

India's ambitions to be a world leader in S&T depend upon a drastic overhaul of the university system

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From politicians to science administrators and leading scientists of the country, everyone speaks eloquently of India's potential in achieving the best in science and technology in the world. There is no denying the fact that the past several decades have witnessed betterment of general science education and facilities for R&D work in various research institutions. In recent years, there are good signs that industrial houses are also taking interest in indigenous R&D activities. Dr R. A. Mashelkar, Director General of CSIR and the current President of the Indian National Science Academy, has proclaimed in his recent essay in *Science*, 'If India plays its cards right, it can become by 2020 the world's number one knowledge production centre'.

The promise or the potential to rise to top in R&D activities, is qualified by an apparently innocuous condition, 'If India plays its cards right'. *It is here that the experience of the past several decades makes one suspect that the promise is unlikely to be fulfilled since our present system actually does more to destroy the potential rather than let it blossom.* The fundamental issues behind such suspicion need serious consideration by science policy and human resource development planners in the country.

The existing scene of decay

It is true that many of the young scientists are returning back to India and settling down in well-equipped laboratories within the country. They are apparently producing 'good' papers that are published in the so-called 'high-impact factor' journals. It is also true that, in general, there is not much dearth of money for developing research facilities and that industry is also beginning to invest in R&D activities. However, these bright promising spots are to be viewed against the broad canvas of the very dismal state of nearly all of the conventional centres of higher education, i.e. the universities. *It is not important to argue whether the universities are being pushed to die by extraneous factors or are dying of their own. What is important is that we are approaching the situation of*

a void, which is already showing cascading effects that negate the advantage that we expect from the few existing bright spots. In biological systems, aging brings about general decline and leads to death but this is always associated with new birth and youth replacing the aged/senescent ones. Unfortunately, that is not happening in the case of universities. One has to directly experience the multifarious problems and stonewalls that any young entrants or even established senior faculty members in the university system face. The problems are more to do with human resource management and the near total apathy of the powers that be. This is added and abetted by the general policies of the relevant governmental agencies, which often work at cross-purposes. Let us look at some of these factors in detail.

Quality of students pursuing basic science courses and quality of training received by them

Almost all countries complain that in today's 'market-driven' social order, 'good' students are rarely interested in taking basic science as their career. However, unlike the developed countries, the dearth of students studying science out of their interest has a cascading effect in India. We cannot attract talent from outside; rather we lose nearly all talented students who happen to study basic sciences on their own (rare) or who drift (majority) to such courses in the absence of their preferred professional subjects.

Whatever be the quality of students who join B Sc or M Sc courses, the greater worry concerns what a student experiences in any college or university in the country. Barring a few exceptions, the student is faced with poorly maintained, dark lecture rooms and laboratories with hardly any functioning equipment! *To make matters worse, most of the teachers are not interested in or not even capable of teaching the basics, leave aside kindling the spark even in a few of the hordes of students sitting in each of these classrooms.*

Majority of the students from such a lacklustre and depressing teaching environment cannot become even good technicians!

Quality of teachers and their environment

A teaching job at a college or a University is not preferred by brighter PhDs. Likewise, those who come back from abroad also have their choices fixed: the top priority being for a position in one of the select few research institutions; only if there are some compelling reasons, a few of the chosen university departments are considered as the next preference. If none is available, they do not want to come back or if they had come back, would soon find their way back to the West. Only rarely does one come across candidates for teaching positions in colleges and universities who know their subject well or who enjoy teaching. *Many happen to be teaching in colleges or universities because they could not find other jobs.*

Most state (and even some central) universities are not allowed to make any fresh appointments or even when the drill for new appointments is allowed, the long procedure and its unpredictability often results in a situation where the better candidates are no more available for appointment. If a relatively competent person does get selected through this highly stochastic event, the person finds himself in the company of colleagues in the department who are rather old and a frustrated lot and, therefore, would not encourage the new entrant to start some good teaching and research programmes.

The department or university neither feels obliged to nor is in most cases endowed with adequate resources to provide at least some basic material facilities or 'seed money' to let a new entrant start research work. In many developed countries, young faculty members are initially given less teaching responsibilities so that they can devote more time to set up their own research activities during the beginning years. However, in our system, young lecturers are supposed to take more and more classes, while experienced senior teachers are required to teach less. This leaves little time for the new faculty members to plan their research activities.

If some enterprising faculty member does succeed in getting a research project funded, implementation of the work plan and utilization of the approved grant invites

more problems. In summary, the system, rather than being a facilitator of research activity, is by and large, inhibitory.

