

Round Table Discussions at the IISc Centenary Meeting

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The power that India feels these days is not simply because it is creating millionaires faster than anywhere else in the world, or that it has the largest number of billionaires in Asia. This is only part of the dynamics. The greater part comes from the change in attitude that it is once again acceptable to be rich and global: that it is acceptable to dine lavishly, to take vacations abroad, to travel first class, to send children to select private schools in Europe and the US, and to partner with multinational companies. It is equally acceptable to use one's riches to further the agenda of acquisition---and to heck with Augustine's principle that "it is better to need less than to have more." This change in attitude is yet to reach a majority of people in the country, but its reach is sufficient that a transition seems to have been ushered in, and the notion that a brighter future is possible is taking root.

Partly because of the technological achievements of the departments of atomic energy, space and defense, and partly because of the gains being made in ICT and biotechnology, as well as steel and chemical industries, the feeling is prevalent that the principal factor that has made these achievements possible is the knowledge advantage residing in the country: to cite a report of the ministry of commerce, "India is willing to strengthen linkages with its trading partners through its knowledge advantage, its pool of skilled resources, its young population, its potential of being a manufacturing hub and a base for high-end R&D". This is presumably why knowledge and power in India appear together in the title of this round table. Presumably, the country is slowly realizing that converting knowledge to power requires a new mindset from that of its past. I suspect that the business community has understood this better than the academic community, but this is a facet to which I will return later.

India has indeed witnessed great changes. The question we should consider is whether it is sowing the seeds needed to continue its growth as in the last decade and a half. The recent financial meltdown has revealed that part of recent gains was the result of a highly inflated liquidity boom globally. Progress has to be anchored to creating and nurturing of a solid base of knowledge and its proper application, and not to the mirage of market manipulations.

I am not an economist or a social philosopher and so cannot pretend to prescribe the right path for the country. I cannot even dwell on whatever ideas I may have in short time. But I want to discuss one aspect that social scientists and politicians don't usually discuss: that is the importance of great ideas, excellence and the role of elite institutions such as IISc. I lean a bit more on the last point since the broad context for the round-table is, after all, the IISc centenary. The country's long-term future, and its psyche itself, and the respect that it will get from the present and the posterity, within and without, depends on the great ideas it generates and the perseverance it shows in following them through; it takes a long time and a strength of character for putting even brilliant ideas to practice.

The only way lay this foundation is to give it top priority. I think that being open and generally curious sets the stage.

It's not a coincidence that some great ideas came to people when they were not mentally engaged with it.

protecting 'producers' to benefiting 'consumers'

The one big change that India requires urgently and in large measure is for the population to develop a deep reverence for nature. The very essence of the myth that Ganga flowed from the world of the gods is that we ought to treat the river with respect. But we have grown accustomed to this sacred idea while thinking nothing at all about polluting the river. Since we have adopted an economic system essentially borrowed from developed countries and have preoccupied ourselves with producing and consuming more and more goods and services, ancient traditions and values have fallen by the wayside. As a result, growth and development have progressively caused damage to the environment without questioning or evaluating the extent of this damage.

Since we live in a world of globalisation, and our progress at every level of society is measured in terms of the output of goods and services, the very first step we need to take is to ensure that our system of income accounting fully reflects costs to the environment. Nowhere, for instance, do we include in the cost of the rapidly growing movement of motor vehicles, the costs that are imposed in the form of air pollution and its health effects. There are enough studies available now that give us a fairly good estimate of these costs, which should be included in the cost of usage of road space in those areas that contribute to air pollution. Such an approach would require the building of expertise and know-how at a decentralised and local level in municipalities and other authorities that are responsible for management of our towns and cities. Public awareness would also be essential apart from regulatory and fiscal measures, so that the public itself understands the relevance of these measures and accepts them fully. The polluter must pay as an essential principle for bridging the difference between private costs and social costs.

A nationwide drive, however, has to begin from the top. Examples of major national efforts and their success are available even in today's world, and we can learn a great deal from them while bringing about the change that is needed in this country. We have, since the time of Mahatma Gandhi, lost our ability to mount public action on a large scale.

