Conceptual Challenges in Developing Azerbaijan Citation Index

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***Abstract*— Conceptual challenges of science citation index development in Azerbaijan are considered. Processing principals of database of scientific publications and analytical-information system based on it are explained. It is demonstrated that, requirements set for scientific journals and publications, unified register of scientific publications, *development* of analytical-scientometric evaluation mechanisms are important challenges set forth. Realization of the system will support evaluation of scientific activity and science management.**

Keywords*— *science citation index; impact factor; e-science; evaluation of scientific activity; requirements to scientific publications

I. MOTIVATION

Development of science citation index and evaluation of scientific activity based on it, preparation of ratings of scientific institutions, journals and researchers and their use in science management and objective decision making are relevant challenges [1].

Citation index is a database indexing references of citations and providing quantity indicators of these citations (number of citations, Hirsch index and etc.) [2,3]. This scientific data base contains a collection of journals, articles, summaries, dissertations and reports. A researcher can obtain information from classified data using these data bases. At the same time such classification allows focusing on results with highest ratings. User can also narrow down to different indicators by searching for key words in a certain science field, title of the article.

There are many international scientific platforms implementing in creation of academic data bases with different functions. CSA Illumina (contains 145 international, regional and national data bases), DataStar (262), EBSCOHost (193), Engineering Village (12), FirstSearch (77), ISI Web of Knowledge (15), Informit (8), ProQuest (27), SilverPlatter (218), WilsonWeb (76) etc are examples of the most widely applied of them [4-13].

Existing academic data bases are divided in two groups:

1. Data bases only performing search system functions [14,15]. For example: DBLP, CiNii etc.

It is possible to conduct search in DBLP based on author, organization, and at the same time independently, i.e. based on key words. Information about conference materials, journals and books is placed here. Its main advantage is distribution of articles based on years and sources, provision of co-authors list as a result of the search. This base also provides accessibility of scientific articles of users from other data bases, but no evaluation system is used.

2. Data bases performing search and evaluation functions [16-18]. For example: Google Scholar, MS Academic Search, Scopus etc.

Scopus is an academic data base that is capable of searching for authors, organizations, journals, as well as evaluating them. For example, while researcher searching, result reflects information such as different variants of name and surname of the author, number of articles, citations, their distribution by years, list of references, their h-index, h-graph etc. This base also allows to conduct comparative analysis of journals, i.e. determines their index.

Academic data bases are also divided in 2 groups by scientific fields that they cover:

1. On all science fields (Multidisciplinary) [19,20]. For example: SpringerLink, Web of Knowledge, Mendeley etc.
2. On certain scientific fields [21-24]. For example: Computer sciences – IEEE Xplore, CiteSeerX, Arnetminer; Medicine – HubMed, PubMed, MedlinePlus; Physics – SPIRES-HEP, Inspec; Social sciences –AgeLine, Social Science Citation Index and etc.

Academic data bases are divided in three groups based on geographic of materials that they cover:

1. International data bases. These bases cover scientific results existing in the world.
2. Regional data bases. For example: Asia, Europe, Islamic countries etc.
3. National data bases. These data bases are based on intra country evaluation criteria and only reflect internal scientific results. For example: Russian Scientific Citation Index (RSCI), Korean Citation Index (KCI) and etc.

Currently, non-English speaking countries need to create a national citation index to objectively evaluate their scientific activity and introduce themselves to international scientific societies, integrate to international data bases. Because, placement of information about scientific results, researches, scientific organization etc that meet international standards and their open utilization in national data base

creates opportunity to make such information accessible for international scientific societies. This results in introduction of intra-country scientific problems to world society, as well as their objective and accurate evaluation. Thus, development of such national index considering world experience is an important task set forth.

II. Problem Statement

The goal of this paper is to develop of conceptual challenges of creation of a national science citation index for evaluation of scientific activity and science management is.

