ACCESS TO NATIONAL AND INTERNATIONAL SCIENTIFIC INFORMATION AS REVEALED BY SCIENTIFIC ACTIVITIES IN THREE PERIPHERAL COUNTRIES

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ABSTRACT

Scientific activities in five developing countries (Egypt, Kenya, Nigeria, Saudi Arabia and Uganda are examined using mainly three indicators: number of publishing scientists, journal used and citation received. The number of publishing scientists do correlate with the number of publications from the journals covered by SCI. However most papers receive no citation and the few that do are published in journals in developing countries. The reasons for the low citability rate are discussed.

RESUME

Les activités scientifiques de cinq pays en développement sont examinées en utilisant trois indicateurs: le nombre de chercheurs qui publient, les journaux utilisés et les citations obtenues. Le nombre de chercheurs qui publient corrèle avec le nombre de publications dans les journaux indexés par SCI. Cependant, à l'exception de quelques publications publiées dans des journaux de pays développés, la plupart des publications ne font pas l'objet de citations. Les raisons de ce faible taux de citation sont discutées.

INTRODUCTION

Nations can be categorized on the basis of the contributions they make to world's science. Countries fall in three categories: central, middle and peripheral levels. Rabkin and Inhaber, when studying three less developed countries (Argentina, Brazil and Norway) applied this categorization (Rabkin and Inhaber, 1979). According to them, the central scientific powers are U.S.A, U.K, USSR and Federal Republic of Germany (now the United Germany). Arunachalam and Markanday (1981) include France and Japan on the list; to make six leading countries. These six countries contribute more than 80% of the world's scientific literature. In *Who Is Publishing In Science* (WIPIS) these central countries rank in the first seven positions including Canada, in the number of publishing scientists from 1971 to 1978. Countries falling in the middle level category are Australia, Canada, India, Israel and a few European countries. These countries have moderate number of publishing scientists and also produce a considerable number of publications. Though these middle level coutries do not contribute as

much to scientific literature as the central scientific powers, their share is still not inconsequantial. The rest of the world falls in the peripheral category. Scientific contribution from these countries is very little and is insignificant compared to that from the first two categories.

The scientific gap between developed and developing countries is very much broader than the economic gap. Much of the literature on science in the world produced by the central and middle scientific powers is not accessible by the developing countries because of this economic gap. Lack of foreign currency prevents developing countries from obtaining most of the international journals. The few journals that are obtained by developing countries are not accessible to scientists of these countries because the journals are put in unorganised, manually searched information systems without professional information scientists. Therefore scientists of developing countries when they struggle to contribute to the world science, their work suffers delayed publication due to manual search of data; and in most cases the work comes out to be a duplicate of the already published research. This happens because of lack of information tools such as Research in progress, current contents and the like. Therefore their work does not contribute much to the world science and does not win much citations.

In the study, two indicators were combined. One is publication count and the other is citation count. Publication indications measure the efforts of individuals who are actively engaged in the pursuit of research. As de Solla Price put it, "whenever a man labours, produces something new and the result is a publication; then he has been doing what I call science" (Price, 1969). It is only in rare cases that one labours to produce something new, but does not publish it in the scientific literature. In such cases publication indicators ignore the research efforts of such individuals. In developing countries it is more likely for such research scientists to publish in local journals rather than failing to publish at all. In the ranking of number of publications and number of Nobel prizes won for the ten countries which contribute more than 80% of world's scientific literature, a correlation has been observed between the two (Frame and al, 1977). Thus there is reason to guess that publication count does not only indicate the quantity of science but also roughly the quality of science.

The citation count as the next Indicator, was used as a weighing factor to the publication count Indicator. A few papers produced and cited carry more scientific quality than a lot of papers produced but not cited. Scientific growth is similar to that of living organisms. In a living organism growth between two points of time A and B can only be measured basing on the orginal mass of the organism at point A. In other words growth is relative and not discrete. Similarly science grows by building on the old ideas already contributed by scientists. A scientist with a new idea cites or refers to the contributor of the old idea which led to the growth of the new idea. For these very reasons one would like to see to what extent the ideas generated from science in the peripheral countries are cited in world science.

If one produces a paper, and it wins no citations, there are several reasons for this. One may be that the paper has not been accessible to those who would have found it relevant and necessary to cite. The second reason may be that the content of the paper has no direct relevance to current science and therefore it is not cited. If the former is true, then the journal in which the paper appeared is local or has little accessibility. If the latter is true, this has several meanings. This can mean that the author's field of research is isolated from the rest of the world's scientific literature. Also it can be due to the fact that the work produced is a duplicate of that already in literature.

METHOLOLOGY

From eight annual volumes of WIPIS, the number of publishing scientists from the three countries under study was obtained from 1971 to 1978. For the year 1978, in addition, the number of publishing scientists from other African countries was collected and compared with the three leading African countries. Similarly the number of publishing scientists in 1978 from USA, England, USSR and Federal Republic of Germany was also collected for the purpose of comparison. From 1971 to 1978, USA, England, USSR and Federal Republic of Germany rank in the first four positions respectively in the number of publishing scientists. The data have been compared as shown in Tables 1 and 2.

