SOME NEW MEASURES FOR SCIENTIFIC MEASUREMENT

G. R. Fadaie Araghi, Ph.D.
Department of Library and Infromation Science
Tehran University, I. R. of Iran
email: ghfadaie@ut.ac.ir

Abstract - This article deals with some social aspects of scientometry. Although scientometry and ISI -one of the scientometry evaluative standards- are something necessary for scientific measurement, they are not without defects. In this regard, the author argues that there are two significant points among criticism. These points are supposed to be external and internal. The external point is highly affected by politics and political powers. The superpowers politely and silently attract and/or invite all alert minds from all over the world and then usurp all their mental activities such as papers and patents. This is so, while these talented persons originally belong to their home countries where they have been trained and given facilities during their scientific life before their immigrations. Putting someone in real need and then preparing his/her needs in another place in order to attract him/her is a kind of imposed dependence but politely and silently. This may be regarded as usurpation if the benefits of the scientific achievements of these persons are not allocated to their home countries. The internal point is that non-English speaking countries have some disadvantages in comparison with the English speaking countries. Therefore, the author suggests that scientometry and especially ISI would operate more efficiently if they establish some branches in other countries or cooperate with some universities all over the world and allocate some benefits to the home countries of writers and researchers.

Keywords: Scientometry, Immigration, Superpowers, Non-English Speaking Countries, ISI Credits.

INTRODUCTION

Evaluation is something necessary in all aspects of our lives by which one can measure things, activities, and processes. It is also very important for decision makers. Without evaluation, no body and then, no country, or nation can decide where to go and what to choose. In fact, all evaluations have economic backgrounds as the research and development have become by words in every nation on the face of the planet. Thus, high standards have been applied to science and technology as a precursor to innovation. From the economic point of view, the contribution to innovation would

bring more value to every nation. Even if somebody or some countries do not count on physical resources, at least, it is seen that life is short and everybody is in the lack of time on the way of development. So, if one intends to do something, he must be aware of its details. Therefore, econometrics has been always a way of describing growth and development. The ability to create and use new knowledge as the most important and valuable commodity is true in the 21st century. In our technological world in which the changes are the main factors to determine things, the evaluation is of great importance. Not only every person but, more than that, every country tries to develop in this world to reach the standards of life so that it would be able to provide its people in view of physical and spiritual aspects. Science and technology which are the basis of any kind of development must be measured in a way to qualify countries in global level. Knowing how to create and use scientific and technological products efficiently and competently is of great value. The experiences eventually will contribute to the added value for each country or nation. Although it is hard to evaluate this abstract in comparison to tangibles, it is a necessity too. Scientometry followed by some ideas such as econometry, and bibliometry showed itself rapidly. Originally, it was established to measure the development of the countries and nations rather than the individuals. The reason is that it was first created by Soviet Russia, then was used in eastern European counties [13] and finally was accepted by other countries. Scientometry is now regarded as a measurement for growth and development. Scietometry, as a newly emerged measurement, has some common concepts with bibliometry, and it is a new domain in research activities. Sengupta [13] defines it as:

> A quantitative evaluation of latest development in a fundamental scientific matter and consideration [of] all the effective factors in continued research progress after the World War II.

But the question is that, is scientometry really the best way of evaluating science, as it is defined now in ISI standards? Does scientometry intend to keep the highest status of developed countries and put undeveloped countries under the standards for ever? Does scientometry intend to globalize the knowledge and share other nations in creativity and innovation? There is no difference whether scientometry has problems in criteria or in its way of evaluating. Therefore, is it possible to suggest some points to promote the situation? Consider that the evaluation of the quality of scientific research may have a variety of motivations. Although we have witnessed a steady growth in scientometry, a number of fundamental questions are unanswered. It must be noted that scientometry is neither an absolute measuring tool nor an act as a magic, but up to now it has been considered as the best means to measure scientific potentials and introduce some solutions to the problems [13].

