Table 1. Average citation per paper for Indian HEP papers from 1980 to 2000

Year	China	India	Israel	South Korea
1980	10	4	22	17
1981	4	4	24	9
1982	6	4	21	9
1983	9	6	22	3
1984	4	3	18	6
1985	3	7	18	8
1986	2	4	20	24
1987	2	5	26	8
1988	2	6	16	6
1989	7	6	20	15
1990	7	10	27	13
1991	7	10	26	22
1992	–	9	22	12
1993	8	10	30	22
1994	6	13	31	17
1995	6	13	28	23
1996	7	12	22	16
1997	6	10	25	16
1998	–	–	18	23
1999	5	8	14	13
2000	4	6	8	11

in the clear increasing trend in the number of citations per paper compared to the other developing countries like China. As a matter of fact, India's share of top-cited articles (more than 50 citations) has gone up from 1.16% for the period of 1980–90 to 3.35% for the period of 1991–95. For China and South Korea, the same numbers are 1.16, 1.85 and 0.32, 3% respectively. While the gains made by South Korea are remarkable, Indian HEP community has not done too badly either. Further, if one looks at the percent share of the top-cited articles by Indian authors for the periods 1980–2000, 1990–2000 and 1995–2000, the numbers are 1.62, 2.50 and 2.75%, again indicating the better citation averages in more recent years.

It is to be noted that from 1996 to 2000, average citations have dropped for India, Israel, South Korea and China. But, this, I believe, is an artifact that the citation index is still rising for papers written after 1996. For example, in a search carried out on 15 September 1980 for India, the total number of citations was 800, and this increased to 806 when a search was made on the 26 October 1980, whereas for 2000 the number had increased much more substantially from 3707 to 4304, during the same period. This trend is shown by data for all the countries considered.

In summary, in stark contrast to the overall decline mentioned by Arunachalam, Indian HEP output has increased, and that too at about the same rate as other countries like Japan, France and Israel, though admittedly slower than boom country like South Korea. Further, the citation rate for this increased output has improved as well. These do not seem to be artifactual results – though a more thorough analysis may be much better.

While this does not mean that the HEP community in India can be complacent, it may in some sense be interpreted to imply that HEP is doing well in India. Further, one may be able to draw lessons from this to find a way so that there need not be a decline in other areas too. For that it may also be useful to consider the possible causes that have helped HEP to do well in India.

(a) HEP was already globalized due to the international nature of HEP experimentation.

(b) High energy physicists in general are net-savvy and the same it true of the Indian community. They also made best use of the open archives to stay on par with the others in the world. Thus they were on par on both fronts – technical and technological.

(c) Extensive collaborations within the country may have helped.

(d) Initiatives like the workshops on high energy physics phenomenology as well as yearly national or international conferences like the String Conference, where a large part of the active Indian HEP community regularly gets together, may have added significantly to foster the networking and hence (c) above. The series of SERC schools in HEP may also have played an important role.

Arunachalam's original article has been useful to draw the attention of the Indian Scientific Community to this important problem. In view of the above-mentioned strong dependence of the conclusions on the area of science that one considers, it may be worthwhile to carry out further discipline-wise analyses to get insights into the issue and possible solutions in areas where there is a problem.

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Winds of change

We write this in response to P. Balaram's editorial 'Science in India: Signs of stagnation' (*Curr. Sci.*, 2002, **83**, 193–194). Balaram cites the declining number of publications from Indian labs to conclude that science in India is stagnating. There is no denying this conclusion. What more could be expected from an environment where meritocracy is not encouraged, leadership of national labs and universities is politicized, institution-building is not valued, and where the spirit of scientific inquiry is throttled by dogma and cultural chauvinism. Notwithstanding this grim scenario, there are positive stories to be told and one of them relates to the 'winds of change' that our national labs – the Council of Scientific and Industrial Research (CSIR), to be specific – have seen.