Recruitment procedures

Recruitment procedures for teaching as well as non-teaching positions in nearly all the universities are cumbersome and not geared to hire the best talent for the job. The earlier practice of identifying a talented young person and offering a job straightaway is now no more possible. The present system is riddled with the so-called 'checks and balances' to prevent misuse of authority. In recent years only a few universities in the country have adopted an open advertisement system and a wider involvement of departmental teachers in selecting a new faculty member. In most other universities, the excuse for not implementing such positive procedures are the existing rules and regulations, and the imaginary fear that such a freedom would be easily misused or subverted.

Political and other kinds of pressures for selecting a candidate or even exchange of money in lieu of getting an appointment are not unknown. This obviously is frustrating for the deserving candidates who get sidelined in absence of 'recommendations' in his/her favour. *Once a wrong candidate gets appointed through such means, the damaging consequences are faced by the department for life, since no one can in reality be thrown out of the 'permanent' job.*

Functioning of funding agencies

The 'backbone' money for all public universities and colleges comes from the state governments and the University Grants Commission (UGC). While the number of universities (and the so-called 'deemed' universities) and colleges in the country continues to increase rapidly, money available for the purpose with the state governments and the UGC has increased only marginally. Consequently, the limited money is spread 'thin' and much of this depleted money goes in the salary component. The available 'revenue' or 'laboratory' grants in most of the university departments and colleges are not sufficient to meet even the routine classroom requirements. Therefore, any money being available for research is a far-fetched desire.

Nearly all research activity in universities/colleges is dependent on individual

research projects funded by various governmental agencies. In spite of substantial increase in the quantum of funds being available with funding agencies, the university system has not benefitted to the desired level. A major cause is the relatively poor level of ongoing research activities. Consequently, university scientists often fail to compete with those from better-endowed research institutions. This traps the university teachers in a vicious circle of poor science, poor recognition and consequently poorer output¹.

Most of the funding agencies take a painfully long time to decide on the submitted projects and even after the project is approved for funding, getting the sanction letter and finally the money can be a still longer wait. Since most universities do not have the resources to 'advance' money to the Principal Investigator (PI) in anticipation of the funds to be released by the concerned agency, the research work suffers silently but significantly. In many cases, the research and other staff appointed on the project are not paid their emoluments for several months because the grant is not released by the agency on time. Whether the fault is at the university administration side (non-submission of the UC and SE in time) or at the door of the funding agency (procedural delays or simple carelessness), research work suffers and often leads to a resigned attitude on part of the PI.

In recent times, a number of schemes have been initiated to improve the infrastructure for research in university departments. UGC provides support in the form of SAP, COSIST and UPEC, while DST initiated the FIST programmes, which are expected to improve the much-needed material facilities for research. These programmes have helped many departments to acquire some state-of-the-art facilities. However, in many cases, things may not have changed much beyond the acquisition step. There are several reasons for this unfortunate situation. In my opinion, a primary reason for the absence of desired improvement in infrastructure seems to be related to its different interpretations. Very often, more expensive and sophisticated equipment facilities are taken as a synonym for infrastructure and, consequently I wonder if in the name of 'infrastructure', have we created only 'superstructures', which the intended beneficiaries are neither capable of handling nor maintaining. The latter because little money is provided for the expensive consumables required for using these facilities and for maintenance. Many

of these 'facilities' cannot be effectively utilized in the absence of trained technical support staff, which, as a rule, is not provided by the granting agencies. Unfortunately, no such competent technical staff is available in most university departments. The few that may be available, are either too old to learn operations of the newer sets of equipment or, more likely, do not even have the capability or desire to learn and serve the community. Fortunately, in the crowd of incompetent technical support staff available, one does find rare individuals who work beyond the call of their normal duty, but the system neither rewards them nor replaces them when they superannuate.

Democratization of the grant distribution process cannot improve the quality or even catalyse the potential of good research work. All the major programmes, like SAP, COSIST, UPE and FIST are granted to the entire department rather than to critically identified groups or individuals. Once any facility is created as a 'central facility' in a department, which has fewer 'active' and more 'inactive' members, it becomes virtually impossible for the 'active' worker to effectively use the facility. All kinds of 'rules and regulations' are put in place by those in majority. *In this kind of 'democratic dispensation', the better ones are more likely to be brought to the 'ground' level rather than those at the 'ground' level being helped to rise higher.*

It is clear from the above, that the existing scenario in almost all university departments is far from encouraging, notwithstanding the fact that there are teachers and researchers in the system who continue to put in their honest efforts in maintaining quality. Unfortunately, the proportion of such committed and competent teachers continues to decline with every passing year, without any sign of the process being reversed in the near future.

