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# A Scientometrics Study about Universities

## Using Chemical Abstracts

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### 1 Introduction

The social role of university is roughly divided into two things. One is transmitting the accumulated knowledge to next generation, i. e. education. And another is creating knowledge by discovery or invention. This is a result of research activity. In this study, I deal with latter among the two, and analyze quantitatively about research activity for natural science. It is a purpose of this study to consider what feature is seen in research activity for each country and establishment form.

A science researcher writes a paper that presents new knowledge from his research on a scientific journal issued from a scientific society which he belongs to. The paper is examined about originality and so on by edit committee. Only the paper, which is passed along such examination is issued on the scientific journal. So, the quality of the paper on the scientific journal is guaranteed beyond a level. We evaluate the degree of scientific research activities of research organizations by the number of papers whose first author belongs to the organizations. So, the number of papers is a reasonable indicator for the evaluation of research activity about research organizations.

The number of papers per teacher of a university is evaluated in order to diminish the size of university and considered the differences in universities by

these data as an index of research (paper) productivity. The comparison of universities is argued through the situation of each country and considered about these features. Therefore, I analyzed quantitatively about the scientific research activity of the country.

## 2 Data Collection

This study counts the number of papers sited on the "Chemical Abstracts"(CA). CA is published by "American Chemical Society Chemical Abstracts Service". The academic articles (full paper) sited on CA are classified following five scientific fields;

- Biochemistry,
- Organic Chemistry,
- Macromolecular Chemistry,
- Applied Chemistry and Chemical Engineering,
- Physical, Inorganic, and Analytical Chemistry,

The total number of papers sited on CA is about 500,000 a year and Institute for Scientific Information (ISI) handles about 680,000. Therefore, it can be said that CA contains the considerable number of papers published in the field of natural science all over the world and contains large number of documents written in other than English.

CA has supplied also as an electronic file and its online searching system. In this study, CASTOR (CA Search Tokyo Online Retrieval) is used, which is an online searching system supplied by Computer Center, at University of Tokyo.

## 3 Comparison of Countries

First, I analyzed of each country by counting the number of papers, and compared each country about this index and fraction (share).

Figure 1 shows the each country share of papers. The United States share accounts for 22% of total papers sited on CA. But both the number of papers and share of US are decreasing tendency in recent years. Conversely, the number of papers of China was seen remarkable increase (14% increase a year (1980-99)). Chinese share of papers in 1999 was about 12 times of that in 1980. The number of papers of other countries are decreasing in recent years likely US, but the share of these countries show no changes.

Second, the number of papers per population (Fig. 2) are evaluated for 20 countries in order to analyze quantitative research activities of each country.

The values of Switzerland and Sweden are the highest values of the countries. These countries show high research productivity in the world.

I adopted ratio to Gross Domestic Expenditure on R & D (GERD) of GDP as an index which shows how much weight each country has placed on science and technology. Consequently, a good correlation is shown between the number of papers per population and ratio to GERD of GDP.

#### 4 Comparison of Universities in the World

I counted the number of papers about top 150 universities in the world. Consequently, about 40% universities of the top 150 are in US (Fig. 3). So the US has more universities with high research activity than other countries. However, 8 Japanese universities are counted in the top 10 universities of the world (8 of 10). It is found that the 8 Japanese universities produce huge number of papers more than any universities in US and in other countries.

UK is the third country with many universities in the top 150 ranking after US and Japan. Germany has 7 universities in top 150 ranking and it is about half of UK universities in top 150, although Germany exceeds UK in number of papers.

China has the most universities with high research activity in Asia except Japan, and shows 60% of Asian universities in top 150.

In order to analyze quantitative research activity of universities, I collected the number of teacher of universities, and evaluated the number of papers per teacher of university. The value is called as research productivity. Consequently, it was found that there were more universities with high research productivity in Japan than other countries, because 10 universities of top 25 were in Japan. It was seen that there was a gap between higher research productivity group and lower group in universities in US.

There are many universities with high research productivity in UK. There are also some universities to have high research productivity in Northern Europe as Sweden, which has a great number of papers per population. So, it is considered that North European area is relatively high research productivity area in the world.

In Asia, there were some small institutes to show high research productivity.

#### 5 Comparison of Universities in Japan

The research activity of universities in Japan is also evaluated from the number of papers of universities, and top 100 universities are determined. Also the

number of teachers of universities are examined and the number of papers per teacher are calculated as research productivity of university.

Consequently, most universities, which produce many papers, are national universities. There are 42 universities in top 100 ranking. Among national universities, the so-called former imperial universities rank the highest. Many national universities also show high research activities. There are several private universities to produce a great number of papers. But most private universities have low research activities than national universities. One reason of the difference between national and private universities is considered that size of faculty concerning natural science in private university is generally smaller than national universities.

The pharmaceutical colleges have very high research activities although the colleges do not come out with high ranking in number of papers. And also national science or technological colleges have relatively high paper research activities.

I collected science research subsidy of each university, and analyzed the relation of number of papers and science research subsidy. Consequently, positive correlation between two is obtained.