The parameters must be able to provide concrete answers to those who have expectations of international institutions which allocate advantages or grants to the contributors. The purpose of this article is to identify some meaningful parameters and indicators by which the overall socioeconomic impact of the intellectual affairs could be assessed.

SOME CRITICISM

There is some criticism on ISI standards, such as it is a quantity-oriented institute, it may not be democratic and it may maintain the benefits of those countries with more potential and capital. Among the existent criteria in ISI such as novelty, information ordering, citation and estimated costs, the highest rankings have been due to two major criteria, the number of papers and the number of citations, for more than 10 years (1993-2003) during which the U.S. has been the highest ranked country in the world. The number of papers for the U.S. has been almost fourfold of that of Japan, the second country in paper production. The number of citations has been 5.3 times more than England, the second county in terms of citation [12]. It is evident that by these criteria some special countries may remain in the first rank in any subject for ever although some, such as Iran, do their research in short periods of time and therefore can not regularly produce high number of papers [3]. One of the real problems for countries such as Iran is that they do not have a basic technological infrastructure and suffer from this element.

Those who agree with this system of evaluation may say that there is not better way found up to now and it can not be helped anymore. There is also some criticism for the standards [11]. We can criticize the other side of the existing standards such as the average number of citations per paper. They state that by this parameter, the U.S. comes after the Guinea Bissau, Bermuda, Senegambia, Rwanda, and Switzerland, while, another study on 22 subjects shows that in view of number of papers and citations, the U.S. ranks first [12]. So, as Saboury [11] states, it seems that average number of citations per paper by itself may not be valid.

Another point is that the ISI standards are technology-based and there is a little attention to humanities. Effective combination of science and society is very important while in ISI evaluation system, there is less attention to this factor. The defects of this attitude target especially those countries in transition which are full of pragmatic problems [2].

ISI STANDARDS

Regarding the standards practiced by ISI, some of the most notable criteria are as

follows [11]: the date of publication; being in accord with international rules and regulations of publications; specialization and possession of titles; abstracts and keywords rendered in English. It is also recommended that sources relied upon be in English language too.

Regarding these standards, much emphasis has been put on English language as much as even the source must be in English. The question is this, although English language is the dominant language in the world, does it mean that other languages are of lower importance? And more important, regardless English language, is it possible to find some good points and new ideas in the world? And does this matter harm global cooperation for science and technology [8]?

Other indices indicate that two major factors must be regarded: first is the amount of investments and expenditures on "research and development", and the share of research found from GNP, and second factor is the ratio of researchers to whole people [6].

Anyway, knowledge produced by universities and research organizations are generally perceived as being the head of a national innovation system. Achieving a desirable status in this field requires the existence of other essential prerequisites such as effective policies from managing the intellectual properties produced in these academic centers [11].

Actually as Rahni [9] states, only by properly understanding the difficulties and obstacles and evaluating capabilities and potentials, an appropriate plan could be devised and selected.

TWO MAIN PROBLEMS

Now we take a look at these criteria from another aspect. It seems there are some other problems which impede this system to be an exclusively viable measurement for scientific evaluation. Here, two kinks of these problems are emphasized on. In this article, these two problems are supposed to be external and internal.

The external obstacle is the role of political influence on the ISI measurement. Some may say that ISI's juries are free from political impacts. But they must go back and observe how some countries especially superpowers have collected papers and patents which are considered as the two main factors in ISI standards for measuring countries' development. Even collaborative network structure is rooted in cultural and political ground [14]. And in Canada, traditionally, economic growth and trade are heavily tied to politico-economic relationships [1].

These days, nobody can deny the fact that superpowers openly or in secret collect the papers and patents, call for innovators, genuine and smart minds from all over the

world. These talented persons are invited and encouraged to leave their home country and immigrate to have more facilities. The immigration rates in some countries especially to USA and Canada prove this claim. Moreover, there is some prejudice from superpowers against some countries. For example, they order their publishers not to publish articles from some countries such as Iran which practiced by IEEE, or do not allow some scholars and scientists to enter their country to participate in seminars or other scientific meetings. Mehrdad, et al. [8] state:

> In recent years the Iranian scientists have been experiencing an undue biased conditions in publishing their scientific articles in some prestigious international journals and there have been extremely discouraging conditions for their participations in international conferences (very strict and sometimes discriminatory visa practices) and even worse facing intolerable conditions when they apply for visa for sabbatical leaves or for collaborative research projects in the international arena.

