Patentometric Study of Global Academies

Chunjuan LUAN[1] Yue CHEN[2] Tianxia BAI[3]

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Abstract

Using patentometric methodology, through analyzing patent activity of global academies, to draw the conclusion that although Chinese academies has the highest number of patent applications, and most of the prolific academic institutions gathered in China, the core patent gathered in US completely. According to the quantitative results, the author suggests that universities in China should improve patent quality and strengthen cooperation with the industry, and Chinese government should adopt positive measures to promote universities' patents transfer.

1 Introduction

The topic of triple helix is becoming a hotspot which attracts more and more attention recently, and this topic have been paid much emphasis by the countries who are trying to develop via innovation. "Triple helix" is a kind of model of innovation, especially means university-industry-government, the three parts collaborating closely and interacting. Innovation is increasingly based upon a "Triple Helix" of university-industry-government interactions. The increasing importance of knowledge and the role of the university in incubation of technology-based firms have given it a more prominent place in the institutional environment. The entrepreneurial university takes a proactive stance in putting knowledge to use and in broadening the input into the creation of academic knowledge. Thus it operates according to an interactive rather than a linear model of innovation. As firms raise their technological level, they move closer to an academic model, engaging in higher levels of training and in sharing of knowledge. Government acts as a public entrepreneur and venture capitalist in addition to its traditional regulatory role in setting the rules of the game. Moving beyond product development, innovation then becomes an endogenous process of "taking the role of the other", encouraging hybridization among the institutional spheres [1]. It is obviously that the academy plays an un-substitutable role in the course of innovation.

It is known that innovation in academy is always the original innovation, and sometimes this kind of innovation is higher than that of in industry. As an important source of innovation, the academy not only produces new knowledge, but also generates many new inventions. With the development of economic society, it appears that the "entrepreneurial university" is a global phenomenon with an isomorphic developmental path, despite different starting points and modes of expression [2]. We find that much research has been done on science papers, especially on SCI papers, but when it comes to academy patents, only little research has been done.

2 Method

The author makes use of patentometric analysis, statistic analysis, co-occurrence analysis, frequency analysis and so on.

3 Data

The data comes from the world authoritative patent database, Derwent Innovations Index, the time-span is 1996-2007, and the assignee names including "univ or college or acad or inst". We get 152 357 patents records, and the distribution of them is as fig. 1. From fig.1, we can easily see that the number of patent application in global academies appears to increase rapidly in recent 12 years, the number of basic patent in 2006 grows 547% more than that of in 1996, from 4533 in 1996 to 29 344 in 2006.

[1]Institute of Humanities & Social Sciences, WISE Lab, Dalian University of Technology, Dalian, P.R.China.
[2]WISE Lab, Dalian University of Technology, Dalian, P.R.China.
[3] Liaoning Huaxia Law Firm. Dalian, P.R.China.

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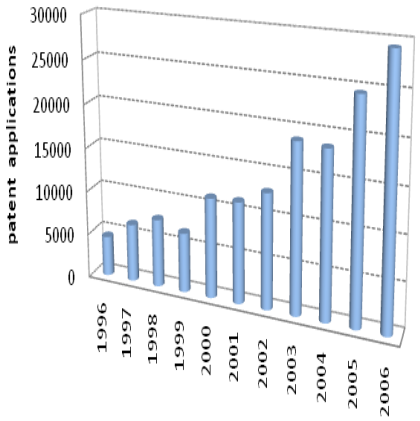

Figure1: The distribution of patent application in global academies yearly (1996 - 2006)

4 Results

4.1 Regional distribution of patent applications of global academies

Every patent record in Derwent Innovation Index (DII) describes a patent family, including an item of basic patent and some equivalent patents. The basic patent stands for a brand-new invention, while the equivalent patents predicate that the inventions which they related to have been embodied by DII as a basic patent. So, it is known that each patent family includes one or a few patent numbers, and the first one is the basic patent, the others equivalent patents. Each patent number consists of two letters and no more than 10 figures, such as CN1561180, JP2006293554, EP1710686 etc.. The two letters are the codes of country, territory, or World Intellectual Property Organization (WIPO), such as CN standing for China, US standing for United States, GB standing for Great Britain, JP standing for Japan, EP standing for Europe Patent Office, and WO standing for WIPO, etc.

