Increased citation of Korean scholarly journals during the years 2008 to 2013

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Abstract
Korean academic journals are registered in Korea Citation Index, a government-operated journal indexing system. There has been a constant increase in registry, but whether this change accompanies an increase in quality of the journals has not been determined. In this study, by using the index data of Korea Citation Index, status of journal citation in eight different research fields during the years 2008 to 2013 was analyzed. Impact factors of top 50% journals and the number of the journals with high impact factor increased in all the fields, while the number of journals with low impact factor decreased. The change varied in degree among the different fields, and that in social science and medicine was most positive. These changes appear not to be caused by an increase in self citation, although self citation itself is quite high. International citation of the journals also substantially increased in the fields of science, technology, and medicine. These results indicate a genuine increase in the quality of papers and an improvement in citability of the journals published in Korea. This positive change could be attributed to several factors that include the quality of the information in the papers and the environments that encourage the citation of domestic journals.

Keywords
Journal impact factor; Korea; Periodicals as topic; Publications; Registries

Introduction
Academic journals in Korea are rich in abundance. However, regardless of the field of research, their citation has been poor as compared to internationally indexed journals even though the restricted audience due to language barrier is considered. Although academic societies had been putting efforts for the survival of their own journals, an academy-wide effort to improve the quality of domestic journals has been negligible except some societies even though Korean government has continued their concern on this matter and tried to implement systemic device to improve the quality and usage of the domestic journals [1]. One of the systemic devices is the journal registration that is managed by National Research Foundation (NRF). According
to the data posted in Korea Citation Index (KCI), which is run by NRF, there are 5,051 journals published by academic societies, universities, and research institutes in Korea by December 26, 2015 [2]. Among them, 2,232 are selectively accredited and registered in NRF. The registered are qualified to apply for financial support from NRF or the Korea Federation of science and Technology Societies, and many of them indeed get varying levels of support for journal publication. However, more journals are published in Korea without meeting certain level of standard in criteria such as regularity of publication, number of peer reviewers, and breadth of submitted and published papers. Therefore, there has been worry in Korean academy on poor integrity of research and publication in substantial amount of papers. Even for the registered journals, consistently meeting the required standard and further increasing subscription and citation have not been an easy task due to couple of important reasons. First, the huge number of journals is in large part a product of academic self-righteousness and/or pursuit of advantage of limited peers, and therefore, the width of subscription and the number of sincere audience have not been big. And, a wide range citation did not actively happen among the journals of similar subject. Meanwhile, there are increasing number of authors who want to publish their papers to the journals which guarantee wider audience and higher citability, which is provided by international journals or a small number of domestic journals. In addition, grant funding bodies and universities have long been counting only the papers published in internationally indexed journals, and therefore the domestic journals especially in the field of science, technology, and medicine (STM) are not considered highly in paper submission. This causes poor paper submission, which, in turn, leads to the decrease in the number of cite-worthy papers and eventually to poor subscription or audience to the journal. This trend, if it is ongoing, would easily lead to deterioration in the quality of the domestic journals in general, and therefore, should be a matter of a great concern for Korean academic.

This work intends to determine how the domestic journals are doing as a source of research information among domestic and international papers through examining the status of citation in the different research fields. The citation of the domestic journals during the period of 2008 to 2013 has substantially improved in most of the research fields. Especially, social science journals have substantially grown in numbers with high impact factor (IF) without relying much on foreign citation and been established as a pool of active source of references. Furthermore, the number of journals which are internationally indexed has been increasing rapidly. The result of this study indicates that, despite the concern above, the Korean journals are improving in quality, and this is happening in two directions; an increase in the citation among domestic papers and an increase in the number of international citations. The reasons underlying these changes are worthy of further investigation and discussion and will be used to further promote the functionality as well as the integrity of the domestic journals.

**Methods**

The status of Korean academic journals was studied mostly by using raw data posted on the date of Dec. 26, 2015 in the KCI website (https://www.kci.go.kr). A total of 685 journals in the fields of STM (259 in medicine & pharmacology, 232 in engineering, 123 in natural sciences, and 71 in agriculture & maritime), and 1,545 titles in non-STM fields (553 journals in humanities, 787 in social science, 125 in arts & sports, and 80 in interdisciplinary fields) are registered and listed in statistics at the year 2015.