III. Solution of the Problem

National academic data base intended for our country – national citation index must be a base that carries search and evaluation functions, covers all fields of science, and provides free-of-charge services. This data base must be capable of performing expanded search (based on certain scientific field, journal, author's name, organization, conference, publication year and etc). Name and surname of the author must be provided both in Azerbaijani and English (in different variants) in accordance with accepted standards. Researchers with similar or identical surnames will be differed not to be confused as the same person during search and evaluation.

Creation of unified register of publications of Azerbaijani scientists will form the basis of national citation index. Objectives of creation of unified register are as following:

- Maximum presentation of publications of Azerbaijani authors in national and international journals, books, dissertations, patents and conference materials;
- Collection, updating and systematization of information about scientific publications of Azerbaijani scientists regardless of their source, time and publication type.

Overall, unified register of scientific publication must operate as data base containing following information:

- Full list of scientific-research institutions of Azerbaijan. Besides contact information of scientific organizations, quantity indicators reflecting scientific activity of these organizations (information about scientific researchers, number of doctorants, doctors, total budget, structural departments and thematic directions and etc.) can be presented here.
- List of researchers. Information about affiliations of researchers, author's name, surname, patronymic in Azerbaijani, Russian and English languages (with different spellings), gender, contact information, scientific degree, position, profile and ID number in the basis can be located here. Also, other information reflecting activity of the researcher – number of patents, grants, scientific awards, number of doctorants, students etc can be provided here.
- Full list of scientific journals registered in Supreme Attestation Committee of Azerbaijan. Detailed information about each scientific journal (ISSN, theme, editing staff, contact information, Internet address etc) must be provided.
- Bibliographic data base of publications of researchers. This data base must cover publications of researchers in national and foreign journals, books and monographies, conference materials, doctoral dissertations.

Many scientometric and webometric indicators are used to evaluate the scientific activity of the researcher, scientific journal, determine the rating of university and country. For example, number of citations to researcher's article (Hirsch index), for the journal impact factor, for organization several academic indicators (number of foreign students and teachers, number of Nobel and Field award winners etc), for the country number of contributions to world science (index activity or attractivity) are calculated.

Thus, scientific activity evaluation indicators (scientometric indicators) are grouped as following:

Scientific activity evaluation indexes (individual evaluation). Here, several indicators including number of articles, citations, age of articles etc are considered to evaluate activity of the researcher. *H*-index, *g*-index, *m*-index, *R*-index, *AR*-index of the researcher can be cited as examples [25-27].

Nowadays, evaluation of scientific works of researchers, different awards' winning are considered among important challenges for researchers. During recent 5 years, many scientific societies express strong interest towards h-index invented by Jorge Hirsch in 2005 [25]. Hirsch index has founded the development of different types of indexes for evaluation of scientific activity. This index unites several positive characteristics such as simplicity of calculation in it.

Many articles have been published on Hirsch index and several indexes based on this index, while differing from it by their advantages have been developed.

According to Q.L. Burrel, *h*-index forms the core of productivity of researcher's articles [28]. For this purpose, R.Rousseau has entered Hirsch core (h-core) term [29]. L.Bornmann, R.Murtz and H.D.Daniel divide all evaluation indexes in two groups taking *h*-core as basis [30]:

I type indexes: Reflects the activity of the researcher in his operating field and provides information about number his articles in Hirsch core. For example *h*-index, *g*-index, *hg*-index and $h^{(2)}$-index, *w*-index, *e*-index [25-26, 31-34].

II type indexes: demonstrates the impact of articles in Hirsch core. For example, *A*-index, *m*-index, *AR*-index, and h_w-index [27-28, 35].

Hirsch index is defined as following:

A scientist has an *h*-index, if *h* of his/her N cited papers have at least *h* citations each.

Evaluation of journals. Here, indicators such as publication year of the journal, number of published articles in the journal and citations to them etc are used. Impact factor, operativeness index, cited half-life, citing half-life etc are models used in evaluation of scientific journals.