We compared the distribution of patent applications in 2006 with that of in 1996. Firstly, we analyze the distribution of 4533 patent families in 1996. There are 20516 patent numbers altogether, among them 15983 patents are equivalent patents, and 4533 patents are basic patents, indicating that most of the patent applications of global academies are new inventions. Fig.2 shows that the distribution of 15983 patent applications. Secondly, we analyze the distribution of 29344 patent families in 2006. There are 37802 patent numbers altogether, among them 8458 patents are equivalent patents, and 29344 patents are basic patents, indicating that most of the patent applications of global academies are brand-new inventions, original inventions. Fig.3 shows that the distribution of 37802 patent applications.

In case of the country or territory distribution of the patent applications of the global academies, the patent applications mainly distribute in EU (29%), US (18%), AU (10%) and JP (7%) in 1996; while CN (42%), US (10%), JP (9%) and EU (9%) in 2006. The ratio of the patent applications of EU has decreased 20%, while that of CN has increased nearly 40%, and that of US & AU both has decreased, and that of JP has increased.

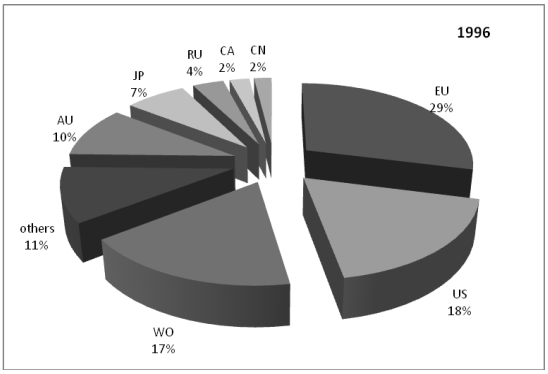

Figure 2: Distribution of patent applications in global academies (1996)

Fig. 2 shows that the 4 top countries (regions) which accept patent applications of global academies are Europe Union(29%), United States(18%), Australia(10%) and Japan(7%), and the total proportion reaches 64.00%.

Fig. 3 shows that the global distribution of the patent applications of worldwide academy, the ranking and the ratio in 2006 is CN (42%), US (10%), JP (9%) and EU (9%). The top 7 countries (regions) which accept patent applications of global academies are China, WIPO, United States, Japan, Europe Union, Russia, and Korea, and the total proportion reaches 92.42%. China is the strongest country in terms of patent applica-

tions of global academies, and this indicates that the innovative capability of China academy has obtained a great improvement. We also see that the total proportion of China, Japan, and Korea reaches 56%, exceeding half of the total, showing that East Asia has become a very important area of international science development.

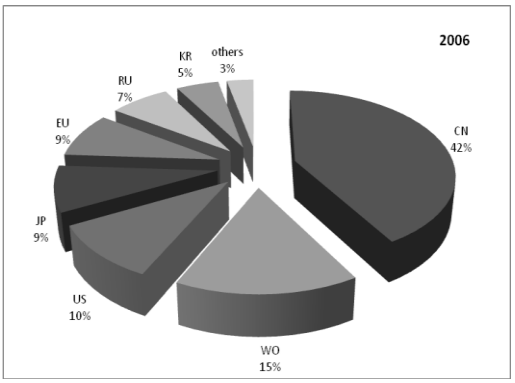

Figure 3: The distribution of patent applications in global academies (2006)

Comparing fig. 3 with fig. 2, we can easily see the evolvement of patent applications of global academies. In 1996, Europe Union is the strongest territory, next to it were United States, Australia and Japan, and the innovative ability of academy in Europe and North America held the advantage distinctly, while that of China was very low, possessing only 2% of the proportion of patent application. It shows that the innovative capability of China academy has improved rapidly, and the worldwide scientific centre is transferring from Europe and North America to China, Japan, and Korea in Asia.

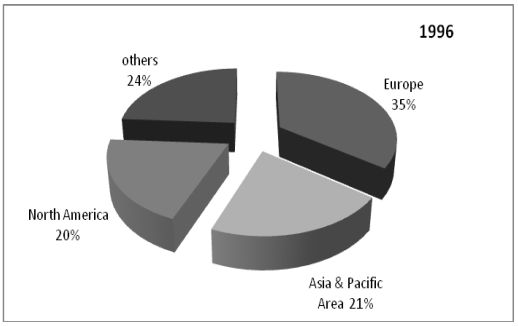

Figure 4: Distribution of patent applications in global academies (1996)

In terms of global distribution of the patent applications of worldwide academies, the ranking and the ratio in 1996 were Asia (35%), Europe (21%), and North America (20%) (see fig. 4); that of in 2006 were Asia (58%), Europe (15%), and North America (10%) (see fig. 5). In spite of the ranking remaining unchanged, the ratio changed greatly: the ratio of Asia has increased 20%, and that of Europe and North America has decreased.

