

the chimp Ai was capable of doing. She would correctly press the key for the number three whether she was shown three pencils or three spoons on the computer screen. We do not yet know whether the bees can perform such true counting and so they can only be said to have mastered the second stage in the evolution of counting, which for lack of

a better term is called 'protocounting'. The answer to the question in the title then is that chimps can count and bees can at least protocount!

- 1 Matsuzawa, T., *Nature*, 1985, 315, 57-59
- 2 Chittka, L. and Geiger, K., *Anim. Behav.*, 1995, 49, 159-164

- 3 Gallistel, C. R., *The Organisation of Learning*, MIT Press, Cambridge, MA, 1990

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## SPECIAL SECTION

### NSU: An experiment unlikely to succeed

*Y. P. Joshi*

The abridged version of Mahajan's proposal for a National Science University (NSU) and the comments of some academics on that subject (*Current Science*, October and November 1994 issues) make interesting and informative reading. By inviting the views of your readers, you have initiated a debate on whether a science university at all needs to be established, and how that university, if it comes into being, should be managed. I understand that the Indian government and many others who are involved in the decision-making machinery are already working seriously on the proposal, and I am almost certain that a debate open to all will hardly have any effect on their grand plans. Yet, I feel it would be interesting to share my views with the readership of *Current Science*.

#### Service at a high premium

I find Mahajan's proposal amusing. There are a number of points that come to my mind. According to him there are a large number of nonresident Indian scientists (NRISs) who are eager to serve this country. Mahajan expresses their keenness through statements like ... foreign-based Indians can repay some of their debts to the country of their birth'. Such statements sound very appealing and they are often highly effective in arousing the sentiments and winning the favour of those who are not in a position to study in detail and to understand an issue at stake and simply trust the gravity of the objectives of a

proposal. Statements of this sort are typical of politicians, who are known to be in the habit of exploiting the sentiments of the masses and pose to be their real benefactors. But it is well-known that they rarely mean what they say and their ultimate interest lies in securing their own political and social position. The first question I should ask is whether the NRISs are also playing a gimmick just as the politicians do. If they are really keen to serve this nation, why should they do that on the terms and conditions dictated by themselves? The NSU is a facility that they demand before they begin to serve and this facility is supposed to have a structure of their choice. The very idea that there should be a university comparable with the best in the West, a university where the NRISs form a floating faculty, a university which is managed, if not fully then at least partly, by them and other foreign scientists, a university that offers latest amenities to them by facilitating their stay and movement (like proximity to an international airport), sounds rather ridiculous. Demanding this much from the country they want to serve is, in my opinion, tantamount to saying 'Oh my country, I wish I could serve you, but would you first offer the amenities I want?'.

#### NSU an international centre

Many of my colleagues and I feel that an NSU that is managed in a manner proposed by Mahajan can be better re-

garded as a foreign university on Indian soil. Or would it be just one more ICTP (International Centre for Theoretical Physics, Italy) based in India? I am not sure if the research being carried at such an institution can be claimed to be truly Indian; it should better be regarded as a work from an international centre. Whether this university would serve the nation is doubtful, but it would definitely serve the NRISs, by offering them a place where they could stay comfortably while on a visit to this country, so that they would have to face minimum amount of inconvenience. By having all facilities at their command, they would have little to lose academically or in terms of physical inconvenience and at the same time would boast of having served a nation facing academic crisis. This is the sort of apprehension that some of my colleagues harbour.

#### Political and government interference

The NSU is planned to have a management system totally new to us Indians. Whether that would succeed and would continue for long is doubtful. In a democratic country (which we claim ourselves to be) guided by socialistic ideals, it remains uncertain if the suggested management structure can be acceptable. In a country where nationalization and denationalization of institutions is a process determined by the whimsical political decisions of the

party in power, and where, in the name of the welfare of the society, new projects are initiated by one government and abandoned by another, it is hard to believe that such a management system can stay for long. For the establishment of NSU the major contribution to the initial funds has to come from the Indian government. Will it then be possible to insulate the management from government interference? Even for totally voluntary organizations, drawing no government grants, much depends on the mercy of the governments. Then how can a university that is supposed to serve a serious and noble national objective remain free from political and government interference? I fear that the university will eventually meet an unpredictable fate. *It would have been better for the enthusiasts of NSU to show no dependence on the government for funds and to seek voluntary donations from individuals, social institutions and industrial organizations. Establishment of educational institutions by nongovernment organizations is not uncommon. Such institutions can hope to suffer less from outside interference.*

