ROLE MODEL SCIENTIST

By

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Introduction

Nine hundred students from 40 schools studying in 10th standard were interviewed to know their career aspirations. Surprisingly, none of them opted for the career of a Scientist. Even the children of scientists do not like to become Scientist. Seventy five per cent of the students do not consider it as a profession. Twenty per cent think that any one can become a scientist by doing experiments. Ten per cent of them just laugh at the suggestion and consider Scientist as an uncommon personality. Now the questions arise : Why this kind of perception has been created among the children ? Can we change this perception ?

There seems to be no emphasis and encouragement that they can also become scientists. The 'Science Day' is being celebrated as a matter of routine. Is it possible to enthuse and inspire the younger generation, so that they can aspire for the career of a Scientist ?

To my question "Who can become a Scientist?", one of my good friends responded "Who can't become anything else becomes a Scientist".

Profession

Science and Technology has emerged as a profession. Investment in Sceince and Technology as percentage of Gross National Product countrywise was for Japan (2.8%), USA (2.7%), former FRG (2.6%), France (2.4%), and India (0.9%). India's expenditure on R&D is distributed as Central Govt. (72%), Private Sector (11%), Public Sector (10%), and State Government (7%).

Financial resources are used to purchase the important secondary inputs, namely the human resources and the facilities (buildings, equipment, material) that make the research possible.

Scientists and Technologists are salaried people. Majority of them are employed by Government. When number of scientists per thousand population of the country is considered, Sweden tops with 262 scientists, Canada has 185, Japan has 111, former FRG has 78, and India has only 5 scientists.

Causal model of research productivity among natural scientists has shown that educational level of the scientist has an important positive impact, years of service has a varying and more modest positive effect, psychological factor have a negligible effect, and the influence a scientist has on his research endeavour has a modest positive impact on productivity.

Factors affecting the quality of the research process (other than resource factors) include the size of the research group, its composition, the leadership provided, the institutional climate (buraucratic versus nurturing), the degree of collaboration (intra-institutional and inter-institutional), and various personal (e.g.,

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age) and behavioural characteristics of the researchers.

The efficiency of the research group can be considered in terms of such factors as the completion of projects on time and within budget. Measures of the creativity of researchers include the number of research proposals generated and the number of these that receive internal or external funding.

The outputs of the research process are the results achieved. For many types of research, these results are manifested as a new product or technique. Research results have little value in and of themselves. They become valuable only when they are made known to individuals or organizations that can apply them. The research group makes its results known by reporting them in various ways : in internal reports, in reports published and distributed in several forms (mostly in scholarly journals), and in such oral presentations as briefings, papers presented at conferences, and consulting/advising activities.

In the longer terms, of course, the research can be expected to produce various outcomes, e.g., benefits to the organization or to society at large. In an industrial setting, obvious outcomes of a research activity are the patents awarded and new products (and thus sales) developed. In other settings, the desired outcome is the adoption of an innovation - a new drug, a new teaching method, and so on. A research activity can have other, less direct outcomes. For example, it can influence the direction of other research, it can interest the general public, or it can influence policy makers (e.g., leading to legislation to ban a particular drug or to protect the environment).

While the ultimate desired outcome of much of research (but, regrettably, not all) is benefit to mankind, the extent to which this is achieved is hard to assess. In particular, it is difficult to measure the contribution of a particular project or research group to a nebulous object of this kind. The long term effects of certain research may not be obvious for very many years. Moreover, much research tends to be synergestic : a particular achievement (e.g., arriving at a cure for some disease) may come about as the result of the work of several different groups, perhaps over a considerable period of time.

Accountability

Is it possible to make cost benefit analysis for science and technology enterprise ? According to the Comptroller and Auditor General of India inefficient use of funds, not lack of resources, is responsible for the failure of scientific departments to meet their targets. hence there is need for continuous assessment of performance of individual scientists and organisations.

Measuring science quantitatively has become a major aim and concern for a variety of reasons : to study evolution of science epistemologically, to know history or sociology of scientists, or to assist in decision making for the management of science. Comparison and assessment of scientific impact of research teams are very difficult, but it appears to be an urgent need for science policymakers and for the researchers themselves.

Role Model

We have studied publication productivity of a few well known individual scientists.

These studies were prompted by the myth that "Most of the developing countries lack role models to motivate other scientists". Efforts are being made to dispel this wrong notion, as there is no dearth of ideal role model scientists at least in India. What we lack is the systematic and continuous studies on such scientists.

This is an interesting interdisciplinary domain which reveals characteristics of the School of Scientific Excellence, formed around a creative scientist, that results in synergistic effect of growth in Science and Technology.

There are individual scientists who have been doing good work inspite of all possible hurdles. If we can project image of such scientists, it may be possible to attract talents of younger generation.

Team Spirit

Scientists have to work with team spirit so as to achieve the targets of research. The number of research publications with other collaborators can reveal this aspect of team spirit in a scientist.

Publication productivity with collaboration

Scientist	Collaborator Scientists	No. of Papers	Period
M.S. Swaminathan	100	254	1950-80
C.S. Venkata Ram	16	114	1950-83
C.V. Raman	38	465	1906-70
K. Ramiah	20	85	1915-65
U.R. Murty	40	158	1969-94
P.K. Iyengar	88	182	1955-91
Vinodini Reddy	67	141	1960-93
R.G. Rastogi	97	312	1954-90
L.L. Narayana	35	175	1955-90
K.S. Krishnan	24	135	1925-61
T.S. West	167	410	1951-92

Indicators of R&D Progress

We should develop our own parameters to indicate R&D Progress. We should establish scientometric database on all such indicators so that it can facilitate national - level planning and harnessing of expertise already available in the country.

Are They Different ?

Majority of Indian Scientists, in their day-to-day life are in no way different from any other person having no training in scientific thinking. I had an opportunity to come in close contact of about 250 scientists and carefully observed their personal behaviour. Most of them were following unscientific blind faiths/superstitions, although by every criterion they were reputed scientists in their field of research. Then question arises - Who should nurture 'scientific temper' among scientists ?

On detailed discussion with a social scientist it was revealed that these are anthropological characteristics practised and enforced since their childhood and have become part of their personality.

Childhood

Hence childhood is the most important period inthe life of an individual. If you like to have most talented scientists, it has to be cultured and nurtured from this period onwards till they can be utilised fruitfully.

The noted historian Arnold Toynbee once said : "It is both absurd and unjust to classify a person, once for all, as being first class or third class when he is only 22 year old. There are slow growers who blossom late in life, and coversely there are brilliant starters who fail to fulfil their early promise."