For the change in the status of citation, the statistics in the registry from 2008 to 2013 was used. Citation is noted by IF which is calculated means of the number of citation of the papers divided by the number of total papers published in the journal during previous two years. The number of citations by domestic journal papers plus that by Web of Science (WoS)-indexed journals are incorporated as IF. KCI statistics also provided percentage of self citation in the journals which is the number of citations made on the papers published in a particular journal in previous two years divided by the number of total citations in the journal published in previous two years.

**Results**

**Change of journal impact factors**

During the period of 2008 to 2013, the numbers of KCI-registered journals and the papers published in them both increased gradually. The journals increased by 12% (from 1,936 to 2,171) and the papers increased by 20.5% (from 85,005 to 102,446) [2]. This expansion of paper contents may have accompanied an increase in the quality of the papers or simply an outcome of the increase in the number of journals. Whether a qualitative change has taken place in the registered journals was determined by analyzing IF of the journals. First, the mean IF of top 50% journals was compared between the years 2008 (papers published in 2006 and 2007) and 2013 (papers published in 2011 and 2012). In all of the eight different fields of research, IF increased substantially with a minimum of 0.13 point and 21% increase in humanities, and a maximum of 0.56 point and 224% increase in medicine (Fig. 1). IF of social science was highest in both years (1.11 and 1.38), although the growth itself was not big. IF of medicine was the lowest
Increased scholarly journal citation during the years 2008 to 2013 in Korea Citation Index

(0.25) but had grown rapidly. Among the field of STM, engineering had grown to the lowest (0.72) followed by agriculture & maritime (0.77). After all, these results indicate that KCI-registered journals in general grew not only in quantity but also in quality in terms of the frequency of citation. Of note, the papers in the top 50% journals in social science were cited more than once a year, and the number was still growing. The high level citation may be due to high tendency of publication and audience in the domestic journals in this field. And, this trend may be attributed to at least two factors. First, there are only few international journals in the field of Korean social sciences, and second, the research may be more of local issues that are more apt to dissemination and discussion in domestic journals.

Change in the number of high impact factor journals
To determine whether the increase in IF is a general phenomenon or what is happening in some selective journals, the number of the journals with IF higher than 1.0 was followed through 2008 to 2013. During this period, the number increased generally in all the fields (Fig. 2), suggesting that the increase in the mean IF is due to the increase in IF of the majority of the journals. The biggest growth is in social science again where the number grew from 7.74% to 36.78% meaning that the papers in more than one third of the journals of this field became cited at least once in a year. In arts & sports and multidisciplinary studies, the number also grew rapidly. Meanwhile, the number grew least in engineering and agriculture & maritime, from 1.55% to 3.37% and from 6.5% to 9.19%, respectively. Especially, in engineering, there were quite few journals with IF higher than 1.0, and the number did not grow much either. Meanwhile, in the field of natural science, the numbers at 2013 was lower than that at 2011 and 2012 (both 9.17%). Although whether the decrease has some significance is not determined yet, there is a possibility that the citation in domestic journals of natural science might have stopped growing considering the rapid advancement in the level of Korean research in this field, and thereby a growing tendency of publication in internationally indexed journals rather than the domestic ones. Overall, these indicate that, during 2008 and 2013, KCI-registered journals expanded in paper numbers and also improved in IF. The quality of paper information and journals themselves might have been improved, but it is also possible that the environment might have changed to encourage communication between the domestic researchers. Maybe, systems such as journal open access promoted quality journal publication and paper access and helped the domestic papers being better recognized and assessed.

Fig. 1. Change in the mean impact factor (IF) of top 50% journals. The mean value of IF of top 50% journals in 2008 (blue bar) and 2013 (red bar) in every field of research is graphed. Separately, the mean values of IF after subtraction of self citation were also presented as green bar (2008) and orange bar (2013) in (-self).

Fig. 2. Change in the number of journals with impact factor (IF) higher than 1.0. The percentage of journals with IF equal to or higher than 1.0 at 2008, 2011, and 2013 was plotted.

Change in the number of low impact factor journals
To further confirm the general improvement of journal citation and quality, the change in the number of journals that have IF lower than 0.2 was checked. In KCI statistics, there are number of journals that haven’t been cited once for a year or years (IF 0.0) [2]. The number decreased in all the fields except for agriculture & maritime, which showed an increase from 20.78% to 49.43% (Fig. 3). The biggest drop was found in engineering which showed a change from 73.36% to 32.49%. This is quite striking that engineering showed the least increase in the number of high IF. Together, this overall...
suggests again an improvement of journals quality. The field of medicine showed a minimum decrease, 55.2% to 49.43%. This field also showed quite small increase in the number of high IF journals (Fig. 2). However, mean IF of top 50% journals in medicine had recorded the biggest increase (Fig. 1). This suggests that, in medicine, IF growth was limited to certain journals. Overall, this trend of the increase of highly cited journals and the decrease of poor IF journals suggests a significant improvement in the quality of the papers and the academic communication between them.

