

Patterns of citation when Korean scientists cite other Korean scientists

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Abstract

Citation patterns of Korean scientists are investigated by analyzing the references of the papers authored by Korean chemists and published in two journals of different standing. Particular interest is given to how frequently Korean researchers quote the papers written by other Korean researchers and whether there is any difference in the citation pattern when Korean researchers publish their papers in a top international journal or in a domestic journal. Two journals in the category of multidisciplinary chemistry, the *Journal of the American Chemical Society* and the *Bulletin of the Korean Chemical Society*, are chosen and a detailed analysis of the references of the papers written by Korean authors in 2015 was performed. The author self-citation rate is found to be much larger than the citation rate of other Korean authors. It is also found that the percentage of self-citations and the percentage of the references by Korean authors excluding self-citations are both significantly larger in the *Bulletin of the Korean Chemical Society* than in the *Journal of the American Chemical Society*. Interpretations of the results based on social exchange theory are proposed.

Keywords

Citation pattern; Reference selection; Self-citation; Social exchange theory

Introduction

References of journal papers play an all-important role in connecting them to a large group of other academic papers. By connecting papers through their references, one can form a huge and complex network of papers. Analyses of this complex network may provide useful information on the evaluation of individual journals and researchers and on the social interaction among researchers at a global scale. The process of reference selection is not entirely academic, but is also influenced by social and psychological factors. In this paper, we investigate some socio-psychological aspects involved in the reference selection process by analyzing the references of the papers authored by Korean chemists which were published in two journals of different standing.

We are particularly interested in how frequently Korean researchers quote the papers written by other Korean researchers. More specifically, we want to ask whether there is any

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difference in the citation pattern when Korean researchers publish their papers in a top international journal or in a domestic journal. For that purpose, we choose two journals in the category of multidisciplinary chemistry, the *Journal of the American Chemical Society* (JACS) and the *Bulletin of the Korean Chemical Society* (BKCS). Chemistry and physics are two representative disciplines where a substantial number of papers written by scientists in Korea are published in top international journals. We have chosen chemistry because, in physics, data analysis becomes complicated due to the papers in experimental high energy physics with an extremely large number of authors [1].

JACS is a top chemistry journal with a very high impact factor and reputation, while BKCS is a Korean chemistry journal listed in the SCI (Science Citation Index) with a relatively low impact factor. Authors of BKCS articles are mostly Koreans. We perform a detailed analysis of the references of the papers written by Korean authors, which were published in JACS and BKCS in 2015. We find some interesting characteristics of how these authors cite the papers written by other Korean authors and notice clear differences between JACS and BKCS.

Methods

The total number of the papers the author lists of which include at least one Korean author and which were published in JACS in 2015 was 70. By ‘Korean’ authors, we mean those who are ethnically Korean and are working in Korean institutions. Ethnically Korean authors working in foreign institutions are excluded. For these 70 papers, we looked up the reference sections and counted the number of all references and that of the references authored by at least one Korean researcher in a Korean institution. This latter number was broken down into the number of self-citations, corresponding to the case where at least one Korean author of the citing paper is also among the authors of the reference, and the number of the references written by at least one Korean author, which are not self-citations. We emphasize that the term ‘self-citation’ is used to mean ‘author self-citation’ rather than ‘journal self-citation’ in this paper.

A similar analysis was done for the papers published in BKCS in 2015. This journal publishes three types of papers: regular articles, communications and notes. For a direct comparison with JACS, we selected all 110 regular articles published in the February (30), April (23), June (20), August (21), and October (16) issues and analyzed their reference sections in the same way as in the previous case. We also performed an independent samples t-test to examine differences between the two data sets, using IBM SPSS ver. 22

(IBM Co., Armonk, NY, USA).

Results

The results of our analysis are summarized in Table 1. The average number of references per paper for the 70 papers in JACS is 55.43, whereas that for the 110 papers in BKCS is 30.98. The standard deviations are 22.92 and 14.49 respectively. It is interesting to note that the papers in JACS have a substantially larger number of references, though both journals are in the same category and the considered papers are of a similar type. It may be the case that authors make much more effort to write the reference section when they publish their papers in JACS than in BKCS.

The average number of self-citations per paper is 3.89 for the JACS papers and 4.11 for the BKCS papers. The latter number is slightly higher, though the difference is small. The standard deviations, which are 3.97 and 5.91 respectively, are very large, being larger than the mean values. This is because there are a relatively small number of papers with a very large number of self-citations. The percentage of self-citations among all references is 7.01% for the JACS papers and 13.26% for the BKCS papers. We note that this number for the BKCS papers is especially high. The self-citation rate for the BKCS

Table 1. Summary results

Category	JACS	BKCS
Total number of papers analyzed (n)	70	110
All references		
Total	3,880	3,408
Mean	55.43	30.98
SD	22.92	14.49
Self-citations		
Total	272	452
Mean	3.89	4.11
SD	3.97	5.91
Percentage of self-citations (%)	7.01	13.26
References written by Korean authors which are not self-citations		
Total	104	221
Mean	1.49	2.01
SD	2.32	2.46
Percentage of references written by Korean authors which are not self-citations (%)	2.68	6.48

Summary results of the analysis of the references included in the papers written by at least one Korean author working in a Korean institution, which were published in JACS and in BKCS in 2015. In the case of BKCS, only regular articles published in February, April, June, August and October were analyzed. JACS, *Journal of the American Chemical Society*; BKCS, *Bulletin of the Korean Chemical Society*; SD, standard deviation.

papers is 1.9 times larger than that for the JACS papers. One of the possible reasons for this may be that the reviewers of BKCS, who are mostly Koreans, either are more generous to authors' making an excessive number of self-citations or pay less attention to the appropriateness of references than those of JACS. We also point out that we have not observed any tendency of journal self-citation.