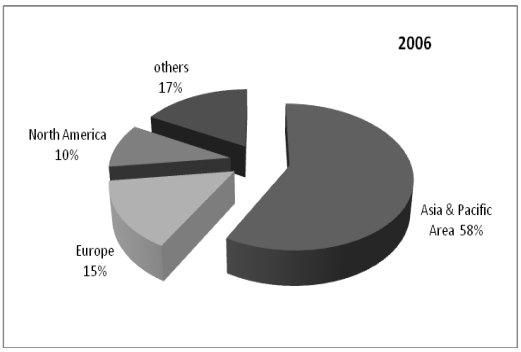

Figure 5: The distribution of patent applications in global academies (2006)

4.2 Patentometric of global academies institutions

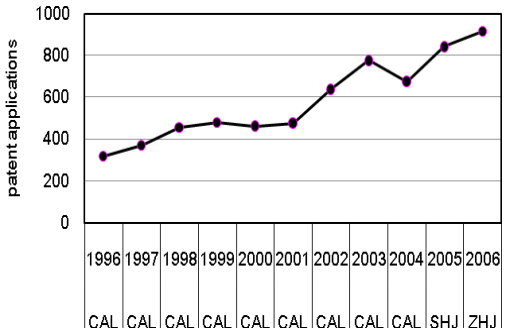

Figure 6: The distribution of patent applications in global academies (2006); CAL - California University, SHJ - Shanghai Jiaotong University, ZHJ - Zhejiang University

1) The top institutions during 1996 - 2006

In terms of the institution distribution of the patent applications of global academies, California University was number one during

1996-2004, and Shanghai Jiaotong University was number one in 2005, while University Zhejiang was number one in 2006 (fig.4). Fig.4 also shows that the number ones' patent applications are increasing. One thing particularly deserves our attention is that the innovative ability of Chinese academies improved rapidly, which was embodied by the phenomena that patent applications increased prominently, and the rankings in the competition rose swiftly. The number of basic patent applications of Shanghai Jiaotong University was 841, standing on top of global academies in 2005; and the number of basic patent applications of Zhejiang University was 914, occupying the head position of global academies in 2006.

2) The Analysis of top 20 institutions of patent applications in global academies in 2006

Among these 20 top institutions, 12 universities belong to China, while the other 8 institutions belong to United States(1), Japan(5), South Korea(1) and Russia(1). Among the top 5 institutions, only California University belongs to United States, and the other 4 universities all belong to China. The innovative capacity of China academies is the strongest to this extent..

We don't see any Chinese institutions among those top 20 institutions in 1996, but we do find that there were 2 Chinese institutions among those top 20 institutions in 2000, UNIV QINGHUA (number 6) and UNIV FUDAN(number 18). There were 4 prolific institutions among top 20 institutions in 2005, and they were UNIV SHANGHAI JIAOTONG, UNIV QINGHUA, UNIV ZHEJIANG and UNIV FUDAN.

UNIV ZHEJIANG climbs to the number one position of patent applications of global academies, and its number of basic patent applications reaches 914.

3) Analysis of inventors' collaboration with institutions of global academies

It is well known that the competition of science & technology is the competition of the talents in the final sense. Institutions possessing a large number of prolific inventors tend to have high outputs. We know that research collaboration is much popular in modern times, and it has been proved that research collaboration has a good influence on their performance. Some research done by the scientometric scientists such as D. Price [3], H. A. Zuckerman [4], and W.Glanzel & H.Czerwon [5] has proved that scientific collaboration is irresistible, and the scale & scope of scientific collaboration is increasing rapidly. International scientific researchers pay more attention to author-collaboration of scientific papers than inventors' collaboration.

Table 1: Top 20 institutions of patent applications of global academies (2006)

NO.	institutions	Patent applications
1	univ zhejiang	914
2	univ shanghai jiaotong	853
3	univ qinghua	731
4	univ california	611
5	univ tianjin	380
6	univ fudan	356
7	univ kyoto	284
8	univ tohoku	284
9	univ tokyo	276
10	univ nanjing	257
11	univ seoul nat ind found	256
12	univ kuban agric	244
13	univ sichuan	221
14	univ nagoya	200
15	univ xian jiaotong	199
16	univ shanghai	198
17	univ osaka	197
18	univ harbin polytechnic	186
19	univ wuhan	182
20	univ donghua	173

4) The distribution of the hot domains of patent applications of global academies

In terms of hot technological fields of global academic patent applications, they mainly distribute in D05-H09: Testing And Detection, S03-E09f: Immunoassay Techniques And Bio-

logical Indicators, B14-H01: Anticancer General And Other, S03-E14h: Investigation Methods For Biological Material, B12-K04f: Tests Involving Dna and Hybridisation Probes Etc. etc.

