Co-authorship and citation: the case of Iranian articles in ISI databases

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Abstract

This article aimed to investigate status of co-authorship in the Iranian articles published in ISI journals and its impact on citation to these articles. About 23497 Iranian articles which had been published in ISI journals among 1989 – 2005 were analyzed. Articles bibliographic data were extracted from Web of science (WoS) database. chi- square, U Mann-Whitney and -Kruskal-Wallis tests were used to examine hypotheses. Results showed that first writer of about 23357 articles (95/1%) were from Iran and about 20718 articles (88/2%) were written by more than one author. Findings also showed that In 18291 articles (77/8%) co-authors were from Iran. Test results showed significant relation between co-authoring and cites to articles, and simultaneously there is a significant difference between citation rate of articles co-authored by homeland and foreigner writers.

Key words: co- authorship – citation rate – Iranian articles – ISI journals

Introduction

Scientific relationship is a social phenomenon in which a thought is either exchanged among. In fact, scientific relationship considers transfer and dissemination of information. To fulfill this objective, patterns and methods which accelerate the process of transfer of information or facilitate dissemination of information have always been noticed. It is inevitable to refer to others' works to produce a scientific work. Therefore, it

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is of great importance for scientists to have effective relationship with each other in their scientific activities. Thus, scientific cooperation is one of the common procedures of scientific relationship which has been noted by scientists and researchers. Identifying the extent of impact of scientific cooperation on status of scientific productions and quality of published papers is one of the methods which facilitates transfer and dissemination of information.

Problem and methodology

International collaboration in producing scientific papers is increasingly growing during the recent years and publishing scientific articles has changed into a mutual attempt from two or more authors (Hart, 2000). Collaboration in producing scientific articles can have various advantages such as sharing expenses and resources, saving time and employing talents of different people from different institutions and countries. In addition to the above-mentioned advantages, co-authorship can also lead to the growth of citation rate to articles. Since each author might belong to a different country or geographical and linguistic region, they can be effective in introducing published articles to others. Therefore, the extent of referring to articles will be enhanced which would result in the enhancement of their use and citations. Citation rate to articles is regarded as an indicator of quality of articles which is also used in determining the impact factor of magazines (Koricheva, 2005).

Identifying different aspects of co-authorship and its impact on citations to articles can help authorities establish more effective policies and select more suitable methods. The present research tries to investigate the status of co-authorship of Iranian papers in magazines published in ISI throughout the year 2005 and recognize its impact on citation rate to these articles. The geographical dispersion of co-authors in Iranian articles and its changes during different time periods is examined and its impact on citation rate to these articles is clarified. 23494 articles of Iranian authors published in ISI during 1989-2005 were examined in this study to provide response to the fallowing questions

1. To what extents have Iranian authors, who had their articles published in magazines indexed in ISI, had co-authors?
2. How has the geographical dispersion of co-authors in Iranian articles been?

3. How has co-authorship in Iranian articles affected citation rate to these articles?
4. Is there any significant difference between citation rates to Iranian articles according to cooperating with different countries from different continents?

Our primary hypothesizes were:

1. There is a significant difference between the existence of co-authors in articles and citation rate to these articles.
2. Co-authorship with different countries according to their continents has affected citation rate to Iranian articles.

Literature review

Glanzel and Schubert (2001) examined cooperative authorship in chemistry in 1995 in their research "Double Effort = Double Impact? A critical View at International Co-authorship in Chemistry". They concluded that international co-authorship results in greater citation rate in comparison with national co-authorship.

Hollis (2001), in a research "Co-authorship and the Output of Academic Economists", investigated data on scientific works of 339 economists to evaluate the relationship between co-authorship and their scientific output. It is shown that for a given individual, more co-authorship is associated with higher quality, greater length, and greater frequency of publications.

Tiew, Abdullah and Kuar (2002) conducted a bibliometric examination of all the journal articles published in the Malaysian Journal of Library & Information Science from 1996-2000 was carried out. The range of articles published per volume was between 14 and 17; average number of references per article was 22.5; the average length per article was 41.2 pages; 53 (69.74%) of the articles were research oriented; the percentage of multi-authored papers was slightly higher at 52.6% or 40 papers out of a total of 76; the most prolific author contributed 12 articles; 36 (45%) of the authors were geographically affiliated to Malaysia; authors affiliated to library schools were well represented (55.2%); the most productive institution was Faculty of Computer Science and Information Technology, University of Malaya with 26 out of 80 author's affiliation; the most popular subject was Scientific and Professional Publishing; 30 (39.5%) articles

contained author's self-citation, while the rate of journal self-citation was found to be 27.6% and most of the articles (67.1%) contained no formal acknowledgement.