Change of self citation in impact factor in top 50 journals
Self citation affects IF; and therefore, the international citation index databases such as those of WoS and Scopus monitor the extent of self citation. Self citation indeed appears to substantially contribute to IF of the KCI journals in all the fields as shown in Fig. 1. IFs decreased substantially when self citation was subtracted in both the years 2008 and 2013. Especially, in the fields of social science, medicine, natural science, and engineering, the drop in 2013 was bigger than 50%. IF can be manipulated if a journal is run by a small academic society. Society members may be asked by the publishers to self-cite in their papers to increase IF in short period. Whether the positive change in IF in the KCI-registered journals was caused by an increase in self citation was determined. Percentage of self citation in IF-top 50% journals was compared between the years 2008 and 2013. In most fields, percentage of self citation decreased or did not change (Fig. 4). Especially, in the fields of agriculture & maritime and medicine, the decrease was substantial. These results over all suggest that the increase of IF is not due to an increase of self citation. It is also indicated that there probably was little society-wide cooperative effort to raise IF; and therefore IF increased not through some kind of manipulation.

The status of journals with international citation
Some KCI-journals are indexed in WoS or Scopus, and therefore can be read in international audience. In fact, the number of Korean journals in SCIE has increased gradually (Fig. 5). There was 77 SCIE indexed journals in 2009, but it increased to 119 by the end of 2015. Similar numbers of SCIE journals published in Korea are found in [3]. The number of KCI-registered journals with Journal Citation Ranking IF higher than 1 at either 2008 or 2013 was presented in Fig. 6. There was an increase after five years. And, the portion of Korean journals in total WoS database journals has also grown similarly. Whether the increase of the IF of the KCI-registered journals is accompanied by an increase in the international citation was determined by counting the journals with WoS citation. In humanities, social science, and arts & sports, there was no journal of
which JCR impact factor was over 1. Therefore, these journals were exclusively cited by domestic papers. However, in natural science, medicine, engineering, and agriculture & maritime, journals had been cited frequently in WoS, and their numbers increased during the 5 year period. Especially, in medicine, the numbers of the journals that have been cited at least once and those cited more than 100 times a year both increased substantially (2.3 and 7.7 fold, respectively). And, in the field of engineering, the number of journals that cited more than 100 times a year increased to 18 in 2013 from 0 in 2008. In other fields, there was roughly a 50% increase overall (Fig. 7). These overall indicate that the Korean STM journals had grown not only in domestic citations but also prospered in international audience as well. Researches in humanities and social science are rather local in general, and the audience of the papers in these fields does not necessarily be international, therefore, they are not expected to have much increase in WoS citations.

**Discussion**

Overall, IF of Korean journals increased due to the increase of both domestic and international citation. The increase is rather substantial in most fields. The underlying reasons for this change may be multiple. First of all, the quality of the information in domestic journals has likely improved to be worthy of citation. This can be speculated from the fact that the papers of Korean authors published in high IF journals indexed in WoS has been constantly increasing (the number of papers published in SCI journals increase from 34,363 to 51,051 from 2008 to 2013), and the citation of these papers also increased albeit at slower rate (the 5 year cumulative number of citation increased from 3.61 to 4.55) [4]. Secondly, NRF has enforced open access policy in most of the KCI-registered journals [5]. Thereby, increasing number of papers in most Korean journals became freely accessible. This would certainly have helped dissipation and discussion of the information in these journals, and thereby, stimulated citation. Thirdly, grant funding authorities and universities incorporated the number of citation and IF of the journals in evaluation of papers as a product of research outcome. This would raise the concern of the researchers on the IF of domestic journals, and may explain the high IF of the journals in social science where papers are not frequently published in international journals. Forthly, systemic or organized efforts are being made for publishing journals with international standard. For example, Korean Council of Science Editors (http://kcse.org/) and Korean Association of Medical Journal Editors (http://kamje.or.kr/) have been established to help Korean STM journals in promoting their quality to international level. The governmental efforts to implement open assess journal policy in Korean academy would be another good example of systemic support for the improvement of citability of domestic journals.

**Conflict of Interest**

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

**References**


