The Analysis About the Dominant Position Change of China in International Scientific Collaboration

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Abstract. Using 2004-2013 SCI papers, compared with India and Japan, we analyze the dominant position changes of China from the overall and collaboration with USA or Europe (United Kingdom, France, Germany, Italy) two aspects. Then we compare the dominant position changes of China in all categories based on ESI subject classification system. Accordingly, we found that, the China’s DRs all are always above 50% in the recently ten years in the overall and ICRs of Japan and India began decrease, but China’s is still increasing from 2008 and China both have the strong dominant position in collaboration with USA or Europe and China’s DR in each subject is increasing in the whole, except Space Science.

Introduction

Research shows that, collaboration in scientific is one of the basic means to enhance the strength in scientific [1]. In the trend of globalization, different regions of the different professional cooperation in scientific increasing, the importance of international collaboration in scientific has been highlighted. Accordingly, International collaboration can make what effects on the development of a country, researchers have made some research by Scientometrics.

International scientific collaboration can improve the influence of the paper. Based on the SCI database, through the analysis of the international collaboration of 1977-1986 EC countries, Narin found that the citation frequency of international collaboration is the two times of the non-international collaboration’s [2]. Vaan found that international collaboration plays an important role in promoting international influence of papers in astronomy by analyzing collaboration papers of Holland published in 1980-1991 [3].

International scientific collaboration can improve the researchers’ research ability. Ma and Guan using SCI database analysis collaboration of 6538 papers of China in the field of molecular biology, found our country non Co-authored produced paper in the field of molecular biology decrease, and the proportion of international scientific collaboration has been quickly increasing [4]. Arunachalam and Doss, solve the problem of small countries are facing in the development of world-class research of equipment not advanced enough, using BBCI database for the Israel scientific collaboration situation analysis in the emerging field of biology [5]. Glanzel compare the international collaboration papers of EU countries, the results clearly demonstrate the importance of the EU in the scientific collaboration between developed and developing countries in the growing. [6].

Besides, China, a developing and non-English country, produces the world’s second greatest number of papers yearly now. With the trend of Globalization, more attention has been paid to the Scientometrics analysis international scientific collaboration of Chinese publications recently.

Anuradha and Urs analyzes the collaboration between China and India based on the SCI database from subject and other countries participating collaboration perspectives by using correlation analysis method [7]. Wang discuss Chinese international scientific collaboration from countries,
institutions, individuals three different levels [8]. He analyzes the International co-authored articles between Chinese and G7 by analysis method making use of Scientometrics in SCI database [9].

In spite of all mentioned above, most previous studies still have certain defects and limitations. Firstly, most researchers focus on the international collaboration current situation of one country or several countries, each country status and the division in in international collaboration research is less. Corresponding author is an important role, can be identified as the leader of the author group. Change of the corresponding author proportion can reflect the scientific strength of a nation. Secondly, previous study most focused on one or several subjects, lack of the study about whole subject in international collaboration.

Why we choose India and Japan to compare with China? As well as China, Japan is also a non-English speaking country, and India is a developing country.

Data and Methods

Data Sources

Our data is collected from Web of Science. We Search the data with the query CU=Peoples R China, CU=India and CU=Japan one by one. The citation database is restricted in Science Citation Index Expanded (SCIE), publication year is from 2004 to 2013, and only documents types of article, review and proceedings paper are taken into account.

1233655 records of China, 372638 records of India and 763834 records of Japan are collected. The all records of every data are downloaded by text format.

Data Processing

We choose Visual Foxpro to storage and process the records from SCI. We design three databases, China, India and Japan to store SCI records downloaded from Web of Science and normalize all records. Index ESI subject classification of each record. We choose 21 ESI subject classifications (Multidisciplinary excluded) to classify all records from SCI based on WOS subject classifications.

Select international collaboration records. We define the international collaboration record of one country as follows, it contains the country and at least one other countries in the address field. Using this definition, we select the international collaboration records of China, India and Japan between 2004 and 2013. Select the dominant records. We take the corresponding author as the dominant author. Using this definition, we select the dominant records.

Results and Discussion

Overall Change Analysis

Using our definition, we extracted international collaboration records and dominant records of each country, and separately statistics all records, international collaboration records and dominant records per country per year from 2004 to 2013.

In view of the all records amount, the number of records of China and India has increased quickly, but Japan is relatively stable from 2004 to 2013. China has a deep growth about 2.66 times, from 58614 in 2004 to 214274 in 2013. The number of India records increases from 22608 in 2004 to 52390 in 2013, almost 1.32 times. It is worth mentioning that, in 2004, China (58614) is lower than Japan (77149), till 2006, China (84913) is over than Japan (77096), in 2013, China (214274) is almost 2.74 times of Japan (78132). The number of Chinese SCI papers is growing every year. All above mentioned shows that China becomes strong, and will become a growing number of strong.