I must also state that many of the research institutes and laboratories spread across the country too do not appear to be in reasonably good 'health' in terms of their internal environment and research output. It will be difficult to deny that barring a few research institutes in the country that have managed to remain in the limelight for their research and technological contributions, many have just existed without having made any meaningful contribution in recent years. One could even say that their disappearance may not have a significant negative effect on Indian science efforts; rather it may facilitate better utilization

of the resources that are being otherwise wasted. Even at the cost of hurting sentiments of several colleagues, I have no hesitation in stating that the R&D output of even our front-ranking institutions is much less than what one should expect from investments on infrastructure and staff. We tend to blow out of proportion any event of success and pat our own backs. And in support of this glorification, we cite what media and colleagues from developed countries say about India's potential, but we conveniently forget the 'ifs' and 'buts' that accompany such praise.

What needs to be done?

Lest I sound pessimistic, with a negative view of the country's achievements in science and technology (S&T), I must state that there indeed has been a qualitative change for the better in recent years in relation to S&T in the country. But this must be qualified by two very important points. First, the precipitous decline in the quality of teaching and research in universities in general is too serious to be compensated by the rare positive signs seen here and there. Secondly, the few success stories have also been often blown out of proportion for public consumption, and politicians and science administrators have conveniently used them to generate a false sense of euphoria. The decay that has set in the university system is serious and is bound to impinge heavily on all other efforts to improve the quality of S&T or R&D efforts of the country. This calls for immediate and drastic actions so that the extraordinary human resource of the country is effectively developed and utilized to really take India forward. Some plausible steps in this direction are suggested below.

Motivate young children to take science as career

Besides the variety of science popularization programmes already directed to school students, *we need to develop programmes directed to parents so that they do not pressurize their wards to opt only for 'professional' courses.*

Role of motivating teachers in developing interest in basic sciences at school level is important. Therefore, jobs of school teachers must be made socially and monetarily rewarding, so that children get appropriate motivation in their formative years.

Flexibility in subject combinations and greater emphasis on integrative and interdisciplinary learning

Today's basic as well as applied research demands wider understanding of a variety of subjects. *Therefore, existing tightly compartmentalized options for choosing subject combinations at undergraduate level and restrictions on lateral movement from one subject to another at post-graduate or Ph D level must be liberalized.* In addition, all teaching programmes must have an interdisciplinary approach, so that students learn in a holistic or integrative manner.

Restrict Master's and doctoral degrees to maintain quality

The country is 'manufacturing' too many MScs and Ph Ds to maintain quality. This number needs to be significantly reduced so that quality can be maintained and the problem of unemployment of 'highly qualified' individuals is minimized.

Recruitment of young and competent teachers in colleges and university departments

In my opinion, the single most important factor that is affecting higher education is lack of competent and motivated teachers. This needs to be tackled urgently.

(i) University jobs must be made more attractive not only in terms of salaries, but also in terms of the working environment. The present system of appointments needs to be radically changed. New recruitment must be a continuous process and the incumbents must be asked to make presentations of their work and their future plans. This would help the appointing departments to objectively assess the teaching capabilities and research potential of the candidates. *Whatever be the actual mechanism of final selection, the process of application, selection and joining must be continuous, smooth, rapid and objective.*

(ii) In order to let the new faculty members escape the inhibitory influence of 'senior' but inactive colleagues, a voluntary retirement scheme (VRS) needs to be introduced. However, the VRS must not be associated with another 'order' that the vacant positions cannot be filled! *An intense re-*

ruitment drive along with VRS would make way for the badly needed 'fresh and young blood' in university departments.

(iii) The general practice of 'permanent' appointments in the country has allowed continuation of those who do not deserve to be in academic jobs. One of the remedies for elimination of complacency following permanency is to have contractual appointments, with stringent assessment at the end of the contract period. Unfortunately, the assessment part is where we have always failed as a system (e.g. the scheme of scientists or the Merit Promotion Scheme introduced by UGC some time ago). In recent years, many universities/colleges have been making contract appointments of 10–12 months for lecturers. This is damaging for the young aspirants, since such short-term appointments do not permit any kind of long-term planning. *What we need, is to make initial appointments on a five-year contract basis and provide necessary facilities to young faculty members for developing their research and teaching programmes (start-up grants) and then evaluate them rigorously and objectively after five years and decide if they can continue or not.* The assessment must be rigorous and honest, if it has to be productive. If not, the entire scheme becomes counter-productive. Even if the provision of permanent appointments is retained, assessment for 'merit' promotions must be rigorous.