Adams, et al (2005), in a research "Scientific Teams and Institutional Collaboration: Evidence from U.S. Universities 1981-1999", explored recent trends in the size of scientific teams and in institutional collaborations. The data was derived from 2.4 million scientific papers written in 110 leading U.S. research universities over the period 1981-1999. Using this measure, it was found out that team size increased by 50 percent over the 19-year period. National and international institutional collaborations were also investigated in this study. The findings showed that private universities which received no budgets from government were more willing to participate in larger teams to gain fame and scientific authority.

In "Scientific Co-Authorship in China: an Examination of Co-Authoring Patterns and the Impact of Elsevier Journals", authors Royle, Coles and Williams (2005) sampled 429 journals, containing a total 37,526 articles from all Elsevier subject areas. They examined the common patterns of international co-authorship in china. Trends relating to potential influences subject, journal impact factor and article type were explored. Distinguished collaborators who have communicated with authors of Elsevier articles and have maintained the range and nature of their relationship were introduced. The results revealed that out of 9.4 percent of Elsevier articles that had at least one Chinese author, 1.9 percent was resulted from international collaborations and 7.5 percent was brought about by either the authorship of only the Chinese author or a single national collaboration.

Zainab (2008) in an article entitled internationalization of Malaysian mathematic and computer investigated the internationalization characteristics of two Malaysian journals, Bulletin of the Malaysian Mathematical Sciences Society and the Malaysian Journal of Computer Science. Citation to articles was derived using Google scholar. The results indicated that both journals exhibit average internationalization characteristics as they are current in their publications but with between 19% -30% international composition of reviewers or editorials, publish between 36%-79% of foreign articles and receive between 60%-70% of citations from foreign authors.

Baradar and et al (2009) strived to clarify the interdisciplinary relationships of Iranian ISI papers on nanoscience and nanotechnology (N&N). Findings of the research showed an increasing trend of publications from 1 paper in 1995 (with 26 citations) to 94 papers in 2007 (with 2425 citations) is obtained. The 4 top subject fields in N&N were manufacturing and transport engineering (with 48.5% of all citations), physical sciences (15%), chemical sciences (14.7%), and nano (13.3%). They concluded that in the outlining perspectives of N&N in Iran, the convergence of basic sciences (physics and chemistry) and engineering (materials engineering and metallurgy) have the highest impacts on their fundamental and applied aspects, respectively.

Tsay & Lin (2009) explored the characteristics of transport phenomenon literature from 1900 to 2007 based on the Science Citation Index Expanded (SCITM Expanded) database and its implication using two scientometric techniques, namely Bradford-Zipf's law and Lotka's law. They revealed that the literature on transport phenomenon grows exponentially with an annual growth rate of about 8.67% for the last century. Their findings indicated that the journal literature on transport phenomenon confirms the typical S-shape for the Bradford-Zipf plot. The author productivity distribution however does not confirm with Lotka's law by the Kolmogorov-Smirnov (K-S) goodness of fit test.

Findings

Based on findings in this section we strive to provide response to questions and exam hypothesizes.

Question 1: To what extents have Iranian authors, who had their articles published in magazines indexed in ISI, had co-authors?

As observed in table 1, out of 23497 published articles by Iranian authors, 88.2% had co-authors and 1.8% had no co-authors.

Table 1. Extent of Cooperation in Published Articles by Iranian Authors

Status of Cooperation	Frequency	Percentage	Total Percentage
With Co-authors	20718	88.2	88.2
Without Co-authors	2779	11.8	100
Total	23497	100	

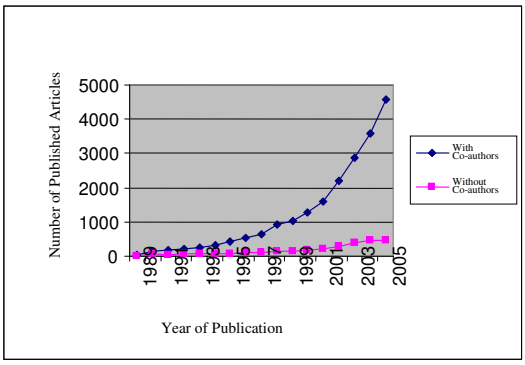
The first authors were Iranian in 94.5 percent of the co-authored articles and only in 5.5 percent of articles, Iranians had cooperated as co-authors. It seems that the extent of international cooperation among Iranian authors is very low and they are more willing to cooperate with national authors.

