

OUR SCIENCE AND TECHNOLOGY JOURNALS — CAN WE NOT IMPROVE THEM?

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Scientific and technological journals are universally accepted to be a vital element of modern S and T activity. This is the single most important medium through which researchers communicate and interact with one another, and they have great influence on the nature and direction of S and T research being carried out. They play a major role in defining a community of research workers, according to their field of specialisation, language and nationality. As the journals are, like Academies etc, organised largely on a national basis, they also serve the purpose of giving a national identity to the different scientific communities. It is generally the case that the productivity, purposefulness and originality of the S & T research done in a country can be quite reliably gauged from the S and T journals in a country. Thus an analysis of the quality of journals in a country is a very important way of comprehending certain vital aspects of the S and T activity of that country.

Like in many other fields, India since independence has made, in quantitative terms, remarkable strides in the area of publication of S and T periodicals. These periodicals are published by various agencies like academies, institutions, universities, research laboratories and government departments. From about 725 in 1964 the number of S and T periodicals in India has grown to 1593 in 1975 and 1891 in 1982. It can be assumed that we were publishing about 2000 of them in 1985 [1]. Leaving out the popular science magazines and reports of R and D establishments, there are 488 scientific periodicals which are covered by *Indian Science Abstracts*. The break-up of 22,000 papers published in 1984 is roughly, 29% in agriculture, 21% in medical sciences and 16% each in biological, physical and engineering sciences. India produces about half of the S and T output of the entire third world and these publi-

cations cover all areas in which research is being conducted in the advanced countries. A recent publication of CSIR [1], summarises the position of India in this connection as follows:-

'India accounts for about 3% of the world's scientific literature output and about half of the entire Third world's. In terms of the number of papers published in more than 4000 of world's leading scientific and technical periodicals, India occupies the eighth rank after the USA, the UK, the USSR, Japan, France, West Germany and Canada. Clearly, India is not merely the undisputed leader of Third World Science, but also occupies a respectable place in the World of Science as a whole'.

Having thus reached a status of significance in the publication of S and T journals, it is necessary to evaluate our performance in this field qualitatively. Some of the vital aspects are :

- 1) How good are our S and T journals as compared to those of other countries?
- 2) What is the evaluation of these journals by the S and T community of our country as well as by that of the rest of the world?
- 3) What is the communication level reached by the journals among the S and T community?
- 4) Do these journals project a national identity to our S and T community?

Unfortunately we do not possess any satisfactory answers to these questions at all: we have done very little analysis and investigation in our country on these questions. We have not even built up a data base of our own regarding the output of our scientific research in various areas.

Even the Indian Science Abstracts only give data about publications in Indian journals, and there is no way to know as to what has been the total output of research work done in India in any given field. In the absence of comprehensive data-base we do not have a realistic assessment of what we have achieved in scientific research so far. While pointing out the urgent need for building up such a data-base and undertaking extensive analysis of such data, the purpose of the present paper is limited to a critical examination of the already existing data and analysis of Indian S and T journals. Our primary aim is to examine how good our S and T journals are and what could perhaps be done to make them better.

The limited studies that deal with our S and T journals [2-9] are mainly based upon the data base built up by Institute for Scientific Information (ISI), USA and the methodology developed by Eugene Garfield. The three key parameters used for the evaluation of an article or a journal are the 'impact factor' (defined in terms of the number of times a particular article is cited in other articles within a specified time period; for a journal, it is the average value of the impact factor of all the articles in that journal), 'immediacy index' (governed by the number of times it is cited in the same year of publication) and the 'percentage citedness' (percentage of the ratio of the articles in a journal that are cited to the total number of articles in that journal). ISI data-base is tuned to evaluate the scientific journals and articles in terms of contributions to what it calls the 'international body of scientific knowledge'. The main concern of ISI is with what it terms 'International Science' and not with the S and T of the third world.

In the year 1973, ISI data base scanned about 3,000 journals out of which only 52 (less than 2%) originated from third world; of the 3,53,000 articles it surveyed in that year only 16,000 (less than 5%) were from third world. Further, the data base of 1973 showed that about 80% of articles originated from US, the developed commonwealth and west European and Scandinavian countries and this situation is not likely to have undergone any major change. Out of the 52 journals from third world (1973 data-base) about 30 journals are from India with 7,888 articles out of the 16,000 articles originating from third world. This makes India the eighth largest country in terms of scientific output. It is to be noted that about 65% of the 16,000

articles from the third world were published in journals of the developed countries.