### Deep-rooted complex

It is stated that the progress of NSU would be reviewed periodically by an academic body having an international character and consisting of some foreign and nonresident Indian scientists/academics. I am unable to understand why the panel of experts should comprise members from the international community. Does it reflect the deep-rooted psychological complex that we Indians have been suffering from – a complex that foreigners are superior to us not only in intellectual pursuit but also in critical, objective and honest evaluation of the progress in any field? Are we sure that foreigners and nonresident Indians will be more objective and honest in making an assessment of NSU's progress, and that they would feel more concerned for the meaningful functioning of the said university? It seems that *we Indians have lost self-confidence and dignity and have developed a habit of receiving guidance from international agencies on every subject.*

### The human factor

These days it has become a fashion to discuss the deterioration of our science

education and science research. Who is responsible for the sad state of affairs is a question we never care to answer in clear terms. Very often the blame is laid on agencies which are vaguely defined in this context. We would say that the administration is responsible or the system is defective. But never do we realize that an administrative machinery or system consists of human beings and, therefore, there must be some of us ultimately responsible for the mess. Who are they? There is rarely any categorical answer from any quarter. We have developed the habit of passing highly generalized remarks. For example, we might say vice-chancellors of universities, directors of institutes, and heads of departments have not been careful in discharging their duties and in raising or even in maintaining the standards of their respective organizations. Such generalized statements do not make much sense, because what is really needed is to identify precisely the individuals who could be held responsible, who could be questioned for their failure, who could be relieved of the responsibilities entrusted to them and, most importantly, against whom deterrent (or even punitive) action could be initiated. No identification process has ever been undertaken by groups of individuals, voluntary organizations or government agencies. When there is no such identification, it is hard to understand how the management of the proposed NSU would go into the hands of deserving individuals. Will it be possible for the NSU to insulate itself from those who have so far been allegedly mismanaging the UGC, the national laboratories, the universities, and other institutions? In the present circumstances, benefit of doubt will have to be awarded to everybody, and anyone who happens to be resourceful to earn the top position in some academic organization will also get an entry into the management body of the NSU. Will the NSU be in safer hands? It is ironical that *we admit the existence of all-permeating corruption in our society and yet never hold any human being accountable*, as if some invisible force or agency is responsible for the sorry state. This applies to all walks of life, including science education and research

### Island of excellence

It is true that our educational system is almost collapsing and that the standard

of research is falling. This is one of the strongest arguments being advocated in favour of NSU's establishment. It is indeed unfortunate that our top intellectuals do not argue in favour of adopting corrective measures to improve the functioning of the existing institutions. And those who accept the responsibility of managing the institutions and are expected to implement corrective measures, whenever these are suggested, have in practice little interest in doing something truly constructive. They succumb more often than not to all sorts of pressures, leading to further deterioration. This fact is being openly discussed and admitted, but none is being held explicitly responsible. Instead, many of us have come out in support of untested academic experiments of establishing newer institutions as alternatives or substitutes. That one or two such institutions will have a visible and significant impact on Indian science is more a matter of wishful thinking, of overenthusiasm, and of overoptimism, and is definitely not based on any serious analysis to understand the root causes of the deterioration in the field of science and education. In my opinion, it would be unwise to boast of improving Indian science on the basis of one or two such institutions, when a multitude of other institutions continue to function poorly and remain neglected. All that the NSU can do is to serve the purpose of a handful of resourceful individuals who are at present facing some sort of stagnation and are looking forward to finding more avenues to fulfill their professional ambitions. Such an elitist island of excellence would definitely offer to some fortunate scientists the satisfaction of working in a place as good as the best in the West, but the majority of us may receive a demoralizing effect from it.

### NSU as a model

It is being argued that the proposed NSU will have a very significant but indirect impact on Indian science. This will happen presumably because it will act as a model educational organization for the rest of the universities and colleges of the country. The concept of a model is rather misleading in the present context. Who needs a model? Those who have no idea of how an organization's performance can be improved need a model to imitate. Are the aca-

demics of Indian universities really devoid of meaningful ideas and are they just waiting for an NSU to act as a beacon? Perhaps not, *many of us know very well, at least in theory, what needs to be done*. The tragedy is that we have lost the will to act and to translate these ideas into action. And this will to act cannot be enthused in our minds by the presence of an NSU. There are plenty of pretexts for us not to practise what we usually plead for in public discussions. The idea of models has not succeeded so far. To realize this we have to note that organizations like the IISc and the TIFR (and the IITs) are described to be doing rather (or excellently) well. Why have other academic institutions of the country not learnt anything from them and failed to improve their performance or even to arrest their falling standards? Some of the universities had been once known for their high academic standards, but their glorious past is now history. Experience suggests that *an NSU would not have any catalytic effect on the rest of the Indian universities*.

