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IUCCA

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[In this write-up Professor Narlikar has discussed the rationale behind the setting up of Inter-University Centres and has described the objectives of IUCCA. The write-up is based on two earlier write-ups published in Current Science Vol. 59. No. 20, October 25, 1990 and UGC letter, (volume 1, No.4, April-May 1992.)]

India's independence in 1947 saw the beginning of a rapid growth in the science and technology base in the nation. Thanks to the perception of Jawaharlal Nehru, and the visionary scientists like Shanti Swarup Bhatnagar, Homi Bhabha and Vikram Sarabhai, a number of national institutions, research centres and laboratories sprang up all over the country. Today the list of R&D organizations makes impressive reading. In addition, national agencies like CSIR, DRDO, DAE, DST, DOS, DOD—fund science and technology projects on short and long term basis.

There is a striking gap in this multipronged approach, a gap that did not exist in 1947 but which came about shortly thereafter and has widened steadily. The universities have missed out in the overall growth of S&T both quantitatively and qualitatively. And the serious repercussions of this widening gap are now catching up with the overall system. The most serious of these is the manpower problem.

Universities in ideal situations provide an environment where a two-way interchange of ideas, question-answer etc. exists between the teacher and the taught. The teacher with his experience informs and motivates the student towards the challenging and exciting aspects of the field. The student, with his freshness and curiosity may ask questions that make the teacher think again. We see these idealized conditions in the successful universities in most of the developed nations. The authors of articles in scientific journals of repute come predominantly from the universities' environment where they are engaged in teaching as well as research.

Unfortunately, these conditions no longer obtain in our universities. There are good departments, motivating teachers, successful research workers and bright students in the university sector ... but one finds them more as exceptions than as a rule. Innumerable statistics can be quoted to say how higher education has prospered since independence, how the numbers and sizes of the universities have grown, etc. None of these can answer this question: 'If so much has been done for higher education, why is there a brain drain away from the universities?'

A Personal Experience

The fact is that sometime during the 1950s and 1960s (it would be worthwhile doing a sociology project on when exactly this happened) our intelligentsia and politicians agreed for once: that the universities are a losing concern so far as the research in S&T was concerned. When I left India in 1957 for higher studies in Cambridge my dream was to return to some university in a job that combined teaching with research. When I returned in 1972, I could not realize that dream and had to settle for the second-best—a job at the Tata Institute of Fundamental Research.

Why should I label the premier research institution in the country 'second best'? This is because, working there under the excellent environment one sadly misses

students who have completed their undergraduate education. And so, the invigorating inputs received from student teaching are lacking.

This is the main reason for the present problem of manpower in our research institutions. These institutions with their better research facilities confine themselves at most to the Ph.D. programmes and as such have no direct contact with students who could be motivated to do Ph.D.s in science. On the other hand the universities, where students exist in abundance, are troubled by infrastructural problems and lack of a research atmosphere.

How can one find a way of resolving the issue?

The Inter-University Centres

What attracts the talent to an academic institution? The ingredients include good salary and living conditions, a low bureaucratic profile, autonomy of operations and last, but not the least: good facilities both in terms of 'man' and the 'machine'. With the recent revision of pay scales the universities have not done badly. The scales in the university system no longer compare unfavourably with those in the national laboratories. So far as bureaucracy is concerned the universities have a long way to go to evolve a working system that involves as few *babus* as possible. Even more difficult is *autonomy.* Sadly the university constitutions have brought in numerous outside checks. The original intention may have been a pious one, that the academics in the university should be accountable to the tax payer and hence there should be outside representatives on the various bodies of the university. In practice it has meant a steady erosion of academic autonomy—a system in which the deans and the registrar are the VIPs who must be kept in a good mood. A fundamental change is needed to reverse this trend.

What about facilities? A scientist needs good working conditions and a healthy interaction with like-minded colleagues. The exchange of ideas with others is as important as having good equipment to work with. With sufficient funds both the problems can be solved.

However, it is clearly not possible to provide top class facilities in all subjects in all departments of all universities. Take an example from astronomy. The difficulties of maintaining a good quality telescope at Rangapur by the Osmania University are well known. A university department needs to be given far greater support than is usually possible, if it is to maintain a top class facility. And the bureaucracy and lack of autonomy of the university system make it difficult for the facility to be used optimally. So there is lack of use. lack of maintenance and eventual frustration and brain drain.

There are two ways of dealing with the situation. The first is to be ashamedly undemocratic by identifying selected groups in selected universities for special treatment. Special treatment means extra funds to be able to provide and run facilities above threshold and a guarantee of autonomy of operations. Considerable political will is needed to make this option work. The success would go a long way towards boosting confidence in the university system.