Table 2. Status of Cooperation of Iranian Authors in Articles having Co-author

Status of Authorship	**Frequency**	**Percentage**	**Total Percentage**
Iranian Authors as the First Authors	19588	94.5	94.5
Iranian Authors as Co-authors	1130	5.5	100
Total	20718	100	

In 17596 out of 19558 articles, both the first authors and the co-authors were Iranians. In the rest of articles, England, Canada and the U.S.A. had a greater proportion as co-authoring countries in producing the articles in which the first authors were from Iran. Publishing co-authored articles had a positive growth during 1989-2005. In 1989, there were only 18 articles which had gained co-authorship; however, this number increased to 4574 articles in the year 2005.

Graph 1. Growth Rate of Iranian Articles during 1989-2005



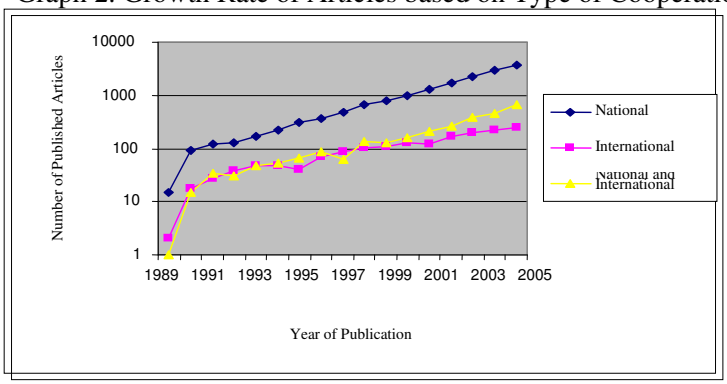
Type of Cooperation in Writing Articles

While responding the question which considers the status of existence of co-authors in Iranian articles published in ISI, the type of cooperation was also examined. Different types of cooperation were considered in this study, such as national cooperation, international cooperation and both national and international cooperation. As table 3 shows, 69.1 percent of articles were resulted from national cooperation. This point is also mentioned in the section concerning co-authors.

Table 3. Dispersion of Articles based on Type of Cooperation

Type of Cooperation	Frequency	Percentage
Without Co-author	2779	11.8
National Cooperation	16230	69.1
International Cooperation	1679	12
National and International Cooperation	2809`	7.2
Total	23497	100

Graph 2. Growth Rate of Articles based on Type of Cooperation



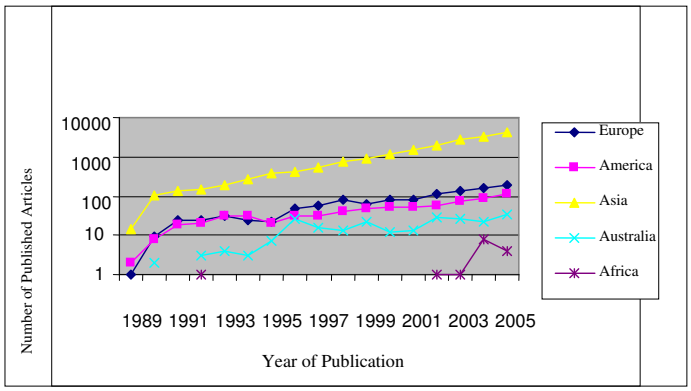
Question 2: How has the geographical dispersion of co-authors in Iranian articles been?

Most of the contributors to producing Iranian articles were from Asia; cooperation of Asian authors accounts for 89.5 percent. Europe and America with respectively 5.5% and 3.5% are also placed after Asia as co-authoring continents. As observed in table 4, cooperation with different continents had a growing process during 1989-2005; however, the growth rate of co-authorship with Asia was much more than other continents. In 1989, only 15 articles were written with the cooperation of Asian authors while it reached to 4226 articles in 2005.