Impact factor – quantity indicator of importance of a journal is calculated in Thomson Reuter. Calculation of impact factor is based on a 3 year period. Status of the journal is determined by correlation of citations to the journal in current year to the number of articles published in the journal during last 2 years [36]. Following formula allows calculating the impact factor of v_i journal in t year:

$$IF(v_i,t)=\frac{\sum_j c(v_j,v_i,t)}{n(v_i)},$$

here, $c(v_j,v_i,t)$ – is a number of citations in t year from v_j journal to v_i journal. During past 2 years, number of articles published in v_i journal are indicated as $n(v_i)$.

Webometrics, which is a direction of scientometrics, is engaged in evaluation of countries and universities. List of ratings is not limited only universities; it also concerns different fields of science, subjects, and programs. Activity and attractivity indexes are calculated even for countries, and their indexes are developed. Thus, Webometrics defines the ratings of world universities, scientific sites and countries based on their quality and quantity indicators and researches are carried out in 2 directions:

Evaluation of organizations. Indicators used to evaluate organizations and universities engaged in scientific activity – number of Nobel Prize awarded employees, number of students or alumni, number of foreign teachers and students, number of articles published in journals with high impact factor etc are considered here.

Evaluation of countries. The contribution and place of the evaluated country in world science is calculated using activity and attractivity indexes.

Index activity is calculated using following formula:

$$AI=\frac{Pdc/Pc}{Pd/P},$$

where,

- Pdc – is the number of publications on a certain scientific field in the country;
- Pc –is the total number of publication in the country;
- Pdc/Pc – is the portion of a certain scientific field of the country in overall publication mass;
- Pd –is a number of publications in the world on a certain scientific field;
- P –is the number of publications in the world;
- Pd/P – is the portion of that scientific field in general publication mass in the world.

As seen from the formula, it is necessary to increase the number of articles published yearly in the country in order to keep the activity index high. It can also be carried out by limiting the minimal number of articles to be published yearly in dependence on scientific fields by each organization (or scientific researcher).

Index attractivity is calculated as following:

$$AAI=\frac{Cdc/Cc}{Cd/C}$$

here,

- Cdc – is the number of citations to publications of a certain scientific field in the country;
- Cc – is the total citations received by the country;
- Cdc/Cc – is the portion of a certain scientific field in overall citation mass received by the country;
- Cd – number of citations to publication of that scientific field in the world;
- C – is the total citations received by the journals in the world;
- Cd/C – is the portion of that scientific field in overall citation mass in the world.

As seen here, index attractivity of the country depends on number on citations received by country during a year directly in relevance with different scientific fields. Because, if the activity index of a country directly depends on number of articles published in international journals, attractiveness index depends on impact, i.e. relevance of those articles. As a result, quantity, as well as quality of published articles must be focused on, in order to keep the country on highest positions of international rating.

It has been proven that, results obtained from evaluation of scientists' scientific activity and journals are different in different directions of science. Reason for that is, certain types of scientific fields start receiving citations immediately after publishing (it means that this subject is relevant for current period of time), but some scientific fields continue receiving such citations after years (number of these citations is not high). From this point of view, it is important to develop a balanced index for evaluation of different scientific directions. For example in world experience, SNIP normalized impact factor is used instead of impact factor for evaluation of journals in the Scopus data base [18].

International experience demonstrates that, listed international evaluation indexes must be absolutely considered alongside with national evaluation indexes to be proposed while developing national citation index.

In order to integrate to international systems, it is necessary to pay attention to many indicators during creation of national citation index. Despite being intended for storage and evaluation of national, i.e. intra-country scientific information, interface must be understood by international scientific societies. For example, it is important that the interface is in English or its English language version is developed. Here, it is also advisable that English language version of main bibliographic information (author's name, title of organizations, title and summary of article, key words, references list and etc.) is submitted.

Besides, unification of scientific journals published in Azerbaijan and their relevance to international standards (development of bibliographic data in English language etc)

are among other important challenges. For this reason, normative requirements (for example web-site for the journal, English language version, equal periodicity interval etc) must be developed for scientific journals.

IV. Result

Thus, creation of national citation index in important for evaluation of scientific activity of national scientific journals, researchers and institutions, comparative evaluation of their scientific research productivity. Relevance of periodical scientific publications submitted to system to unified requirements is one of important conditions set forth.

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