The second, softer option is through the creation of centralized facilities in the university sector which are managed by autonomous institutions specially created for the purpose. These 'inter-university centres' are thus meant as national coordinating agencies in specific fields. The first such IUC was created by the University Grants Commission in 1984 in Delhi. Known as the Nuclear Science Centre, this IUC now has a top class facility in nuclear physics—the pelletron. Another IUC to be created next was in astronomy and astrophysics at Pune. The third one at Indore is for atomic research with the facilities already existing under the umbrella of the Department of Atomic Energy. An IUC in instrumentation (at Bombay) is in the pipeline.

An IUC is a registered society with a Council and a Governing Body, the latter being a subset of the former. To start off the registered society there have to be a set of rules and a memorandum of association to be approved by the Government of India. After registration the society works within the framework of these

rules and the bye laws that it approves. The IUC is thus provided with an autonomous structure that allows it to function much more freely and flexibly than a university can.

How does an IUC function? The example of IUCAA, the Inter-University Centre for Astronomy and Astrophysics will illustrate the answer.

The Inter-University Centre for Astronomy and Astrophysics, set up in 1988 by the UGC as a centre of excellence in research, development and training in astronomy and astrophysics for the university system is an autonomous organisation with a Governing Body under chairmanship of the Chairman, UGC and located on the campus of the University of Poona. It provides a place for scientists, from universities, IITs and colleges, who are interested in astronomy, astrophysics and related areas to gather, exchange ideas and initiate research and training programmes. The following facilities are available at the IUCAA for its core faculty and visitors:

Library: The IUCAA library has a collection of over 8000 books on astronomy, astrophysics and related areas. It benefits research workers, students and also less experienced persons coming to the IUCAA for summer schools, refresher courses, etc. The IUCAA subscribes to about 140 scientific periodicals. The IUCAA library is fully computerised, with all user services as well as library management functions being carried out with the help of software developed at the IUCAA.

Computers: The IUCAA has developed a network of computers to serve its numerical computing and image processing needs. The network consists of a steadily growing number of advanced SUN workstations with all kinds of storage devices and other peripherals. The IUCAA has also developed a network of PC-compatibles for administration, accounting, library management, and desktop publishing. The IUCAA has a dedicated E-mail link with NCST at Bombay, which provides access to computers and databases all over the world.

Astronomical Data Centre: The Astronomical Data Centre (ADC) at the IUCAA has a large collection of astronomical catalogues and databases together with software for efficient retrieval of the data. A workstation with 600 Mb of disk space has been obtained and networked with other computers at the IUCAA. Facilities at the ADC are available to the astronomical community now.

Observing facilities: The IUCAA has acquired two small telescopes—a sophisticated computer controlled Celestron C-14 and an Ultima 8—for training students in optical observations, as well as for testing instruments developed at the IUCAA. The telescopes are equipped with a solid state photometer, a small thermoelectrically cooled CCD and so on. Control and data acquisition are done by computers, which are also equipped with software for image processing. The set up provides an excellent state-of-the-art introduction to students in various aspects of astronomical observing. Astronomers at the IUCAA have regular observing programmes on the Vainu Bappu Telescope at Kavalur and the UPSO telescope, Nainital. The data are analysed using the image processing facilities in the computer centre. The observing programme is open for participation to all interested scientists in universities and colleges.

Instrumentation laboratory: The instrumentation laboratory is developing instruments like photoelectric photometers for use on small automated telescopes. The laboratory provides facilities to be used by scientists from universities and colleges in developing their own instruments.

Faculty and visitors: At present, the IUCAA has 9 permanent faculty, 6 post-doctoral fellows and 11 students working for a Ph.D. In addition, the IUCAA has 45 associates and senior associates selected for three years, who visit the IUCAA for a few months each year. A large number of distinguished foreigners and Indian visitors come to IUCAA for varying periods. The long and short term visitors provide a very lively and stimulating atmosphere and offer opportunities for academic interaction to everyone.

Workshops and schools: The IUCAA conducts a number of workshops, schools and minischools, all levels, from the undergraduate to the advance research level, on the campus in Pune as well as in university departments in different places. These meetings are designed to provide instructions as well as to review recent progress in various fields and initiate research projects.

IUCAA's Eight-fold Way

Astronomy and Astrophysics (A&A) have received considerable thrust worldwide and are regarded as rapidly growing parts of physics. Although the dividing line of interest between these two subjects is never very sharp, we may broadly identify astronomy with the observation of the cosmos and astrophysics with the physical interpretation of what is observed. Advanced countries like those in Western Europe, the United States, the Soviet Union, Canada, Australia, Japan etc. have astronomical programmes of a kind that would have been considered highly ambitious a generation ago but which are becoming realities thanks to the rapid developments in technology. Most facilities are either national or multinational, the latter applying to the more advanced facilities. Nowhere is the usage confined to a single institution or a university. Even where the management vests in a particular organization, the 'guest observer programme' encourages outside observers to use the facility in question.