The average number of the references written by at least one Korean author in a Korean institution excluding self-citations is 1.49 for the JACS papers and 2.01 for the BKCS papers. The standard deviations, which are 2.32 and 2.46 respectively, are larger than the mean values. The percentage of these references among all references is 2.68% for the JACS papers and 6.48% for the BKCS papers. We notice that these rates are much smaller than those of self-citations. There is a strong tendency toward author self-citation and a tendency for Korean authors not to cite other Korean authors frequently. We also note an interesting feature that Korean authors cite other Korean authors substantially more often in a domestic journal than in an international journal of high reputation. The rate 6.48 is about 2.6 times larger than 2.68.

As we mentioned earlier, the process of reference selection is not entirely academic, but is also influenced by various social and psychological factors. It occurs often that authors make a guess about possible reviewers and include their publications as references to give a positive impression in case they are actually chosen as reviewers. This may give a partial explanation of why the rate of citation of other Korean authors in BKCS is much larger than that in JACS, because the reviewers of BKCS are mostly Koreans, while those of JACS are almost always foreigners.

We think, however, that there is another subtle reason for this phenomenon. When Korean authors publish their good results in a prestigious international journal, they may have a psychological desire to be recognized as representative Korean researchers in the field by the global academic community. This may lead to the consequence that they cite the works of other Korean researchers considerably less frequently than

usual. In fact, we believe this kind of tendency is universal and is not limited to Korean authors. It may appear more clearly in Korea because Korea is a small, closed society with well-defined cultural boundaries. On close inspection, however, we believe a similar tendency will be observed in all countries, though perhaps in a modified form. In a more general perspective, we think this is a pertinent example of social exchange theory, which claims that social behavior is the result of an exchange process, the purpose of which is to maximize benefits and minimize costs [2,3]. The benefit of making more self-citations and citing other Koreans less is to give a positive impression that the author is a representative expert in the field in Korea, while their cost is to give a negative impression that the author is arrogant and dishonest. This cost and benefit effect is different when a paper is published in a top international journal or in a mediocre domestic journal, which leads to different behaviors. Socio-psychological aspects associated with reference selection are an area which has not been explored in detail and deserves to be studied further.

We have also performed an independent samples t-test to examine differences between the two data sets, using IBM SPSS ver. 22. In Table 2, we show the results of the analysis of three variables, which are, respectively, the percentage of all references written by at least one Korean author in a Korean institution in each individual paper, the percentage of self-citations in each individual paper and the percentage of the references written by at least one Korean author in a Korean institution, which are not self-citations, in each individual paper. The mean values of the second variable, 7.07 and 11.86, are slightly different from the corresponding values in Table 1, 7.01 and 13.26. This is because the former are the averages of the percentage of self-citations in each individual paper, while the latter are obtained by dividing the total number of self-citations in all papers by the total number of references in all papers. The same applies to the other data in Table 2. The values of P were calculated from the obtained t-values and the corresponding degree of freedom, 178. We find that the test

Table 2. Results of an independent samples t-test for JACS (n=70) and BKCS (n=110) papers

Variables	JACS (n=70)		BKCS (n=110)		t-value
	Mean	SD	Mean	SD	
Percentage of all references written by Korean authors (%)	10.06	8.34	18.4	13.31	14.52***
Percentage of self-citations (%)	7.07	6.66	11.86	11.97	16.83**
Percentage of other Korean citations (%)	2.99	4.28	6.54	7.27	21.04***

The three variables used are the percentage of all references written by at least one Korean author in a Korean institution in each individual paper, the percentage of self-citations in each individual paper and the percentage of the references written by at least one Korean author in a Korean institution, which are not self-citations, in each individual paper. The results indicate that there are statistically significant differences between the two groups.

JACS, *Journal of the American Chemical Society*; BKCS, *Bulletin of the Korean Chemical Society*; SD, standard deviation.

***P < 0.001, ** P < 0.01.

was statistically significant in all cases and both the percentage of self-citations in each paper and that of the references by other Korean authors in each paper are significantly larger in BKCS than in JACS.

In conclusion, we have investigated the citation patterns of Korean scientists by analyzing the references of the papers authored by Korean chemists and published in two journals of different standing, JACS and BKCS, in 2015. We have found that the self-citation rate is much larger than the citation rate of other Korean authors in both journals. We have also found that the percentage of self-citations and the percentage of the references by Korean authors excluding self-citations are both significantly larger in BKCS than in JACS. We have made some discussions on socio-psychological aspects involved in the reference selection process. There are many questions in this subject which have not been explored. A further study in

other academic disciplines will be greatly helpful.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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