(iv) The present trend that anyone who has done Ph D in India must do a postdoctoral stint in a Western country so as to get 'exposed' to the scientific community, is seriously flawed, self-defeating and therefore, needs to be seriously discouraged¹. If we can objectively identify young and fresh PhDs and offer them positions in the university departments with a reasonable 'start-up' grant, I am sure that most of them would mature into competent teachers and researchers, who can subsequently visit more developed research laboratories as equals rather than as postdoc subordinates. Several years spent as Ph D scholars and then more years as post-docs, do not provide any opportunity for young persons to develop a liking for teaching and consequently, most of them insist on joining a research institute only. On the other hand, if those that display promise were challenged to develop as teachers and independent researchers at a younger age, most would prove their

worthiness. *If each science department in universities can employ even a few such energetic young and fresh Ph Ds (mid-twenties to mid-thirties) and provide them with initial support, the face of teaching and research in universities would undergo a dramatic change for the better.*

(v) *From the point of view of taking up challenging research in novel areas, it is necessary that fresh Ph Ds, who take up faculty positions on a competitive basis, are encouraged to define their own research problems rather than the currently prevalent trend, where those returning from the developed countries carry with them some part of the research topic that their 'parent' laboratory is engaged. This practice promotes neither original research nor research that may be of relevance to the country.*

Infrastructure

Even a highly competent person would fail to deliver if the infrastructure and the 'environment' is not conducive to constructive activities. Therefore, to get the best out of the faculty, it is necessary to overhaul the present depressingly poor infrastructure.

Water and power supply: Quality water and uninterrupted and stable electricity supply must be ensured to universities, especially where research in science and engineering departments is actively pursued.

Library and internet: All universities need to be put on broadband network of Inflightnet (or any other library network) to ensure on-line access to a large number of journals and other internet facilities to faculty members, students and research scholars.

Laboratory grants: Most of the earlier established departments continue with laboratory grants that were fixed several decades ago and consequently, are not in a position to provide any support for research, and in many cases, even for classroom teaching. In addition to a better provision for a reasonable sum of money being always available to all teachers of the department for routine office and laboratory expenses, there must be a provision for minimal assured 'start-up' grant and laboratory space to every new faculty.

The universities need to generate more local resources and one necessary step that needs to be taken up is to enhance the tuition and other fees. *There is no justifi-*

cation for continuation of the ridiculously low tuition and other fees that are in vogue in most places. Higher fees would also inculcate a sense of responsibility in students to take their studies more seriously. When the fees are substantially enhanced, there should also be adequate provision for loans/scholarships for those who are financially weak but otherwise deserving.

Funding for excellence: Various schemes of UGC, DST, DBT and other agencies for infrastructure support and promoting excellence had only limited success, because of misplaced emphasis on acquiring more expensive equipment/facilities and because of the prevailing 'democratization' of the available grants. The system must identify excellence and nurture the same specifically while providing reasonable opportunities to others to rise higher till they can also compete for excellence. *Whether one agrees or not, it is a fact that academic excellence and acumen for advanced research are not democratically distributed and therefore, the system must be geared to identify those who deserve better support than many others. This 'non-democratic' support system alone can encourage and sustain excellence.*

Philosophy of sharing of facilities: More than the physical facilities, we also need to bring about a change in our work-culture and philosophy, especially as these relate to sharing. Often, young faculty members or other new entrants in even a reasonably equipped department suffer from compartmentalization of the facilities. *So-called 'central facilities' often degenerate into 'central store-houses' in the absence of adequate supporting manpower and the philosophy to work in a 'joint family' atmosphere. Tendency to build 'empires' rather than working facilities needs to be strongly curbed. An interacting laboratory environment would not only allow optimal utilization of the limited resources, but would also provide the much needed crosstalk between students and teachers working in diverse areas.*

Administration

Over the decades, the administrative wing of every university, like that in every other governmental department, has become overbearing and instead of 'serving' the academic community for which it is put in place, it tends to make the academic community subservient to its whims and fancies.

Autonomy: It is rather ironic that in spite of UGC's insistence on financial and academic autonomy to all those departments that are recipient of COSIST/SAP support, hardly any department in any university has become autonomous. At the same time, it is equally disturbing that even the limited powers that are provided to the Heads and Deans, are rarely used in an effective manner. There is increasing tendency to pass the buck, so that everything awaits the Vice-Chancellor's orders or approval.

The primary reason for the administration not granting autonomy to the academic units like departments, faculties or PIs of research projects is the fear of misuse or abuse. It is ironic, however, that those who misuse or abuse, continue to do so even under the apparently 'stringent' administrative supervision, because punishment in such cases is rarely put in practice.