Table 4. Cooperation of Iranian Authors with Authors from Different Continents (1989-2005)

	Co-Authoring Continent					
Year	Europe	America	Asia	Australia	Africa	Total
2005	196	114	4226	34	4	4574
2004	161	89	3312	22	8	3592
2003	131	74	2646	27	1	2879
2002	113	57	1983	29	1	2183
2001	83	53	1455	13	0	1604
2000	80	53	1116	12	0	1261
1999	60	50	905	22	0	1037
1998	80	39	773	13	0	905
1997	55	30	538	17	0	640
1996	50	32	409	27	0	518
1995	23	21	372	7	0	423
1994	24	30	362	3	0	319
1993	31	32	193	4	0	260
1992	24	20	148	3	1	196
1991	24	18	140	0	0	182
1990	9	8	108	2	0	127
1989	1	2	15	0	0	18
Total	1145	722	18601	235	15	20718

Graph 3. Cooperation of Iranian Authors with Authors from Different Continents (1989-2005)



Findings showed 64 countries had a contributing role in publishing co-authored articles which were produced by Iranians or their cooperation. Iran, with 88.3%, achieved the greatest proportion among the countries which contributed to producing articles as co-authoring countries. England, Canada, the U.S.A and Australia with respectively 2.1%, 1.8%, 1.8% and 1.1% of contribution were placed after Iran among the co-authoring countries.

Question 3: How has co-authorship in Iranian articles affected citation rate to these articles?

As observed in table 5, articles published by Iranian authors received 126793 citations altogether; i.e. 5.40 citations per article. Citation rate to the co-authored articles (5.65%) was greater than the articles which had no co-authors (3.54%).

Table 5. Total Number and Average of citations to Articles with or without Co-authors

Do they have co-authors?	Average	Number	total
Yes	5.65	20718	116965
No	3.54	2779	9828
Total	5.40	23497	126793

Hypothesis 1. There is a significant difference between the existence of co-authors in articles and citation rate to these articles.

Chi-Square test was used to examine whether there is a significant relationship between the existence of co-authors and citation rate to articles. Considering the fact that **P** Value equals to 0.00 and is lower than 0.05, the null hypothesis is rejected and the

research hypothesis which was based on the impact of existence of co-authors on citation rate to articles is supported.

In examining the impact of cooperation on citation rate, the following question is raised: Does the type of cooperation in producing articles make a difference in citation rate to them? As shown in table 6, the lowest citation rate is attributed to national cooperation, which accounts for only 5.17%. International cooperation accounts for 6.11%. This is while the greatest citation rate is dedicated to both national and international cooperation which is approximately 8.13%.

Table 6. Citation Rate to Articles based on Type of Cooperation

Type of Cooperation	Average	Number	Total
Without Co-author	3.54	2779	9828
National Cooperation	5.17	16230	83865
International Cooperation	6.11	1679	10269
National and International Cooperation	8.13	2809	22838
Total	5.40	23497	126793

Non-parametric Kruskal-Wallis test is employed to observe if there is a significant difference between citations in different types of cooperation, based on the impact of types of cooperation on citation rate to articles. Since P Value equals to 0.00 and is lower than 0.05, the null hypothesis is rejected and the research hypothesis which claimed a significant difference between citation rates to Iranian articles according to the type of cooperation is supported. Therefore, there is a significant difference between citation rates according to different kinds of cooperation. Considering the citation rates, it can be concluded that national and international cooperation together results in a greater citation rate.

Question 4: Is there any significant difference between citation rates to Iranian articles according to cooperating with different countries from different continents?

Europe and Australia are respectively situated in the first and second place, with 8.14% and 7.78% citations to Iranian articles. Regarding the number of articles which were written by the cooperation of Australia and citation rates to these articles, it can be suggested that cooperating with Australia will result in the growth of citation rate to articles.

Table7. Citation Rate to Articles according to Co-authoring Continents

Continent	Number	Average	Total
Without Co-authors	2779	3.54	9828
Europe	1145	8.14	9358
America	722	7.43	5356
Asia	18601	5.39	100365
Australia	235	7.78	1821
Africa	15	4.27	64
Total	23497	5.40	126793

Hypothesis 2: There is a significant difference between citation to Iranian articles produced as the result of co-authorship with different countries according to their continents.