As stated earlier, the ISI data base is skewed in favour of the USA and UK and under-represents the scientific output of India, USSR, Japan as well as the entire third world. In spite of this shortcoming, the conclusions that seem to emerge from the analysis [2-9] of these data are significant:

1. India stands eighth in terms of the quantum of scientific output and contributes about 3% of the world's scientific output. Among the third world countries, India's contribution is nearly 50% in terms of scientific output. Indian scientists tackle problems in almost all scientific fields and their contributions come 'close to those of the developed countries'.
2. An average value of 2 was obtained for the impact factor for the period 1973-78 for articles originating from India which is low in comparison with that of advanced countries (US 6.9; UK 6.3; FRG 4.6; Japan 4.1) as well that of 30 other third world countries.
3. Indian journals had the highest impact factor (1.1) amongst all the third world journals; however this value was very low compared with journals of developed countries (US 6.9, Developed Commonwealth 5.5, West Europe 3.9, Japan 2.9).
4. Most of the references made to Indian journals are by Indians. It appears that the rest of the world S and T community has hardly taken any serious notice of our journals.
5. The majority of references cited in the articles of Indian journals are to papers that are more than 10 years old, thus giving a very low value to the immediacy index.
6. Indian journals have poor inter-disciplinary content.

This analysis had led to two broad conclusions. Firstly, that the quality of our scientific output is poor, from the point of view of contributions made to the so-called international

science*. The second conclusion that emerges from this analysis is that our S and T journals are of poor quality which is the prime concern of this article.

An interesting phenomenon noticed was that nearly 60% of the scientific output of the third world researchers appeared in the journals of the developed countries. As compared to this, countries like France, Western Europe as a whole, Japan and Germany contributed only 5%, 12%, 20%, and 33% respectively to the journals published outside these countries [10]. No other country or region suffers such a high drain of its scientific output. This affects the evaluation of the scientific journals of the third world so adversely that these journals carry a low impact factor of 0.8 when the third world scientists themselves had an impact factor of 2.3.

As far as India is concerned, our journals received only 44% of our scientific output, the rest went to foreign journals [2]. Studies have consistently shown that more than half of India's scientific output is sent abroad [7] and in this regard at least, the 'undisputed leader of third world' [1] is not setting an example worthy of emulation by others. The consequence of this was that while Indian research output published abroad achieved an impact factor of about 3, our own journals could achieve only 1.1. It should be quite obvious from the above that Indian S and T journals are quite poor today not because the science done in India is as such very poor; this is so because most of the output of our research is denied to our journals. This is indeed a situation that ought to be and can be, improved significantly. For that, we should find out more details about how such a situation has come about. For example, is it that our younger researchers are more 'foreign crazy' and they are refusing to follow the patriotic examples set by the senior scientists? Is it a case

of our younger generation going astray? What sort of traditions were being set up by the peers of Indian science and leaders of our scientific community? We present some representative data that throws some light on these questions.

Indian National Science Academy (INSA) has recently brought out two volumes containing detailed profiles of its Fellows as on 1986 [11] which have some data relating to the publication patterns of these scientists. Each Fellow was asked to give a list of what he or she considered to be his/her important contributions to science. Table 1 shows an analysis of the data generated from 441 responses (out of 530 Fellows, each with 15 papers on an average) which shows that in no discipline did the Fellows contribute even half of what they considered to be their important papers to Indian journals, the average figure being 34.4% which is even considerably poorer than the 'national average' of 44% ! In some disciplines like Physics, the contribution to Indian journals was as low as 21%.

Let us also present some data on the publication pattern of the members of the editorial boards of representative journals in two disciplines namely, physics and chemistry. The journals we chose are India's leading physics journals - *Pramana* and *Indian Journal of Pure and Applied Physics* and for Chemistry - *Indian Journal of Chemistry* Section A and B. The number of scientists covered was 68 and 23 respectively with a contribution of 514 and 213 articles in the respective disciplines. It was seen that for the two year period 1983-85, these two groups of scientists contributed only 32% and 30% respectively of their papers to Indian journals. In other words, even those who are in charge of improving the standards of our journals do not seem to have any serious commitments towards Indian S and T periodicals. The pattern that

*That our scientific research or our scientific journals do not have any significant impact on world science, or that the world scientific community does not perhaps think too high of our work need not by itself have caused us much worry if our S and T community had seen itself as working towards some other identified goal. For example, if it were the case that our S and T community saw itself primarily as working towards fulfilling our country's needs and not being overly concerned with making contributions to world science, then such an evaluation could perhaps have been dismissed as being of no great consequence. But as is well known this is perhaps not the case, and being a part of the international scientific enterprise and making significant contributions to it have all along been claimed to be a vital dimension of all our S and T efforts.

For the sake of being considered a part of the international S and T community, we even choose most of our research problems from abroad. A recent study has shown that about 90% of all references cited in Indian journals are to articles in foreign journals[3]. Such being the case, an assessment that our contribution to international science is of rather poor quality ought to be a matter of serious concern.