To be pessimistic, one may compare this situation to the exploitation of work forces from other countries especially African continent in previous century. They used to take workers and bring them as slaves and exploit their work forces as much as they could in any way they wanted. Now the form has changed and they collect the intellectual work forces in a very polite-based manner. In other words, it has become natural and legal to be free to appoint one's place for living anywhere possible. But this matter must be taken into sever consideration if it has been done as the result of natural process or by visible or invisible forces. This occurs mostly because of the propaganda or other encouraging elements that the superpowers call for the minds from all over the world. Developed countries are quite aware that the talents and sophisticated minds especially of the youngsters are the best investments and are of high value. Consider the elements allocated to the specialty and age for immigration to some countries such as Canada. In some countries such as Iran, it is said that as long as a student gains a medal in Olympiads he/she is immediately invited to advanced universities and all kinds of facilities will be awarded to them and even to their families. To support this idea, I would like to mention an ironical statement from one of my colleagues, living in Canada as an immigrant, who indicated his views towards this matter. He said the superpowers' approach towards underdeveloped countries is with double benefits. These superpowers authorize the dictators of under developed countries to exploit their national ground facilities and under ground mineral resources. This will consequently bring poverty and disaster to that nation. And as the consequence, people of these countries become angry and dissatisfied with their governments, and suffer from the low standards of life especially in scientific domains. Afterwards, the superpowers call for unsatisfied people who have the potential for developing their countries, and then

deliberately provide them with all facilities they require and finally make benefits of them. Therefore, they attain mineral resources as well as mental capital of those mentioned countries by one tactic. Also, there were the statistics in nearly 25 years ago, which said, for example, the number of Iranian medical specialists in one of the states of America; California, in 1974, was more than those who were in Iran. Another statistic showed that about 60% of the scholars in U.K. have come from the commonwealth countries [5].

THE INTERNAL OBSTACLE

The internal obstacle refers to the homeland countries themselves. As mentioned above the ISI insists on English language. Even it emphasizes that the recourses should be in English. It may be stated that it is their standard and it cannot be helped. But there are some questions: Is it fair to allocate full advantages to those whose native language is English? Does it mean that other languages such as German, French, Spanish, Japanese and etc. are undeveloped languages? Aren't there in the countries in which English is not first language, the scholars and thoughtful persons with smart and creative ideas? Is it right to think they can not cooperate in the global scientific exchange? Mehrdad, et al [8] say:

> In other non-English nations many quality articles appear in the domestic periodicals written in the local vernaculars, which obviously are not considered in the international data banks.

THE PRESENT SITUATION

In this situation, scientometry, and consequently ISI, which for ranking tries to account the number of present papers and patents of the countries, must be aware that all these advantages are not really for some special countries. Note that the previous situation of every scholar has a great role in establishing one's scientific personality and must be considered as much as possible. It must be known that other countries which deliberately or unintentionally send their intellectual investments abroad, share in this development. If the immigration of smart-minded people from other countries did not take place, the scientific and technological conditions of superpowers would be something different. To be frank, let's give an example and compare a human scientific maturity to the process of making a factory. For making a factory, there must be taken several major steps as foundation, installation, operation, and production. Is it fair those engaged only in production claim that all the advantages belong to them? This claim pretends them to be the main effective persons in factory creation and production. Here,

in human scientific maturity all the stages in one's scientific life are important enough. It is like a spectrum that all its parts must be considered and be taken into view. If the evaluation is for individuals, there is not any problem because every body knows that one's scientific and technological production in every moment of life is the result of previous activities. But when the evaluation is for a nation or a country, there may appear some differences. One who spends a good portion of his life in his homeland and gets benefit from all the facilities and then by any reason immigrates to another country, the right of homeland must be regarded. For example, suppose a scholar or a scientist has spent 40 years of his academic life in Germany and then immigrates to Canada. Do all advantages that he gains after that totally belong to Canada or the right of Germany should be observed, too?

