

Great science and technology in India – at IISc and other educational institutes? Further analysis and possible solution

After N. R. Narayana Murthy's strongly worded speech at the convocation address at IISc, Bengaluru on 15 July 2015, many articles by distinguished scientists have appeared¹⁻⁴.

I wish to dwell on the core theme in the light of what has been stated by these scientists, indicate a missing element in each of these observations, draw upon the recent history involving success in building excellence out of an existing dilapidated system and outline a strategy to grow, even if slowly, from the current situation to excellence in multiple dimensions.

The tone of most of the writings I have read is somewhat defensive and on occasion using offense as a tool for defence, partly related to Narayana Murthy drawing parallels from MIT (USA) without adequate and deeper reflection of the accomplishments and the role played by academia, including IISc in India. The positive point of his address is the start-up of strong debates contributed by many distinguished people.

Padmanaban¹ who spent his lifetime of active work at IISc and as a director for four years has made two critical points. He states '...Are we doing cutting-edge research? Not really. It is very good research, but not the breakthrough kind. Even senior scientists do not want to leave the comfort zone to risk an untrodden path. It's still "publish or perish" that decides the future of scientists' and '...The problem with the IISc is its laid-back environment'. The question that arises is, can we do something concrete about these two aspects?

Rao² has in fact suggested that if a few billion dollars were provided for, he could help create a world-class university. Even if this were possible in say, 5–10 years from now, what about IISc with its long history and the dozen other science and technological institutes of higher learning of history not as long, but substantial and those established in recent times; should these be written off? There is an alternate pathway I want to describe that should bring up all institutions. Great work happens because there is a large pool of good scientists doing good work, large pool of scientists doing very good work and a smaller number

doing extraordinary work in a pyramidal manner – Greatness does not appear in isolation, albeit with a very low probability.

Mashelkar³ invoked lack of 'irreverence' as a possible reason for lack of high-quality research. While this may well be so, if we have not seen better evolution towards irreverence over this period and no hopeful situation coming along, how long can the country wait for the right people to arrive – is there no sure approach to obtaining results instead of unsure expectations?

Vijay Chandru⁴ has brought insight from the systems in the truly successful situation in USA, explaining what may be lacking here and expressing hope of creating a structure through NITI Aayog. No matter what structure is suggested, creation of new knowledge of worth to the society around and the world at large is an act that should happen within the institution, and discussions on the way forward must also happen within. Inputs can come from outside, but that is no argument for the lack of intense discussions within.

The example that I wish to bring to the attention of the scientific community is of Abdul Kalām on what he did at DRDL, Hyderabad – aspects that have not figured in any of the recent articles on him by many distinguished people. I was familiar with most of the scientists and directors from that time – quite often engaging them in conversations on why ISRO appeared performing better than DRDL in rocket engine-based vehicle-related developments. There was a clear despondency in DRDL with most active scientists having no self-faith, feeling that nothing significant would happen in their organization. Kalām's entry to DRDL as its director in 1982, after the successful launch of SLV was of course greeted with enthusiasm, but the lack of trust between product developers and users, namely defence services was considered a stumbling block. That he created an integrated guided missile development programme (IGMDP) with five different classes of missiles along with the user community on-board and sanctioned by the Government was in itself extraordinary achievement. Then

onwards, he devoted all his time – on a 24 × 7 basis to these projects, brought to fruition the most important ones. With Sundaram as the project director, Prithvi, the semi-tactical surface-to-air missile saw its successful flight and further tests leading to interest in deployment by the army in about six years. The joy this development gave to the organization was stupendous. We must remember that the change occurred in just six years. What is crucial is to appreciate the role played by Kalām. He would engage with individual scientists at several levels and technicians in workshops at DRDL with a zeal and commitment that was simply not seen in the organization till that time. He could drive his colleagues to intense work and also show compassion at moments of personal misfortunes in ways that all those associated with him felt clearly that they were working with him and not simply for him – implying working for the country. He brought greater fame to DRDO through the realization of the strategic vehicle, AGNI over the years both at DRDL and later as Scientific Advisor to Raksha Mantri. The third vehicle – surface-to-air tactical missile, AKASH was fruitfully completed to the satisfaction of the user community more recently and based on this, DRDL has received orders for 30,000 systems – an extraordinary achievement by any standards.

During the period when he was the director, Kalām made no fundamental changes to the organization. He gave the organization what was needed most – a leadership with organizational interest being the uppermost with little visible personal gains demonstrating to people at every level that they also mattered and mattered to the organization.