Our perception of greatness is based on religion, region, language and profession. Marathi can never call Malayali a great man. Tamilian can never recognize the greatness in Kanada people. Delhites do not see greatness in Mumbaiis, Rajput do not find greatness in Brahmins, Muslim do not see greatness in Hindus, IAS officers do not see greatness in engineers or doctors, politician does not find greatness in entrepreneur, khandani people do not find worth calling great who are not khandani and so on.

The lack of recognition of greatness has created vacuum of excellence in this country. Everyone finds some fault or other in everyone. That is the reason, people who migrated to West during the peak of Brain Drain found their excellence recognition which would have been otherwise lost in mediocrity of crowd.

In 2005, I set up the Mittal champion Trust targeted at improving our medal hauls at the London Olympics in 2012. To an extent, we were able to help Bindra on his way to gold at Beijing. But there is an enormous amount of work to be done if we are to come better than 50th in the London medal table. First of all we need commitment from schools, colleges and places of work to do all they can do to promote sporting activities for students and employees.

India is experiencing a great momentum in its economic transformation. As that journey continues, we need to draw the nation together. We need to pride in everything we do. High-profile sporting success is one way to help foster such pride. A sport also confers great benefit on individuals and communities who take part in it, even at the most basic levels. The most obvious benefit is improved health and fitness. As India becomes more prone to obesity, diabetes and heart disease, we can promote health through sports as a means of avoiding these problems. The benefit of sports can be summed up as a greater self confidence, more will power, greater discipline, and the willingness to take on and succeed in challenges that might have earlier seemed difficult or simply impossible. I have known from personal experience how sport can play its role in a balanced life.

The world today is witnessing profound changes in the economic and social systems at all scales-local, national, and global as never before. These changes are impacting on the ecosystems of the planet at such a rapid rate, and in such a wide ranging manner that they threaten the very basis of life on earth. Globalization has transformed the world in an unprecedented manner. Yet the divide between developed and developing societies persists. Poverty and inequity continues to be endemic. Production and consumption patterns that have evolved over the years are becoming unsustainable. It is time that we reflect on the role of S&T in order to reach a better understanding of the issues, challenges and options involved in sustainable development.

The reconciliation of society's economic and social development goals with the planet's environmental limits is what constitutes the basis for sustainable development. Sustainable development thus rests on three pillars- economic growth, social progress and

protection of the environment. This idea emerged from the Brundtland Commission report on Environment and Development, based on scientific perspectives about the interdependence of society and the environment, and has since evolved along with the significant advances in our understanding of this interdependence.

Today, problems faced by society are no longer determined by local events but by an interconnected world system which, shaped by the forces of science and technology and communication, has effectively eroded the traditional insulators of distance and time and have drastically altered one's notion of resource frontiers.

Humanity has faced many challenges in earlier eras and revolutionary changes in economic and social spheres have occurred largely through agricultural, industrial and informatics revolutions. We are now on the threshold of a new era that promises even deeper and wider transformation of society that can bring improvements in quality of life if only we can manage the challenge of sustainability. Technologies that underpinned the development of societies in the past and the consumption patterns that evolved subsequently, many of which have roots in the late 19th and early 20th centuries, are no longer considered to be sustainable. A whole generation of new technologies, many of which are already in the pipe line, will shape the production and consumption patterns of future generations. That there is a compelling need to reconcile the imperatives of environmental integrity, social progress and economic growth is resonating not only in political circles but more so in the scientific and technical community.

Technology is one of the principal drivers of our interconnected world. We find that many national and global issues are interlinked to a large extent. Energy, clean air and water, transportation, medicine and health, systems of management, and conservation of natural resources, to name a few, are all dependent on global developments in science and technology.

To generate adequate responses to the challenges of our times particularly, those that are posed by the quest for sustainable development, the thrust of science and technology will have to be progressively reoriented.

There is a compelling need for a new relationship between science and society. This new relationship should obviously be built on a reinforcement of scientific education and cooperation, giving due recognition to the need to connect modern scientific knowledge and traditional knowledge, and to foster inter-disciplinary research. The importance of addressing the ethics of the practice of science and the use of scientific knowledge, should also receive due attention.

A responsive S&T system that can contribute critically to the sustainability transition is clearly needed at this time. It must be able to harness its capacity and readiness to incorporate the perspectives and concerns of the major stakeholders involved, and adopt methods for collective decision making in pursuing practical applications.