Therefore, it seems, it is not fair to allocate all the advantages to the country as an end user; the country which invites or accepts the scholar or scientist as receiver. Nevertheless, if they are obliged to do so, they must consider some extra advantages for the home countries.

NEW PROPOSALS

Here, to make a change and get some balance, some models are proposed which although do not decrease the scientific rank of the receiver countries; some advantages are allocated to the sender countries as well. In this regard, there may apply two models; one may be called as time set model and the other as knowledge based model. In the first model the proposal is as follows:

1. Consider the average scientific life time of a scholar or a scientist is something about 60 year, which begins from 5 years old and goes up to 60 or more. If we divide it, for example, into three parts, it means that the elementary and secondary education, in whatever style and method which each country may have, are categorized in the first part. The higher education and some primary research courses could come in the second part. And the full maturity of one's scientific activities allocates to the third part. So if one emigrates from his home land -which could be called the sender country- to a more developed country -which could be called as the receiver country- after the first part of his life and then writes a paper or does any scientific activity which gains rewards from ISI and the like, one third of the advantage may allocate to his/her home country. If one immigrates after the age 45 of the so-called period, and gains some points from some institute such as ISI, then along with the advantages given to the receiver country, two third of the advantages may belong to the home country.

In case one attains advantages before the age of 60, while being in the first part of his/her age, the same advantages would be for both countries. For example, if a scholar

from German goes to Canada in the age of 22, and attains a grade from scientific activities, the same is for Germany, too. And if he/she is in the second part of his/her scientific age and gets some advantages, the same results may be for the home country too, given that immigration date is in this part of his/her age. But if in this case, he has immigrated in his first part of scientific age, one third of benefits belongs to the home country. So if we name the time by which one has immigrated to another country *A*, and the time by which he has gained an advantage *B*, then we may have always a formula such as:

$$A/B \leq 1$$

2. According to the second model we can allocate a co-efficient to each section of one's educational and academic certificates gained in his/her homeland and then by adding up the grades the homeland may attain some advantages. For example, if we allocate for elementary education *0/1*, secondary,*0/2*, bachelor section *0/4*, master of science *0/6*, Ph.D. *0/8* and post doc and more *1*, then if somebody has obtained each one of the above-mentioned certificate in his/her home land, the relevant portion of the advantages belongs to the homeland, too.

In this regard, if we name the advantage of the home land "*a"* and the coefficient of the certificates gained in the home country "*b"* and the advantages given by ISI to a scientific work tired in the receiver country "*c"*, then we have an equation such as:

$$a = b * c$$

3. For each model we can consider appropriate score(s) for non-English speaking scholars and scientists and add to the advantages of where deserve. And if ISI allocates some points for non-English language countries, there may appear some sense of contribution towards the objectives of ISI. And if they agree with the idea, why can not they allocate some more advantages to those whose native languages are not English?

If these models are accepted, it must be taken into consideration that all these figures and rates are suggestions and may be subject to change. That is, if the main concept is accepted by ISI, then the figures and the portions could be discussed, too. And if so, then a valuable formula could be reached and suitable software could be created to be applicable for all cases.

ESTABLISHMENT OF ISI BRANCHES IN OTHER COUNTRIES

Cooperation with ISI directly or indirectly to promote the execution of functions is suggested. That is, if in each country or at least in some regions there exists a branch derived from ISI to facilitate activities, the work would be appreciated. This certainly brings this confidence in all over the world that ISI is to promote the situation and bring

up the standard level of research by calling for all kin minded and training them to develop their ideas.