Kruskal-Wallis test is used to examine if there is a significant difference between citation rates to Iranian articles regarding the collaboration of different countries according to their continents. Since P Value equals to 0.00 and is lower than 0.05, the null hypothesis is rejected and the research hypothesis which claimed a significant difference between citation rates to Iranian articles considering cooperation with different countries from different continents is supported. In fact, there is a significant difference between citation rates to articles according to cooperation with different continents. The average of citations shows the high impact of cooperation with Europe and Australia.

Discussion

The findings of the current study showed that the number of articles published during 1989-2005 had followed a positive growth. Indeed, producing information resources and disseminating knowledge has acquired greater importance during the recent years. Findings of prior researches such as those conducted by Hollis (2001) and Adams (2005) also reveal a positive growth of production of information resources and greater attention to publication of articles. 88.2 percent of Iranian articles published in ISI had co-authors; however, the co-authors in 77.8 percent of these articles were from Iran as well. This situation is also observed about Chinese articles. Royle's research (2005) shows a 72.6 percent of individual writing or exploiting national cooperation of Chinese authors. This is while the findings of this research as well as other researches such as those performed

by Frenken (2005) and Koricheva (2005) confirm the impact of international cooperation on increase of citation rates and improvement of the quality of research works. Ignoring these findings can be one of the reasons for low citation rates to Iranian articles. Since one of the objectives of producing scientific information is including them to the total knowledge of human beings and disseminating knowledge, it is impossible to ignore the accessibility of information at an international level. Using international research collaboration is considered as one of the ways of disseminating knowledge at a wider level. Findings of researches of Frenken (2005) and Leydesdorff (2008) demonstrates the growth of international cooperation in publishing research articles, the strategy which needs to be more noticed by Iranian researchers.

The findings of the research about co-authoring countries show that England, Canada and America had a greater participation as co-authoring countries in the articles in which the first authors were Iranians. As researches of Royle (2001) and shaikevich (2006) show, America and England are also among the main participants of producing articles in countries such as China and European countries. Not only this point confirms the superiority of these countries in producing science, but also makes it necessary to examine their research patterns in producing scientific works. Of course, the supremacy of English as an international language is one of the main reasons of dominance of these countries. English and American authors do not have any difficulty with this international language while, at least in Iran, language is definitely one of the main obstacles of producing global scientific information.

As the findings of the research show, 79.2 percent of articles are produced by the collaboration of Asian countries. Regarding what is already mentioned about co-authoring countries in producing articles in the previous sections, Iran is regarded as the main contributor to Iranian articles (77.8%); therefore, it is natural for Asia to gain the first rank among co-authoring continents in producing articles. Europe and America are respectively placed on the second and third ranks; however, the average of citation rates to articles according to the cooperative continent shows that Europe and Australia achieved the highest average of citation rates. This is while the number of articles which had been produced by the collaboration of Europe and Australia was very low. Regarding these results, it seems essential to revise international research programs and collaborate

with countries of these continents more than ever before. Growth of citation rates is considered among the main objectives of producing information resources and should be more noticed.

Suggestions for Further Studies

As mentioned earlier, no research has been conducted on co-authorship so far. Therefore, a wide range of studies can be conducted in this regard and the following suggestions are just some of the topics that can be noticed:

1. Conducting a similar research in a more limited time period to examine more subtle issues such as status of self-citation in articles and to gain information about the status of co-authorship in the braches of the general fields studied in this research.
2. Conducting comparative studies about the status of co-authorship in countries with higher ranks than Iran in ISI database and examining the possibility of using their strengths in Iranian researches.
3. Conducting a similar research in a specific field in order to gain information about the patterns used by its researchers in research collaboration and authorship.
4. Conducting a research about the extent of knowledge and willingness of researchers and faculty members to make use of research collaboration and co-authorship as a tool for improving research quality.
5. Conducting a research about scientific collaboration of Iran with some certain countries and examining their available research potentialities regarding strengths and weaknesses of their researches.
6. Conducting a research about institutional and international collaboration of universities and research centers and determining the status of co-authorship in them.
7. Conducting a research about scientific cooperation either among national scientific institutions and organizations or their collaboration with foreign institutions and examining its impact on citation rate to performed researches.

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