The physical interpretation of data also has advanced dramatically. On the theoretical front astrophysical models demand sophisticated ideas from physics, advanced techniques of mathematics and highly developed computing software. Although human ingenuity and intuition are still at a premium the back-of-the envelope calculations have to be followed up by detailed analyses.

These exciting developments have found echos (albeit modest ones) in India too. The 2.3 m Vainu Bappu Telescope that was set up recently at Kavalur is probably the biggest optical telescope on Asian soil. the 1 m infrared telescope Gurushikhar has the benefit of a very good astronomical site. The 10 m dish at Bangalore is equipped for state of the art work in millimetre wave astronomy. And perhaps the most ambitious project is the 50-crore Giant Metrewave Radio Telescope being erected at Narayangaon near Pune.

Significantly, none of these facilities fall within the university sector. Although university users could in principle have access to some of these as guest observers, the existing framework does not make it easy for them to do so. Moreover, the more glaring question is 'Where are the users of tomorrow?' With most student manpower residing in the universities which as a whole have a very low profile of A&A in the form of teaching and R&D, it may well happen that good facilities will go unused for lack of astronomers !

This is where IUCAA steps in with an eightfold objective. To begin with, the Centre will have a core faculty, postdocs and research students of its own engaged in basic research and participating in teaching and developmental activities. This is essential if IUCAA is to have credibility as a national coordinating centre. As a major research centre in A&A, IUCAA will organise schools and workshops in frontier research areas where national and international scientists will participate as resource persons. But growth of activities at IUCAA must be matched by on-campus nucleation and growth of A&A in the universities. To this end IUCAA's next objective will be to establish a dialogue with university departments through regional meeting wherein the problems faced by them in implementing a vigorous A&A programme are discussed. For example what should an ideal M.Sc., Physics syllabus with specialization in A&A contain? How can the courses be supplemented by experimental aids and projects? Can A&A be introduced as a compulsory ingredient of the B.Sc. Physics curriculum so that students at least get introduced to these areas? IUCAA will help find practical answers to such questions.

This leads to IUCAA's third and fourth objectives ... the training of man-power in A&A and growing the culture of astronomical instrumentation. Thus teachers

need to be trained or reoriented for the teaching of A&A. So IUCAA needs to plan introductory or refresher courses for university and college teachers at various levels. And, it is equally necessary to organize elementary schools for undergraduates to acquaint them with exciting developments in A&A. To encourage development of astronomical instruments like detectors, cameras, photometers etc. IUCAA proposes to have an Instrumentation Laboratory where faculty and research students from the universities can participate in specific projects.

To some extent IUCAA is patterned on the International Centre for Theoretical Physics at Trieste, with a small core group and a large flux of visitors. As its fifth objective IUCAA has an Associateship Programme like that in the ICTP. An associate of IUCAA can visit the centre for long and short duration to take advantage of its centralized facilities or visiting resource persons. The travel and living expenses for such trips are borne by IUCAA. Directed at the university and college teachers, this programme is expected to improve mobility amongst the associates, increase contacts and promote interactions between scientists who might otherwise feel isolated.

IUCAA's sixth and seventh objectives are geared towards facilitating the use of major astronomical facilities by the staff and students of universities for research projects. The siting of IUCAA in Pune was dictated to a large extent by the location of GMRT at Narayangaon. By a happy turn of events both the IUCAA and GMRT office complexes are side by side in the congenial campus of Poona University which itself has a healthy and outward looking Physics Department. Thus IUCAA's sixth objective is to involve the university community more closely with the GMRT, and to encourage the use of the guest observer programmes at other major facilities in the country and abroad by the university community. IUCAA will act as a catalyst for potential astronomers in the universities.

The eighth and final objective strikes at the root of it all: to participate in science popularisation through the interaction with amateur astronomers, young students and the general public. At present there is hardly any exposure to A&A at the school level while even amongst the general public a desire to know about the scientific discoveries in astronomy is coupled with superstitious beliefs in astrology. IUCAA can play a vital role in this area through information dissemination, practical demonstrations, astronomical slide shows etc.

The UGC has set up the IUCs with high expectations in the hope of arresting and reversing the widening gap in higher education mentioned in the beginning. The success of the experiment depends on the users themselves. Thus, to make the associateship programme work, the universities must come to look on IUCAA as their own field station so that a staff member who has come to use its facilities is treated as on duty. IUCAA's overtures to university departments for strengthening the A&A will need to be reciprocated and taken advantage of.

To summarize, IUCAA is like the hub of a wheel, with the universities lying on the rim. Both the hub and the rim need to be connected in order that the wheel rolls along.