

An Attempt to Grasp Researchers' International Migration

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Introduction

Researchers' international migration has been a critical issue of science and technology policy, however, few bibliometric studies had been carried out for addressing it. Bibliometric methods have some advantages in its non-intrusive nature to questionnaire. I attempted to analyse effect of researchers' migration on national publication by combinatory use of bibliographic data and researchers' CVs published on the Internet.

Some valuable studies were carried out to utilize CVs published on the Internet for quantitative analyses. Dietz, Chompalov, Bozeman, Lane & Park (2000) explored the methodology for systematical collection and analysis although their main purpose was not concerning researchers' migration. Ioannidis (2004) investigated the international migration of highly cited researchers, using the HighlyCited.com database compiled by the Thomson Reuters.

On the other hand, some researches utilized other data sources. Laudel (2003) elaborated methodology for bibliometric analysis of international elite migration, mainly using bibliographic data. Leweson & Kundra (2008) associated Indian researchers' surnames with their origin to investigate their internal migration.

Data and Method

I selected one of three engineering disciplines which were analyzed in our previous research (Yamashita, Ueno, Tomizawa and Kondo 2007); "Computer Science, Artificial Intelligence". I used CVs which researchers of the discipline

published on the Internet as main data sources. To complement them, biographies contained in research articles were used.

Researchers might migrate in their childhood, so I regarded the countries in which the universities researchers graduated from were located as their country of origin according to our previous study. If the university from which a researcher acquired his or her Bachelor's or an equivalent degree was not disclosed, the country of birth was considered as the home country.

Each author's contribution to an article was equally counted as one divided by number of authors for avoiding overrating multi-authored articles. The articles were counted with regard to the following two factors: (a) number of articles written by an author originating from country A (hereafter designated as $No(A)$); and (b) number of articles produced by an institute located in country A (hereafter designated as $Ni(A)$).

In 5,009 papers of which document types were "Article", published in the year of 2006, top 51 cited papers (1.0% of all papers. 51th paper obtained same citation as 50th) in the discipline were extracted from the Web of Science database.

Result

Countries of Residence and Origin of Authors of Highly Cited Papers

Figure 1 depicted relationship between shares of $Ni(A)$ and $No(A)$. Countries of which ranks of either $Ni(A)$ or $No(A)$ were in the top ten were depicted in the figure.

As for $No(A)$, 15.8% of all contributions were not disclosed, thus, vertical axis means "least estimated shares". The US

had predominant share of Ni(A), whereas its share of No(A) was not the highest. China showed the highest share of No(A), which indicated it had provided outstanding research personnel to other countries or itself.

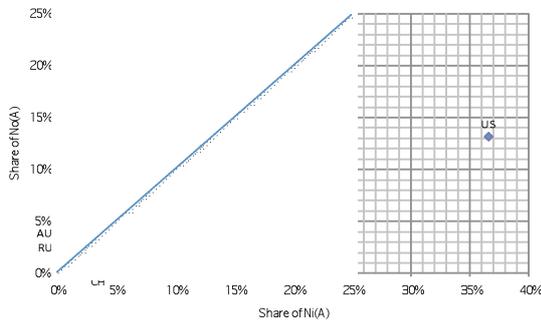


Figure 1. Shares of Ni(A) and No(A) of major countries in the AI discipline in 2006.

As for other countries, it seemed difficult to estimate No(A)s because of their relatively small shares (0-5%), however countries located above diagonal, such as France, India, Australia and Russia had tendencies to provide research personnel to other countries.

Contribution of foreign-born researchers concerning top 1% papers in the world was showed in Figure 2. Arrow signs designated number of publication (thickness of the lines), countries of researchers' origin (starting points) and researchers' destinations (terminal points).

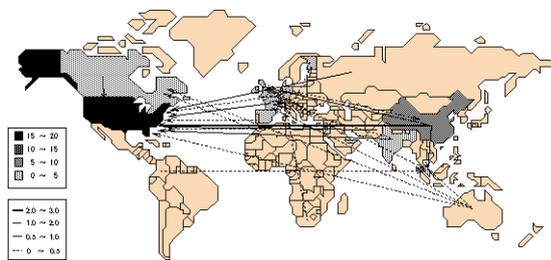


Figure 2. Number of publication and contribution of foreign-born researchers in 2006.

The US gathered many lines from all over the world, thus, it attracted many outstanding foreign researchers. Singapore also published their top 1% papers by foreign-born researchers. On the other hand, Chinese-origin researchers

contributed to many publications of foreign institutions.

Contents of Research-Personnel-Providing / Provided Countries

The US and China had undertaken the role of providing research environment / personnel to other countries. Here, we tried to show the extent of their acceptance / provision of research personnel quantitatively.

Figure 3 and 4 showed content of researchers' origin in papers written by US and Chinese institutes, and destinations of researcher of both countries' origin. Content of these two giants of the AI discipline revealed contrasting natures of them. The US accepted many outstanding researchers from at least ten countries, while China published 76.5% of their high-impact papers by domestic researchers. On the other hand, researchers of US origin tended to publish their high-impact papers in their home country whereas researchers of Chinese origin tended to conduct high-quality research abroad, such as the US, Singapore or the UK.

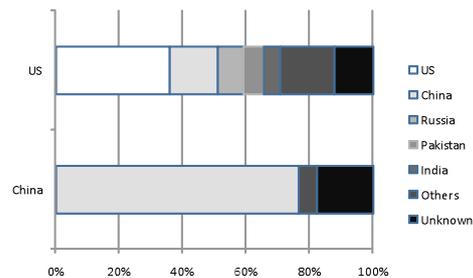


Figure 3. Country-origin of authors of papers by US and Chinese institutes in the AI discipline in 2006 (publication shares in fractional counting).

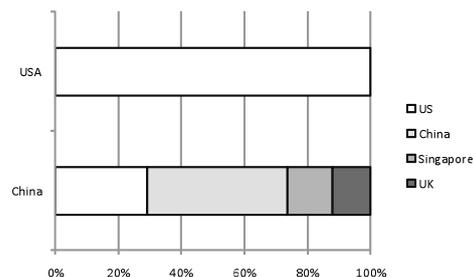


Figure 4. Destinations of researchers of USA and Chinese-origin in the AI discipline in 2006 (publication shares in fractional counting).

Discussion

I tried to analyze effect of researchers' migration quantitatively, by gathering CVs of authors of high-impact papers in a discipline. Although there was limitation of sample size and precision, my analysis revealed publication tendencies of two giants; the US and China.

Selection of discipline is a critical factor of the analysis in the aspect of academic propriety. Laudel (2003) stated that subject category system provided by ISI was not suitable for migration analysis because of its roughness and lack of flexibility. Present study used the system since this study is to be extended to diachronic analysis and relatively stable classification system is needed. Thus, additional analysis is needed to secure eligibility of the discipline.

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