### Excellence without foundation

The major objective of the NSU will be to bring excellence to Indian science. This implies that not only will the faculty of the university be consisting of scientists, teachers, experts in and dedicated to their diverse fields of activity but also the students graduating there will be equally talented and determined to pursue science. A pertinent question which deserves serious thinking is— who would form the intake of the undergraduate courses of this new university? Our attempt at achieving excellence at the university level is very much like erecting a splendid building on a weak foundation. At present all education from primary to higher secondary is far from satisfactory and there are only a few schools left which have been maintaining their standards. The NSU would perhaps succeed in attracting some of the students from these schools, but it would be wrong to claim that the most talented out of the large youth population are being identified and attracted. Unless we revamp the lower-level education, identify the scientifically talented students, and encourage them to pursue the study of science, we cannot hope to receive in NSU the best of students. It appears that the advocates of NSU have not given a

serious thought to why talented students are unlikely to enter an NSU. In the existing socioeconomic conditions, a student's career is not determined by his/her talent but by a number of other factors of nonacademic nature. Strong family pressures, disappointing employment picture, political issues like reservations, promotional and financial prospects in different professions are some of the factors that have a profound effect on a student's choice. For students from the lower and middle classes, employment security is often the first priority, and to earn this security, more and more of our science students are opting for an engineering or a medical profession, their individual tastes, temperaments and capabilities remaining in most of the cases unimportant. The present-day students are facing strong stresses created by a variety of competitive examinations that have sometimes a devastating effect on their hopes, confidence and talent. It must be noted that *teaching or research career is the last choice for the majority of students*, who are becoming more conscious of careers characterized by professional security, social prestige, administrative powers and financial gains. In this respect government administrative services have always been the first choice for many bright students. Many of our IIT graduates are now switching over to glamorous administrative jobs. Lately, another new trend is also visible: students are showing more interest in the study of commerce and business management courses, not because they are specially talented in these fields but simply because they find it more profitable to join business corporations and eventually become executives. This means that in the existing circumstances, *scientifically talented manpower is being lost to other professions*. In this connection, we should note that for the last several years the central government has been selecting, through its Science Talent Search Scheme, bright students at their school-leaving stage. But only a small percentage of students continue to study science and later to accept a teaching/research career. Should we then hope that the best of brains will opt to graduate at the NSU to take up a science career? Admittedly, a small number of students continue their interest in the study of science and take a research career, but even in their case the attraction of a visit abroad and an eventual

stay there is the strongest motivating force. It goes without denying that for us Indians a stay in the West has its own charms and that it adds to an individual's social status and professional prospects.

### Export of trained graduates

Will the proposed NSU prove to be just one more export house sending trained graduates to the developed countries? The IITs were established some four decades ago with the high hope that the engineers and technologists produced by them will serve the needs of the country and will prove to be our asset. But it is an open fact that a large number of IIT graduates leave for US and other countries, and the trend continues. There must have been some reasons for them to do so. It is not clear why those reasons, whatever they are, will become inoperative in the case of NSU graduates. The proponents of the new university are hopeful that nothing like a permanent brain drain will take place, but they have not spelled out what solid grounds they have for their high hopes. Let us stop wishful thinking and admit the bitter fact of life that *the first concern of an ordinary mortal is his/her own welfare*. Not many people feel equally (or in exceptional cases, more) concerned with the society. People do migrate from one place to another in search of better working conditions, better professional prospects and more financial gains. NRISs are themselves a testimony to this migratory phenomenon. A question then arises: Why would not the NSU graduates leave the country temporarily in the beginning and permanently at a later stage? It is true that some scientists have a preference for staying back in their homeland, but that is not because of a strong urge to serve the nation. It is, in fact, because of compelling social factors like strong family bonds or the prospects of getting more prestigious and powerful assignments within the country. This would apply to some of the would-be NSU graduates but not to the majority of them as is being hoped. In fact, it would become a serious problem for these graduates to find a place of their choice. How can a graduate who is trained in a research environment comparable with the best in the world feel satisfaction in working in any of the Indian universities discernibly inferior to NSU? I think

the proponents of NSU do not have in their mind IITs, TIFR, IISc and a handful others as the prospective employers of these graduates. And what about the graduates of these institutions themselves? *Unless the funding and working conditions of the existing universities/colleges are improved, no NSU graduate would be prepared to join them.* Ironically, proposers of NSU are not undertaking the task of improving the lot of existing academic institutions on priority basis.