To let the creative teaching and research activities flourish, it is essential that the investigators, Heads and Deans have autonomy in academic and financial matters. Misuse or abuse of autonomy can be checked by timely and stringent action against the guilty. The funding agencies may release the research project grant directly to the investigators and make them responsible for submitting audited accounts on a regular basis. If international funding agencies can do this with Indian investigators in India, why can our own agencies not repose faith in our investigators? The advantages of such autonomy to all those who really want to work will be far greater than the disadvantage of misuse by some.

Vice-chancellors: The appointment of Vice-Chancellors of universities must be an academic activity, free of any political interference. *Those who are appointed to occupy such high positions must have demonstrated their own academic (in teaching as well as research) excellence besides administrative and visionary capabilities.* Only a person with these attributes can run the system effectively and plan for future. A Vice-Chancellor should not be bogged down with daily mundane administrative issues, so that instead of 'fire-fighting' on a daily basis, he/she can concentrate more on leadership and futuristic developments.

A Vice-Chancellor's term must be for a period of five years, so that one can conceive and execute developmental plans. Appointment of the next Vice-Chancellor must be made in good time so that periods of inter-

vening uncertainty do not exist and transition is smooth and effective.

Work-culture of funding agencies

Various governmental agencies that have been established to create, facilitate and promote opportunities for higher education and advanced research have not functioned properly and consequently, the desired developments have not taken place.

Objective assessment: A common malady afflicting our social structure is the general inability to 'call a spade a spade'. This does not help bring in accountability. The peer-review must be objective and independent of 'position' of those who are being reviewed. *The first research project from a young investigator may be evaluated a little more liberally, but as the investigator begins to gain in experience and 'status', the evaluation should be progressively more stringent.*

Rules should be facilitators rather than inhibitors: In a progressive system, the administrators must not dominate over the 'expert committees'. Once the academic committees have made some recommendations, the administration should follow them, and if some 'rules' come in the way, they may need to be re-examined to ensure that the desired programme is not jeopardized due to procedural issues.

Decisions and release of grants must be quick: Processing of research proposals, etc. and subsequent release of grants must be quick and must take minimum time. *If a research proposal in a competitive area cannot be undertaken timely, it may not be worth pursuing at all.*

Long-term support to the university system: Creation of a 'facility' or 'centre' by diff-

erent funding agencies in universities is primarily to boost capabilities in specified areas. However, many of them have failed to do so because after the 3 or 5-year support by an agency, the concerned university is expected to maintain it on its own. This is almost always impossible, first because the university has no funds to spare and secondly, the will to sustain and promote such centres/facilities may also be wanting locally. Consequently, such investments ultimately go waste. *It is necessary that various funding agencies and the UGC/university system work in tandem in a participatory mode.*

Inter-institutional cooperation in capacity building

In spite of many rounds of discussions on inter-academia, university-research institutions and academia-industry interactions, nothing concrete has emerged. *A possible mechanism that can bring about productive interactions is a system of dual appointments so that a person formally appointed in a research institution can actually have his/her laboratory supported by the parent research institution, in a university where he/she also participates in teaching programmes.* Since several scientists in research institutions also like to teach on a regular basis, they will find this an attractive possibility. Additionally, this arrangement will be of mutual benefit: the research institution will gain by direct interaction of one or more of its scientists with those in the university and the university would gain by having the expertise and facilities that it usually fails to garner.

There can be many additional or alternative ways that can be thought of to improve the academic environment and performance of the university system. However, *what is important is that the corrective steps are applied in an integrated manner and with a strong will. A piecemeal approach*

is of no use, since the gravity of the situation is beyond cosmetic changes.

The other point that we need to remember is that many of the ills that afflict the university system may appear trivial or local and, therefore, are often glossed over by some who claim to have an optimistic and positively forward-looking approach, and by many others who believe that these things do not concern them. However, after having spent more than 35 years in the university system and having had the opportunity of experiencing the good and bad of it (and also of learning about other research institutions in the country as an outsider), I must state that *it is the cumulative effect of the long neglect of the apparently trivial and local problems that has brought us to the present state, when the very existence of the university system is in danger.*

We have already paid a heavy price for inaction². Let us not permit ourselves to be pushed over the precipice from where we can never rise again.

If we really want to see India reaching a position of stature in the next one or two decades, we must now act comprehensively and with a clear and well-defined long-term plan to revive and improve the university system in entirety. Making small changes here and there or concentrating on a few select universities or creating some new 'science universities' will have little consequence in a country of such dimension and diversity.

1. Lakhota, S. C., *Curr. Sci.*, 2003, **85**, 20–22.

2. Lakhota, S. C., *Curr. Sci.*, 1997, **73**, 6.

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