Table 2: top 9 hot technological fields

No	Derwent manual code	Hot domains
1	D05-H09	testing and detection
2	B14-H01	anticancer general
3	S03-E09F	immunoassay techniques and biological indicators
4	B04-E08	vectors, plasmids, cosmids, transposons
5	D05-H12E	vectors
6	D05-H08	cell or tissue culture
7	D05-H12A	wild-type coding sequences
8	B12-K04F	tests involving dna, hybridisation probes etc.
9	B12-K04E1	testing for substances other than for diseases

5) The distribution of core patent of institutions of global academies

We can identify high quality patent by the indicator of patent citations. It is known that if a patent is cited by many later patents, such high cited patent is also regarded as a core patent. The scientometric scientist F. Narin thinks that a company's patent high citation indicates that the company has a strong technology, the number of patents a company has is not significant in the regression, it is the citation indicators that count [6]. Narin also analyzed a company's patent citations, and found that high citations also appeared 2-4 years after patent being granted [7]. So we choose 11228 patens which applied in the year of 2000, and list top 10 patents with high citations (tab.3).

Tab. 3 shows that top 10 high cited patents are all patents of United States, 4 of them belong to UNIV CALIFORNIA, 3 of them belong to UNIV STANFORD, and each of UNIV ARIZONA STATE, and UNIV WASHINGTON, and UNIV CASE WESTERN RESERVE has one high cited patent. It is known that UNIV CALIFORNIA and UNIV STANFORD are typical entrepreneurial universities, and it is also well known that the whole UNIV STANFORD is a huge incubator [8]. Though the number of patents of universities of USA has decreased, the quality of patents of university of USA is the highest in the world.

Table 3: 10 top patents with high citations of institutions of global academies (2000)

citations	patent number	assignee name
165	us6097859	univ california
150	us5985356	univ california
145	us5990479	univ california
138	wo200048196	univ arizona state
126	us6011795	univ washington
125	wo9963598	univ stanford
122	wo200042231	univ california
104	us6075938	univ stanford junior
94	us6052730	univ stanford junior
93	us6006332	univ case west reserve

5 Conclusions and suggestions on China's triple helix

It is concluded that during 1996-2006, patent applications of global academies has increased rapidly, especially those of Chinese academies. Among top 20 institutions of patent applications of global academies, there were 12 prolific institutions belong to China in 2006, and the total proportion was 60%. It is a common phenomenon that inventors apply patents collaboratively. When it comes to patent quality, the top 10 highly cited patents all belong to USA.

It is urgent to strengthen collaboration between universities and industries of China. The number of patent applications of Chinese academies is much higher than other country's academies, but the total amount of Chinese patent applications is not the highest in the world. Nowadays universities are transferring from research type to entrepreneurial type, and universities not only produce knowledge and talent persons, but pay much attention to the utility of scientific research. Many universities have science gardens, incubators, and through which they put their patent into industry. All these activities improve university's collaboration with industries closely. Industries not only produce products, but train talent person, and afford much to research and development. Industries should keep a close eye on the frontier of S&T, in addition to focusing on the production and market. In our investigations, we find that there are 96 patents applied by Samsung Electronics CO LTD with academic institutions, but there are few

patents applied by Chinese companies with academic institutions.

Chinese academies should pay much attention to improvement of patent quality. Though the number of patent applications of Chinese academies is very high, we did not find any highly cited patents. So we think that Chinese academies should attach much more importance to the quality of patents while pursuing the number of patents.

Chinese government should play a positive role in the innovation of triple helix. The role of government lies in framing and perfecting law to encourage and protect innovators' benefits, building up innovative environment, setting up innovative systems, and assigning public scientific fund fairly and efficiently, and also in positively developing incubators and science gardens to push universities patents into industries. It is proved that the 85 Act of USA to accelerate the collaboration between industry, government and university is successful [9]. Nowadays Chinese academies possess so many patents, so it is urgent for Chinese government to adopt some measures to assist in putting universities' patents into industries.

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