### Science and progress

Science is vital for the progress of the nation and NSU would be one step in this direction. This is the most important point being used by the proponents to justify the formation of a science university. For many of us progress and science are intimately linked things, but, unfortunately, no scientist has ever bothered to explain what really progress means and how science contributes to that progress. I do not find it easy to define the term progress, but I believe it must include in its definition all aspects of human existence. In the context of a nation, it must refer to the overall well-being of its citizens and to a state in which their intellectual, physical and social aspirations approach near-fulfilment. There is no denying that science has played an extremely important role in the advancement of human civilization. It has opened a treasure of objective knowledge and in addition has proved to be an effective instrument in achieving seemingly impossible tasks. In this sense it is an important, may be essential, factor determining our progress. But the most important factor is the human element itself. Progress of a nation depends on the attitude, outlook, temperament and work-culture adopted by its people. At present we are facing a crisis of social values and many of our problems are essentially of social nature, which cannot be solved merely by an application of science. National progress demands a movement in which people participate actively and constructively. Science can provide an instrument but cannot act as an agent to effect a desired result. Our society is heading towards a state in which there is no concept of accountability, no sense of responsibility, no respect for social institutions, no adherence to principled politics and above all no feeling of na-

tional pride. I strongly believe that these factors have, in fact, been responsible for the deterioration in our education and science. Unless an integrated effort is made to bring about a social change and to reestablish our social values, we cannot hope to improve and maintain a high level of science research. Any attempt at bringing excellence in science is bound to be adversely affected by the aforesaid social factors. Will it be possible for the NSU to insulate itself from the rest of the society so that no social pressures malign its functioning? An attitude of let's-hope-so will not work miracles.

### Modesty please, no arrogance

We should be somewhat moderate in emphasizing the importance of science and should present it in the right perspective. Science is important for two reasons. The first is its knowledge content—the objective knowledge that refers to our understanding the mysteries of nature. The second is its applicational aspect. Knowledge is, in fact, not much relevant to the general public; only those who are involved in its study appreciate its worth. In this context, science is as much important as history, literature and philosophy. What really matters more is its applicational aspect. *People know science not through its knowledge content but through its innumerable applications to real-life physical problems.* All societies of the world have been supporting science simply because of its capability of solving our problems in a variety of fields like transport, energy, communication, medicine, education and entertainment, and now ecology and pollution (which in part are the result of injudicious and unrestricted usage of new gadgets available to humankind). In the present age of consumerism and new technology-based economic order, the knowledge content of science is losing its original relevance in the eyes of the majority of people. What are the gains of science that is being done or is planned to be done has become an important question not only here in our country but also the world over. The worth of any science research that is being done anywhere is being evaluated in terms of the technology that can be derived from it. This is an important point we should all ponder over. Whether research aimed at gaining aca-

demical knowledge be encouraged, and to what extent, is a sensitive question which can be raised with equal emphasis in respect of many other fields of human endeavour. I am not addressing this question here. What is needed is to recognize that not all research in science can find a technological application. It is not hard to identify research activities which can be put to practical use in a relatively short time. It is also possible to identify research problems, which can prove technologically relevant in not so distant a future. But it is perhaps impossible to establish whether a given research work can ever prove to be beneficial as an applicable knowledge. Our experience has shown that an element of doubt often remains there. In India, we have been in the habit of awarding this benefit of doubt to every piece of research. There is practically no monitoring of the quality of research. Technological progress of the country is the central point when we have to justify and support science research, but when it comes to real practice we hesitate to evaluate even the academic worth of a work. Should it not be spelled out whether a research proposal is to be supported purely for academic reasons or for the consequential technological benefits? The NSU proposal does not make it clear, to the extent I could understand, which research it would support and emphasize.

