36                      |
| Plant & Animal Science       | 4354   | 9482      | 2.18                      |
| Mathematics                  | 2628   | 5387      | 2.05                      |
| Agricultural Sciences        | 2378   | 7128      | 3.00                      |
| Biology & Biochemistry       | 2268   | 10616     | 4.68                      |
| Computer Science             | 1802   | 3624      | 2.01                      |
| Pharmacology & Toxicology    | 1778   | 9616      | 5.41                      |
| Geosciences                  | 1414   | 5528      | 3.91                      |
| Environment/Ecology          | 1362   | 4849      | 3.56                      |
| Social Sciences, General     | 1267   | 2336      | 1.84                      |
| Neuroscience & Behavior      | 868    | 4947      | 5.70                      |
| Microbiology                 | 755    | 2161      | 2.86                      |
| Molecular Biology & Genetics | 691    | 4083      | 5.91                      |
| Immunology                   | 414    | 2549      | 6.16                      |
| Space Science                | 362    | 1021      | 2.96                      |
| Psychiatry/Psychology        | 325    | 1817      | 5.59                      |
| Multidisciplinary            | 277    | 106       | 0.38                      |
| Economics & Business         | 156    | 273       | 1.75                      |

Data were obtained from http://esi.webofknowledge.com/home.cgi accessed 31 July 2011.

DISCUSSION

Iran is a country with bright history of science and rich scientific culture. Over the past decades, despite numerous socioeconomic difficulties, most branches of Iranian science have flourished. Indeed, available scientometric evidences indicated growth in scientific production. Osareh and Marefat evaluated Iran’s scientometrics in Medline between 1976-2003 and concluded a significant growth especially during 1990-2003. In another report, Iranian articles in three different fields of ISI was evaluated between 1993-2002, and a major growth was found. The same results was found in the field of medicine in another study. In a recent essay written by Abdollahi (2011), various reports of international scientometric societies were reviewed and a major record in the world science growth was found for Iran as 736 papers in 1996 reached 13238 papers in 2008. Iran with a rank of 31 in the world has the second rank after Turkey among its neighbors and the eight in whole Asia. Fortunately, the quality of Iranian publications have been also increased.

We authors of the present paper believe that scientific growth of Iran is mainly related to the thoughts of policy makers in paying more attention to science and technology and allocating more budget to developing human resources and infrastructure. In the essay published in European Science editing in 2006, the author related the growth of science in Iran to several reasons such as larger allocation of budget to scientific research sector, increase in the number of graduates and assistant professors over the recent years, and the requirement of students to complete their study with publication or patenting or creating a product. Of course, in the last years, the subject of science editing has been dramatically improved. Most of Iranian journals are now managed by expert editors who know the procedures of improvement the quality of publications such as indexing, online journal management systems, peer review, etc. Now, many of Iranian journals are covered by Scopus, MedLine/PubMed, Web of Science. Meanwhile, the number of Iranian editors who have become member of the Committee on Publication Ethics (COPE), World Association of Medical Journal Editors (WAME), and European Association of Science Editors (EASE) has increased dramatically. In addition, some of them are managing the mentioned committees at higher stages.

Iranian scientists have been very productive in several experimental fields such as pharmacology/toxicology, chemistry, physic, computer, engineering, and clinical medicine. Iranian researchers have gained internation-
al reputations since the 1990s and some of them are listed among 1% top scientists of the world as reported by ESI. Highly expensive instruments especially for high technology researches have been provided in Iranian universities during the past two decades. In addition, many inventions have been registered in Iran in the last 5 years showing a dramatic increase in comparison with the past.[1] Considering the growth rate of science in Iran, it would not be surprising to see Iran as one of the most powerful countries in the field of science in the world.

**ACKNOWLEDGMENTS** This study was partly supported by Pharmaceutical Sciences Research Center of TUMS.

**REFERENCES**

1. Abdollahi M. Perspectives of science in Iran. IJPR 2010; 9(3): 207-8.

2. ISI Web of Knowledge [Online]. 2011. [cited 2011 Aug 3]; Available from: URL: http://apps.isiknowledge.com.

3. Scimago Journal & Country Rank [Online]. 2011. [cited 2011 Aug 3]; Available from: URL: http://www.scimagojr.com.

4. Essential Science Indicators [Online]. 2011. [cited 31 Jul 2011]; Available from: URL: http://esi.webofknowledge.com/home.cgi.

5. Habibzadeh F, Vessal K. Scientific research in Iran: forgotten factors. Lancet 2006; 368(9546): 1494.

6. Osareh F, Marefat R. Iranian researcher's role in the world scientific production based on Medline. Rahyaft 2005; 35: 39-44.

7. Saboury AA. Iran research status report in 2002. Rahyaft 2003; 28: 87-95.

8. Aminpour F, Kabiri P. Science production in Iran: the scenario of Iranian medical journals. J Res Med Sci 2009; 14(5): 313-22.

9. Abdollahi M. Perspective of pharmaceutical sciences in Iran; Job remaining. DARU 2011; 19(2): 80-2.

10. Habibzadeh F. A bird's eye view of science publishing and editing in Iran. Euro Sci Editing 2006; 32(4): 98-100.

11. Abdollahi M. Perspectives on science editing and publishing in Iran: think globally, act locally. Eur Sci Editing 2011; 37(2): 40-1.
کارگاه‌های آموزشی مرکز اطلاعات علمی

مقاله نویسی علم انسانی

اصول تنظیم قراردادها

آموزش مهارت های کاربردی در تدوین و چاپ مقاله