Balaram, unfortunately, does not seem to agree and uses the publications criterion, which is too narrow and exclusive a definition, to dismiss the scientific contributions of national labs. The editorial's comment that national labs are pursuing applied research for the 'carrot of large funding' ignores the fact that most national labs were founded with the objective of conducting applied research. Balaram's dismissiveness of efforts to heighten awareness about patenting amongst Indian scientists as a ploy to

hide the purportedly poor productivity of applied research is cynicism of an extreme order. Finally, we take particular exception to Balaram's description of the work of national labs as 'apparently applicable'. The comment reflects Balaram's ignorance of the work of India's national labs and does not behove the editor of what is perhaps India's best-circulated science journal.

We take this opportunity to educate by providing an example of the 'apparently applicable' research of one of our national labs. In the 1990s, the Indian Institute of Petroleum (IIP) in Dehra Dun developed a process to convert a petroleum distillate called naphtha into liquefied petroleum gas (LPG) and gasoline (known as the NTGG process). The Gas Authority of India Limited recently commercialized this process near Baroda in Gujarat. In the year 2000, India had 11 million applicants waiting for an LPG connection. IIP's process has the potential to impact at least a few of these several million households. In our minds, such research, notwithstanding the 'apparently applicable' labs, is highly desirable from the context of national relevance.

This example also has something for the academic whose definition of impact is limited to the impact factor. The elucidation of the fundamentals of the NTGG process resulted in at least 1 Ph D student and several peer-reviewed publications. However, we provide this information not to support the (valid) argument that applied research also results in papers, but to argue that publications alone should not be used to evaluate research. Other factors, which should be considered are technology commercialization, employment generation, contribution to the innovativeness of Indian industry, and impact on the lifestyle of the poor. Policy makers of Indian science need to develop tools to quantify these impacts instead of ignoring or, worse, disparaging them just because they are not easily quantifiable.

Balaram's editorial, while raising an important issue, loses credibility by attempts to disparage scientists who manage science. Management of science is an important activity. One of this letter's authors (TSRPR) takes pride in being one of the 'managerial scientists' that Balaram seeks to disparage. In our view, the productivity, progress, and direction of scientists, irrespective of nation and institution, strongly depend on the leadership provided to them. A conscientious 'managerial scientist' recognizes an institution's strengths and weaknesses, fortifies its strengths, redresses its weaknesses, recruits and nurtures new talent, obtains new funding and facilities, aligns an institution's research agenda with its mandate and national interest, develops a committed and qualified second rung of leadership, and motivates workers to dream and think big. In all, a successful 'managerial scientist' provides an enabling environment for scientists to enhance their productivity measured in terms of publications, patents, technologies, or impact. We wonder which scientist would oppose the existence of such 'managerial scientists' whose output if measured merely in publications would have little meaning. This is not to suggest, in the least, that 'managerial scientists' do not produce good papers or are poor scientists.

Balaram's comments on 'managerial scientists' is particularly surprising because every once in a while *Current Science* features suggestions that India establish a science administration cadre that better understands science and technology. While such suggestions are bandied about, we have an editorial that disparages those scientists who choose to curtail their research interests to help develop a climate that truly fosters and cultivates science. This, in our mind, is hypocrisy and has to be replaced with respect for those who help manage science in good faith and with honorable intentions.

The saga of Indian science needs to be viewed with a balance. In the absence of such a balance, it is equally easy to dismiss the impact of Indian publications, which, by Balaram's own admission, seem to have minimal impact as determined by science citation indices. However, just as Balaram's views on applied research are untrue; so is such a sweeping dismissal of academic research. We strongly believe that applied and industrial research has made a positive and substantial contribution – papers or no papers – to India and this needs to be better understood, recognized, and appreciated.

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Academic standards in Indian universities

Print media often publishes reports on the deplorable situation of academic standards in Indian universities. The common causes discussed mostly are 'political appointments of Vice-Chancellors' and/or 'unscrupulous interferences by governments and/or political parties'. In my opinion, these are peripheral issues and the root cause lies in the 'standard of teachers and teachings' in the universities. Gupta[1] once rightly commented, 'hospitals cannot be run and dams cannot be constructed by second-rate and third-rate graduates'. The same is true for universities. 'Excellence in universities cannot be achieved by average and mediocre teachers'. Here are some factors, which have contributed to the lowering of academic standards in the universities.

(1) Ph D as a minimum qualification of university teachers – Though it may sound unusual at the outset, it has distracted university toppers and brilliant students from joining the universities. A topper automatically finds his position in