CONCLUSION

As stated above, the evaluation is something necessary especially in the field of science and technology. It is a means to measure development. The evaluation of individual's contribution to the world development and research may not cause any problem, but if one tries to measure the country's research and development, especially its contribution to the global intellectual affairs and progress, there may arise some criticism. It must be pointed out that the objection to the ISI' policies showed itself by several severe steps two of which are emphasized here. First, there is a general attitude to the open access journals. Koosha [7] in his Ph.D. theses stated that there is a good attitude to use open access journals for citation especially in social science disciplines, and Ghane [4] in his Ph.D. theses proposed that developing countries must try to create an organization to support open access citations. Another major step belongs to the Islamic countries which Regional Information Center for Science and Technology (RICeST) on behalf of the so called countries has established a new structure called Iran and Islamic World Scientific Citation Center (ISC). The ISC structurally is equal to the Institute for Scientific Information (ISI) and contains all features of its scientific products. The only difference is that ISC is based on the scientific publications of Islamic countries [10].

However, one of the solutions to decrease discrimination is to allocate some advantages to the countries that train and educate the intellectual manpower in the first stages of scientific life . By this, although we do not reach the highest point of justice, it may decrease the wide gap between developed and underdeveloped countries. If we accept this idea and apply these formulas or any other similar ones, then we may count the advantages as follows:

1. It does not change the credits given by ISI to the receiver countries,
2. It decreases the sense of brain drains made by superpowers,
3. It enforces the sense of cooperation among nations. That is, although underdeveloped and developing countries witness brain drain and flee of their intellectual manpower, they may attain their hope that they are partners in the global progress and development.
4. The developed countries may work in the fields of science and technology as joint ventures, taking into consideration the rights of each side without any oppression and one-sided expectation.
5. Each country may evaluate its potential and then be able to overcome its weaknesses.

REFERENCES

[1] De la Mothe, J., "The Evolution of Science and Technology Evaluation in Canada." Available: at <*http://www.kav.cas.cz/nato-arw/sum.html*>, 2004.

[2] Engelbrecht, J., "A Number of Highly Accurate Quantitatively Indicators Exist to Measure the Performance of Innovative Systems." Available: at <*http//:www.kav.cas.cz/nato-arw/sum.html*>, 2004.

[3] Etemad, S., et al., "Mainstream Research in Iran 1970-2003." *National Rsearch Institute for Science Policy.* Available: at <www.NRISP.org>, 2004.

[4] Ghane, M. R., *Procedures for Providing an Appropriate Pattern for Iranian universities Academics' Open Access to Scientific Information.* Ph.D. Dissertation, University of Tehran, 2007.

[5] Iran, Ministry of Sciences and Higher Education, Pamphlet (unpublished), 1985.

[6] Jalalabadi, A. and Taheri, A., "The Important Research Indices in Iran and Other Countries." *Rahyaft*, Vol. 33, 2004.

[7] Koosha, K. *Motivations for Linking to Open Access Scholarly E-Journals: A Comparison of the Characteristics of Web Citations in Four Science and Social Disciplines.* Ph.D. Dissertation, University of Tehran, 2007.

[8] Mehrdad, M., et al., "Basic Science in Islamic Republic of Iran." *Scientometrics,* Vol. 61, No. 1, 2004.

[9] Rahni, D. N., "A Paradigm Shift in Opportunities and Challenges in Scientific Pursuts in Developing Countries in the 21st Century." *Rahyaft*, Vol. 29, 2003.

[10] Islamic World Science Citation Center. Available: at <http://www.isc.gov.ir>.

[11] Saboury, A. A., "Standing Scientific Journals and Critera for Evaluation of ISI." *Rahyaft,* Vol. 29, 2003.

[12] Saboury, A. A., "Ranking of Science in USA." *Rahyaft*, Vol. 33, pp. 49-58, 2004.

[13] Sengupta, I. N., "Bibliometrics, Informatics, Scientometrics and Librametrics: An Overview." *Libri*, Vol. 42, No. 2, pp. 75-98, 1992.

[14] Yoshico, O. and Zitt, M., "Searching for Research Integration Across Europe." *Science and Public Policy,* 2004.