The next source of data was SCI Corporate source Index 1979. This index lists all the publications in one calendar year, countrywise. It was searched by hand to find details on institutions, authors, journal, volume, starting page and year for each one of the papers published, from these three countries; and the details were recorded on work sheets. All duplicates noted were removed and the total counts from each country were noted.

Counting of citations of each and every publication contributed by the three countries was done from the annual editions of SCI of 1979, 1980 and 1981. Limitation to this method is that a period of three years is not long enough to cover a considerable number of citations expected on any publication. Most publications, especially those from developing countries, win citations after a considerable lapse of time. Due to the fact that other indicators mentioned above were not affected, this limitation was borne with. All citations to these papers were noted on the worksheets. For every citation noted, the citing journal with details of volume, starting page, and year were recorded. The citing author in every case was cross-checked with cited author on the worksheet. In case the two were the same, a note of self-citation was made on the worksheet. After citation count, the analysis of the data was done as follows. All papers not cited at all in a period of three years were counted and noted. Then papers with one to "n" number of citations were counted and a table of citedness was made (table 3).

The second phase of analysis was on the journals used. All journals noted on the worksheet were tabulated (table 4). Papers published in each of the journals

were counted and tabulated (table 5). The International Serial Catalogue was used to check the journal title abbreviations and the country codes, showing where the journals were published. The country codes were used to identify how many journals originating from developed countries are used by each of the three countries. For the journals not covered by ISC, or those covered but country codes are not given; Ulrich's International Periodical Directory was used as an alternative. International Standard codes for the represantation of names of countries (ISC 3166) was used to know the countries represented by the codes. Impact factor was added for journals under, study. The data was collected from journal citation reports, JCR. How often, on average each item published in a journal is cited, is considered to be the impact factor of that journal. The total number of items published by the journal influences the number of times it is cited. The more the journal publishes the greater the number of opportunities it has for it to be cited. Therefore, impact factor indicates whether the journals used by the three countries under study are of good quality or not.

RESULTS

Using WIPIS as a source, data on number of publishing scientists were tabulated (table 1 and 2). This was to show the comparative strength of publishing scientists from these countries. Data collected from SCI corporate Index 1979 were subjected to several analysis. First, journals used were listed to find out preferred journals based on the number of papers published in them. Using codes from ISC, the countries of origin of journals used were determined. Journals published from USA, UK and the Netherlands, used by each country, were counted because these journals were more often used than journals originating from other countries. Data on journals from USA, UK and the Netherlands were tabulated on table 4 and table 5. Table 4 was to show the percentage of journals used from USA, UK and the Netherlands, the percentage of journals used with impact factor of one or more; and the percentage of journals used from other countries.

Table 1 : Number of publishing scientists

Years	1971	1972	1973	1974	1975	1976	1977	1978	Av. of 8
Egypt	436	442	547	559	648	738	731	666	595.8
Nigeria	195	242	288	340	473	521	643	650	419.0
Kenya	119	100	130	113	178	202	174	166	147.7

Source: WIPIS, ISI different editions)

Table 2 : Number of publishing scientists in 1978

USA	141,1398
England	25 407
USSR	23,581
FRG	19 467
Total of Africa without S.A = A	2 531
Total of Egypt, Kenya and Nigeria = B	1482
B as % of A	58.5%
Total of Africa as % of USA	1.78%

Source WIPIS 1978

Table 5 was to show the percentage of papers published in the journals originating from the three developed countries, the percentage of papers published in journals with impact factor of one or more and the percentage of papers published in journals originating from other countries.

Citations of the papers from the three countries were counted and table 3 of citability was made. This was to show the percentage of papers not cited at all, cited one to four times and cited five more times. In addition to this the table showed the total citations won in the period of three years and the percentage of self citations to the total citations.

From the number of publishing scientists originating from the three countries (table 1), the following can be deduced. Egypt had the highest number of publishing scientists in the eight years followed by Nigeria and Kenya the least. Nigeria unlike the other two countries, Egypt and Kenya, her number of publishing scientists increased steadily in the eight year period. The three above countries were the lending countries in the number of publishing scientists and accounted for more than 50% of the total number of publishing scientists from African countries: (in all comparisons with Africa, white ruled South Africa is excluded). To place Africa science in perspective, one notes that the number of publishing scientists in African countries is just 1.78% of the number of publishing scientists from USA in 1978.

The choice of journals made by scientists to publish their work has a direct relevance to the quality of scientific papers. Through well defined editorial processes and refereeing systems, journals maintain a certain level of quality. Therefore when a good quality journals is used, papers are also likely to be of

good quality. The standards of quality differ from journal to journal. And in fact a paper that is accepted and published in one journal need not necessarily be good enough to be found acceptable by a higher quality journal.