### Science research and the changing scenario

While emphasizing the role of basic science in respect of technological progress of the nation, proponents of NSU have not paid due attention to the transformation that the nature and style of science research has undergone during this century, particularly in the second half. Gone are the days when research was to a large extent an amateur activity. Now it has taken a highly formalized and professionalized shape and is governed by the concepts of management, marketing and salesmanship. Science research is no more confined to the study of phenomena closely connected with everyday human experience as it used to be in the olden days. In this era of modern science, research means performance of somewhat complicated and highly refined experiments aimed at discovering and interpreting new and often unprecedented phenomena. Re-

search activity now demands sophisticated and expensive techniques, with the result that the importance of monetary funds and funding agencies is rapidly growing. The funding agencies in their turn have to make a direct and foolproof assessment of the returns that would flow from an investment in the research activity. And the scientists are faced with the problem of how to sell their research work as if it were necessarily a consumer product. It must not be ignored that management and control of science research is gradually slipping into the hands of multinational commercial organizations and the patenting of all applicable knowledge is becoming a harsh reality. Basic science research does sometimes result in new technological advancements as by-products, but that happens when such research demands new techniques and instrumentation and this demand is fulfilled by indigenous means. In our country basic research often means data collection and analysis using imported instruments, so that there is hardly any question of achieving a technical breakthrough and even a refinement in instrumentation (defence and space research being exceptions). At present, understanding newer phenomena and thereby building newer concepts is not as serious a problem before us as achieving a higher level of sophistication in existing technologies. I think something significant cannot be attained unless research with indigenously developed methods and apparatuses is encouraged. Will the NSU take due care in selecting the research problems and the methods to be adopted? Or will it justify in the name of progress every piece of work using imported apparatus?

### Any hopes?

We are now living in the age of hypocrisy and pretensions and the gap between precept and practice is rapidly growing. I am not quite sure if the concern being expressed by many of my colleagues is genuine. My skepticism is based on what I have been experiencing for about the last two decades as a university teacher. It is being openly admitted that almost all the universities are plagued with a variety of problems. Research journals are either not available in these universities, or are available rarely in time. The libraries are mostly in shambles. Their examination processes very often take three to four months. Admission processes are also equally and unnecessarily slow. Vacations and holidays are available in plenty. Many of these are on trivial occasions and can be avoided. Add to these the number of days lost when these universities get closed on account of one agitation or the other. The actual number of working days available for teaching some of the courses is much smaller than what the UGC demands in principle. Admission rules go on changing, not to encourage and to attract bright students but to suit the convenience of the university students and employees. Selection committee meetings are not held regularly, and in many departments vacancies continue to remain unfilled for several years altogether. Indiscipline amidst students and employees has been recording a growth in majority of these places of learning. The list of problems is not small. Ironically, some of these universities have on their faculties FNAs, FAScs, FNAScs, Bhatnagar awardees, etc., and others recognized nationally and internationally. Many of them have been serving on a variety of national-level

committees and are also strong advocates of excellence in Indian science. Perhaps they are contributing significantly at the national level, but back home in their respective places of academic activity, these top-ranking faculty members have almost always failed to make concerted efforts to help their universities to get rid of the problems. The apathy of these colleagues is understandable: in most of the affairs there is nothing much of their personal interest. In such a situation, I wonder if proposers of NSU would be fortunate enough to get a different breed of teacher scientists – people who are not only experts in their respective fields of activity but are also genuinely concerned with the problems of their institutions in particular and the society in general.

### A closing remark

Whenever a society is faced with serious problems, there appear on the scene two types of forces. The first comprises individuals, usually small in number, who feel deeply concerned with the state of affairs and get involved in easing the situation, demanding little in return from the society. The second includes those whose concern is rather superficial and who do not hesitate in exploiting the situation to their advantage. While doing so, they have to pose before the masses as if they were the real saviours. It is hard to know who belongs to which one.

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## The National Science University and the politics of science in India

*S. R. Valluri*

The scientific community owes much to the editor of *Current Science* for initiating a debate in its pages in the 10 October 1994 issue by publishing a proposal to start a National Science University (NSU). The issues raised go far beyond the case of NSU and indicate that not

only the scientific community but society at large is concerned about the S&T scene in the country.

The general view that emerged from the debate about the Mahajan/Srivastava proposal to start the NSU was that it deserved to be buried. However, few, if

any, cared to analyse his critical observations. Mahajan's proposal was to correct these distortions. The contributors to the debate either ignored or practically denied them in passing remarks. Perhaps our awareness and perceptions of the politics of science