What would be inferences for the question on hand, namely performing excellent science and technology in academic institutions? The analogy that I am drawing from the above illustration of Kalām is illustrative. In the case of DRDL or ISRO, the goals are clear – develop a system with specifications. It is not so for an academic. The goal is excellence in science, wherever it takes. In such a journey, it is possible that one goes a long way along unknown paths

and is struggling to move ahead – as it will be so for excellent scientists, but there is another extreme that is more common – being lost in justifiably significant, but in truth, insignificant work being pursued for decades. If an effort is made to allow deeper reflection on the latter aspects, some who are ‘lost’ can indeed be ‘retrieved’. I know of many who are looking deeply inside for direction, but do not get any for a variety of reasons and think that it is below their self-esteem to seek clarity from colleagues. Most importantly, excepting promotions that affect their immediate stature, there is little institutional demand for performing excellently. I am discounting long or short speeches at faculty meetings when the directors make remarks demanding excellence. It is simply not clear to anybody whether such a demand is more than statutory. This is the reason for what Padmanaban¹ described as ‘laid back attitude’.

What then is the solution? The directors of institutions should – (a) interact directly with individual faculty members on a one-to-one basis for an hour or two each year, exploring the broad contours of individual research – motivation for research or development; what the peers think of this class of work; does the faculty member have difficulty in getting things published; are there any serious bottlenecks in the conduct of work within the campus and offer suggestions, when possible, to get to higher levels in the exploration of the field and all that encompasses the academic world. The fact that the director is directly interested in his/her work becomes the strong motivating factor for individual pursuit to excellence. (b) Hold meetings of small groups of academics pursuing similar subjects in a more relaxed environment along with divisional chairmen and chairmen of connected departments (senior academics overseeing progress of

work and promotions) to discuss cooperative work enhancing the total accomplishments. (c) Often use the presence of distinguished academic visitors to hold similar group meetings and encourage a vibrant discussion without direct intervention. The last technique was what Kalām used; to calibrate various people, including ‘experts’ and academics, gently prodding people to perform better or accomplish more. The directors of institutions should deal with these subjects beyond administration, a role that seems to occupy most for most of the time.

It is realized by many directors after a while that there is some deadwood within their academic family. It is important that serious attempt be made to identify and nudge such people to get out of such situations. It is far more serious these days when full professors have an academic life of 25 years or so, and can cause havoc if they are non-functional and spread an impression that the kind of life they are living is also worth living. Such problems cannot be resolved unless dealt with directly by the director speaking quietly, gently, but surely to the individual faculty.

Further, the point made by Padmanaban¹ on the impression that ‘publish or perish’ attitude being dominant is denied by some directors. However, from what I have known, there is a visible broad tendency to disown developmental and technological accomplishments, even if they are truly science-based; and even if this is untrue, it is certainly true to mention that this is the public impression. It is therefore extremely important to speak about work of significance to the nation in various relevant forums, allowing the possibility for rejuvenation of broad-based academic values.

Over the years, there has been decay in the functionality of segments related to contact with the industrial world. Serious efforts must be made to keep the dia-

logue with industry alive on a periodic basis, both semi-formally and formally. It is also equally true that interaction of academia with DRDO and ISRO is decreasing over time. Conscious efforts must be made institutionally to keep the links with reality alive. There is no escape from reality checks for any academic work, particularly in engineering science.

Lastly, Narayana Murthy made a point that MIT provided him with a booklet indicating the list of technologies that they offered the nation during his visit. In 1996–97, when the then Prime Minister, Deve Gowda visited IISc, five technologies were presented to the nation by Padmanaban, who was the director at that time. These events have neither been followed up or preserved over a time with continued attempts to dismantle institutional segments of significance for this kind of outreach.

In summary, there is much room for raising the quality of work and projecting it to the world with academic authenticity. There is responsibility for the heads of institutions in knowing the broad contours of academic work of individual faculty members – whether it is for the cause of international science or national development, and providing the needed encouragement for their colleagues.

1. Padmanaban, G., *Hindustan Times*, 11 August 2015.
2. Rao, C. N. R., *Curr. Sci.*, 2015, **109**(5), 844.
3. Mashelkar, R. A., *Curr. Sci.*, 2015, **109**(6), 1021–1024.
4. Vijay Chandru, *The Hindu*, 3 August 2015.

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Photo check – why and how?

The advent of digital photography and radiology has revolutionized the scenario in science like never before. The last two decades have seen a massive transition from photographic film and tube-based cameras to semi-conductor-based sensors in high-resolution digital cameras and

radiographs¹. They have made life easier for scientists in terms of generating records and their storage, cost-effectiveness and are frequently considered as authentic visual representation of tangible cases or situations in scientific presentations and publications. But modernity is

also associated with ‘greater the power, greater the abuse’. Digital abuse has surfaced in the form of digital forgery, due to excessive intentional manipulation of images with easily available image-editing software on the internet, like Photoshop, Paintshop and Picassa 3.9.