Table 1

*Publication Profile of 1986 Fellows of INSA
(Numbers in bracket are percentages)*

Subject	No. of Scientists	Total publications	Indian publications	Foreign publications
Mathematics	37	527 (100)	159 (30)	368 (70)
Physics	64	966 (100)	201 (21)	765 (79)
Chemical Sciences	67	1091 (100)	283 (26)	808 (74)
Engineering and Technology	43	670 (100)	245 (37)	425 (63)
Earth Sciences	41	660 (100)	327 (49)	333 (51)
Plant Sciences	47	846 (100)	353 (42)	493 (58)
Animal Sciences	30	509 (100)	174 (34)	335 (66)
Medical Sciences	44	792 (100)	284 (36)	508 (64)
Agriculture, Animal Husbandry, Fisheries	37	616 (100)	272 (44)	344 (56)
Total	410	6677 (100)	2298 (34.4)	4379 (65.6)

evolves out of this analysis may perhaps be representative of the inclinations of our senior scientific personnel. It is apparent that the problem lies with the examples and models set up by the leaders of our S and T community.

That our S and T journals are in poor shape is not merely of national prestige, it has serious repercussions on the functioning of our entire S and T community. In a sense, it merely reflects the state of affairs on our S and T front. For one thing, our journals today do not serve as an effective medium of communication among our S and T workers, which is the primary role of a journal. Whatever communication exists among our scientists seems to be routed through the

medium of foreign journals. Such a situation does not help in the emergence of our S and T community with a national identity. Secondly, this dispersion of our research output in a very large number of world's journals prevents us from having an overall view of what exactly is being achieved by our scientists. Furthermore, if the compulsion for publishing in foreign journals were to be removed, then it may be possible that we turn our attention to those problems which are of greater concern and relevance to our country. This may lead in some way to make our own unique contribution to the pool of world's knowledge. Another advantage of changing over to publishing primarily in our own

journals would be that our scientists would begin to take the other fellow scientists of the country more seriously. By making Indian scientists more responsible in assessing each other's work, the collective sense of dignity and self respect of the entire community as such are enhanced. And so also their collective strength and bargaining power vis-a-vis the international scientific community.

Surely, there are various reasons why our scientists today do not prefer to publish in Indian journals. The circulation figures for the Indian journals are almost of the order of 1000 in comparison to circulation figures for 'Nature' and 'Science' which exceed 60,000 and 150,000 respectively. Other difficulties include lack of proper and rigorous refereeing procedures, uncertain periodicity, absence of journals devoted to particular specialised area, long delay between submission and publication, poor quality of production, etc. However, these things could all be improved once our S and T community becomes seized of the problem. But from what has been said earlier, it is clear that the initiative has to come from our senior scientists.

While it may be true that our junior scientists would be taking greater 'risk' by not publishing abroad, the same cannot be said of our senior scientists - they have already acquired international standing and recognition. They should be willing to make the 'sacrifice' of increasingly diverting their publications to Indian journals. If, our senior scientists start publishing as a rule all of their important works in our own journals, there is no doubt that the state of our journals would start showing significant improvement. That we do not give the better part of our research output to our journals is not the consequence of our journals being poor, it is the very cause of it.

These points are no new revelations ! In fact the case for having our own journals and our scientific community publishing in them can perhaps not be better expressed than in the words of C.V. Raman himself. While founding our first modern scientific Academy viz., the Indian Academy of Sciences, Raman wrote in the *Current Science* of May 1933, 'It is true that individual scientific workers in India have by their indefatigable industry achieved great distinction for themselves, but the prestige of both official and non-official research is still slow in attaining that status of international importance reached by most European countries. This unsatisfactory

position is in our opinion partly due to the tendency of scientific men to export their more important contributions for publication in foreign journals with a proportionate impoverishment of Indian archives *Continuance of this practice will retard the process of building up a scientific tradition for India and keep her in a position of semi-dependence in the world of science* India will have to organise and develop her national scientific institutions before she can enter into the comity of international scientists' (emphasis added).

This attitude, as reflected in the words of Prof. Raman, had to some extent, made our scientific journals of the thirties and the forties achieve higher standards internationally. This can be gauged by the fact that, in the days of Raman, many of the Indian journals like *Proceedings of the Indian Academy of Science* (30th in 1944), *Indian Journal of Physics* (73rd in 1944) had sufficiently high standing in the international rating. Further an analysis of 33 of the 125 founding fellows of INSA for whom the data were immediately available (12) revealed the interesting fact that they had published nearly 77% of their research works in Indian journals even though at that time those journals could not have been as well supported and developed as today. It would be farfetched to conclude that these founding fellows of INSA were less reputed scientists than say any of our present day top scientists.

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