In view of international collaboration records, we adopt the International collaboration rate (ICR) [10] to analyze the station of the country collaboration with other countries. The ICR of one country is the ratio of the country’s international collaboration records number to it’s all records number. In the whole, the three countries’ ICRs all are growing. From 2004 to 2007, the order of them is Japan, 122
China and India, ICRs of Japan and India are increasing slowly, but China decreased slightly. From 2007 to 2013, the sort of them is India, Japan and China. ICRs of Japan and India are increasing quickly, especially India, and China increased relatively slowly keep around 25%. The gap between China’s ICR and India’s OR, Japan’s becomes more and more wide. In a word, the government of China should supply some relevant policies to encourage Chinese to pay attention to international cooperation (Figure 1).

In view of the dominant records, we define the dominant rate (DR) [11] to analyze the role of a country play in the process of participation in international collaboration. The DR of one country is the ratio of the country’s corresponding author number in in international collaboration records to the number of all international collaboration records. In the whole, the two developing countries, China and India, is more dominant than Japan, the developed country, the China’s DRs are all always above 50%. From 2004 to 2007, the sort of them is China, India and Japan. Compare with in 2007, DRs of three country all have a deep growth in 2008, but China increase more slowly than India, so China is caught up with by India. From 2008 to 2013, ICRs of Japan and India are decreasing, but China is still increasing. As we can see, the dominant position of China is important in the process of international cooperation, scientific strength began to increase after 2008 (Figure 2).

**DRs Changes of China, India and Japan Collaboration with USA or Europe**

We select United Kingdom, France, Germany and Italy four countries on behalf of the Europe. As is known to us all, America and Europe almost on behalf of the world’s highest level, there is no doubt
that if a country collaborate with them, it’s scientific level will get enhanced. We separatetly select the records including USA and Europe (United Kingdom, France, Germany and Italy) in address field from the three databases (China, India and Japan), analyzing DR changes of the three countries.

In the process of collaboration with USA, all DRs of the three countries concentrate on 36% to 57%. DR of China is always above 45%, and keeps the trend of increasing. However, DRs of India and Japan is always lower than China’s, and the trend of decreasing is obvious. In 2004-2013, the DR’s gap between China and India, Japan is becoming more and more wide (Figure 3). Similarly, in the process of collaboration with Europe, DRs of China is always above India’s and Japan’s, keeping around 50% stably. However, the others countries keep the trend of decreasing, especially India (Figure 4).

![Figure 3. The 2004-2013DRs changes of China, India and Japan collaboration with USA.](image)

![Figure 4. The 2004-2013DRs changes of China, India and Japan collaboration with Europe.](image)

What mentioned above shows that, compared with other countries, in the collaboration with the country or region in the world high level, China display a higher dominant position, and keep significantly increasing. Therefore, China’s scientific strength is become more and more strong.
**DRs Changes of China in 21 ESI Subjects**

We use the ESI subject classification system which has been adopted widely in the world. In order to compare DRs changes of different subjects in China from 2004 to 2013, we class the SCI records by 21 categories (Multidisciplinary excluded) of ESI.

As Figure 5 shows, in the whole, almost all China’s DRs in 21 categories keep increasing, Computer Science, Engineering, Geosciences, Materials Science and Environment/Ecology have high DRs, but Space Science’s, Clinical Medicine’s and Economics & Business’s is relatively low now. From 2004 to 2013, the DRs of Psychiatry/Psychology, Immunology, Clinical Medicine and Neuroscience & Behavior increasing quickly, the most quickly is Psychiatry/Psychology’s (from 35.5% in 2004 to 63.7% in 2013). Space Science’s DR has a insight decrease and are always around 50%.

Obviously, in China, some excellent categories have high DR, but increasing is relatively slow. Some weak categories’ DR increase quickly, but they are still relatively low. There is an exception that Space Science’s DR is close to the excellent categories in 2004, but it almost keeps stable in recent 10 years, become the lowest from 2011.

**Conclusions**

Through analysis, we can find that, the number of SCI papers published by Chinese is increasing quickly, but, compared with India and Japan, the international collaboration rate increase relatively slowly. So the gap between China’s ICR and India’s OR, Japan’s becomes more and more wide. The China’s DRs all are always above 50%. From 2008 to 2013, ICRs of Japan and India decrease, but China is still increasing. Meanwhile, in the collaboration with the country or region in the world high level (USA and Europe), China display a higher dominant position, and keep significantly increasing.

Obviously, in China, some excellent categories have high DR, but increase relatively slow, and some weak categories’ DR increase quickly, but they are still relatively low. There is an exception that Space Science’s DR is close to the excellent categories in 2004, but it almost keeps stable in recent 10 years, become the lowest from 2011.
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