Table 3 : Citability

COUNTRY	EGYPT		KENYA		NIGERIA	
Total papers	1119	100.0%	283	100.0%	709	100.0%
Papers not cited	758	67.7%	155	54.7%	424	59.8%
Papers cited	361	32.3%	128	45.3%	285	40.2%
Papers cited 1 to 4	337	30.0%	94	33.2%	256	36.1%
Papers cited 5 or >5	24	2.2%	34	12.1%	29	4.1%
Total citations	697		491		672	
Self citations	199	28.5%	47	10.0%	167	24.8%

Table 4 : Journal use

COUNTRY	EGYPT		KENYA		NIGERIA	
Total journal used	413	100.0%	120	100.0%	343	100.0%
Journal with IMPF=1	103	24.9%	34	28.3%	94	27.4%
USA journal used	109	26.4%	39	32.5%	86	25.5%
UK journal used	73	17.6%	42	35.0%	77	22.4%
NLD journal used	24	5.8%	11	9.2%	23	6.7%
USA+UK+NLD	206	49.8%	83	76.7%	186	54.1%
Other countries	207	50.2%	37	23.3%	157	45.9%

Table 5 : Journals in which papers are published

COUNTRY	EGYPT		KENYA		NIGERIA	
Total papers in SCI*	1119	100.0%	283	100.0%	709	100.0%
Papers in journal with IMPF=1	202	18.1%	57	20.1%	202	28.4%
Papers in USA journals	119	10.6%	54	19.1%	123	17.3%
Papers in UK journals	158	14.1%	89	31.4%	177	24.9%
Papers in NLD journals	34	3.0%	20	7.1%	47	6.6%
USA+UK+NLD	311	27.7%	163	57.6%	347	48.8%
Other journals	808	72.3%	120	42.4%	362	51.2%

*during 1979

Egypt used 49.8% of journals originating from USA, UK and NLD of her total journals used; and published 27.7% papers in these journals out of her total papers published. Journals with one or more impact factor used by Egypt were 24.9% of her total journals used; and published 18.1% papers out of her total papers published. Kenya used 76.7% journals originating from USA, UK and NLD of her total journals used; and published 57 . 6% papers in these journals out of her total papers published. Journals with one or more impact factor used by Kenya were 28. 3% of her total journals used; and published 20.1% papers out of her total papers published. Nigeria used 54.1% journals originating from USA, UK and NLD of her total journals used ; and published 48.8% papers out of her total papers published. Journals with one or more impact factor used by Nigeria were 27.4% of her total journals used; and published 28.4% papers out of her total papers published.

The total papers counted for Egypt, Nigeria and Kenya were respectively 1119, 709 and 283. Out of 1119 papers Egypt had 32.3% of the papers cited; and of these 30% papers were cited one to four times while 2.3% papers were cited five or more time. The 32.3% papers of Egypt cited, won a total of 697 citations and out of these citations 28.5% were self citations . Out of 709 papers Nigeria had 40.2% of the papers cited and of these 36.1% papers were cited one to four times while 4.1% papers were cited five or more times. The 40.2% papers of Nigeria cited, won a total of 672 citations and out of these citations, 24.8% were self citations. Out of 283 papers, Kenya had 45.3% of the papers cited and of these 33.2% papers were cited one to four times while 12.1% papers were cited five or more times. The 45.3% papers of Kenya cited, won a total of 491 citations and out of these citations, 10% were self citations .

DISCUSSION

From the results of tables 1 and 2, the three countries rank in the order of Egypt, Nigeria and Kenya (according to their quantity of science produced in the eight year period). From the results of table 3, the three countries rank in the order of Kenya, Nigeria and Egypt (according to their quality of science revealed from citedness of their papers). From the results of tables 4 and 5 of journal use, the three countries rank in the order of Kenya, Nigeria and Egypt (according to 1) the number of journals originating from USA, UK and NLD used, 2) the number of papers published in journals originating from the above three developed countries; and 3) the number of journals used and papers published respectively in journals with impact factor of one or more). The order of quality of scientific work from these three countries under study, correlates significantly with the order of journal use of journal originating from the three developed countries and also with the order of journal use of journals with one or more impact factor.

Therefore one would think that scientific work accepted in international journals such as those originating from developed countries; or accepted in journals with impact factor of one or more must be of good quality. In addition to the good quality, publication of this scientific work in such journals disseminates it and makes it accessible to most of the scientists. Therefore this work wins more citations than scientific work published in journals of low impact factor and in journals originating from developing countries.

CONCLUSION

The bibliometric study has revealed that science contribution from the three countries is still of a peripheral nature. It's size and quality compared to those of world science are still minimal. This may be mainly due to inaccessibility to International Scientific information carried mainly in the journals of developed countries by the third world countries countries; as revealed with low percentage of journal use from developed countries. However the little scientic work that overcomes the barriers of communication and gets accessibility to international scientic information contributes fairly well with the rest of world science.

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