Although the mobilization of collective will and setting up of appropriate institutional mechanisms are political tasks, the S&T system can and should play a facilitating role in bridging the gap between policy makers and stakeholders in exploring alternative pathways to sustainable development.

Already dramatic progress is seen in advanced materials, energy systems, biotechnology, electronics, information and communication technologies, and nanotechnology, and these among others, have the potential to provide new products and processes which fulfill both economic growth and environmental protection goals. Increased awareness and emphasis on green technologies represents a desirable trend that could not only reduce environmental stress but could be an attractive business opportunity. Placing greater emphasis on clean production processes and cleaner products is what makes the environmental revolution in industry and services sectors a truly scientific and technological challenge.

India's rapid economic growth is demanding much more of us in innovative new ideas, as existing solutions for issues like higher education, health, energy and the environment. In his session at IISc he will discuss why there is a need for reforms in these areas. India cannot, for instance, have an energy policy that is based entirely on the heavy use of hydrocarbons. He highlights that we should worry about the environment right now, rather than try like other developed countries to salvage it after industrialization has ripped through our natural resources. We also have to put in place a sustainable, realistic social security system, and ensure that our public health challenges do not swing, as they have in the developed world, from one end of the health spectrum-starvation-to the other-excess. And finally, we must incorporate modern technology and innovation more fully into the economy.

I have experience with some Indian faculties abroad. In short, they just want easy life! They severely lack courage to perform their so called 'good' science in India (defining their 'good' science is another serious ethical issue). They want easy funding, a lot of which is burned due to their careless and non-conservative approach. In contrast, they have to be competitive enough to get good funding in India. Conservative approach has to be adapted, not because we are poor, but to value the money of people. Most of them go back when filled up their CV with whole bunch of publications and now wish to have stable job for rest of their life, 'publishing good' does mean much to them now. Of course, exceptions can't be denied.

These days, a raising concern among me and my friends is how unethically these indian faculties abroad use indian/south asians students in their labs. Most of them are infamous for their 'screwing' tactics, the same that they themselves have experienced under their western supervisor. They take up enthusiastic students from India and 'use' them. Most of these students, who worked for long under these people are now not able perform well independently elsewhere. They generally follow the 'division of labour' policy where not all students understand the whole project. Though, they might be getting their name on good articles, they don't evolve as a good scientist and end up being a factory-worker. There are many such indian students in USA, who are just doing postdoc after postdoc

and that's their career 'to work as an expert of a particular technique'. It was heart-breaking to realize that in many such labs student-teacher relationship is now turning into master-slave relationship.

On the other hand, most successful scientist in India were abroad for short periods only. There are quite many such scientist now. The good science should actually be scaled to the input investment also. As we do that, I won't be surprised to see many south asians scientists among the top. Having said that, we can't ignore the pitfalls in indian system. One major concern is as following:

We have quite a good education system till post graduation (based on that we are preferred in west), but what happens after that? We have same (or even better) pool of well read students as we supply to west, then why can't we publish in nature/science/cell? Well it relates to management and mal-handling of students that can be discussed in detail some other time.

Turning back to ur point, I would say it is extremely hard to keep the students trapped in India, everyone needs better scientific exposure and there is nothing wrong in doing postdoc abroad. The point is 'to come back and serve our country with better skills and experience' and unfortunately that does not happen with present mindset of youngsters. I will ponder over 'how can we enhance respect for pdfs in India' and come back with my views

It is good to see that people really realize the problem which India faces currently in terms of attracting talents and keeping them. In my personal experience, I can say that all we lack in India is the "right attitude". After being here in US for two years now, I realize that its neither talent nor money that we lack in India for doing good science but it the attitude problem. Professors and Scientists (Supervisors) consider themselves demi-god(an asian mentality) such that they are never ready to what their students have to say who really work on the bench. I really doubt if even 10% of the total number of scientists in India have ever done a full experiment themselves in the last one year. The best thing they do is bossing around, meeting and free eating with govt money in seminars and symposiums.

The most disgusting part is the lack of trust on their own colleagues, even in the same institutes, what to talk of national level. There is a complete lack of professionalism. Its a common place thing in asian countries to interfere even in personal matters of students and India is no exception to it. Above all, its disheartening to know how the "scientocratic system" is set up in India. Its not the novelty of the projects or innovativeness which gets funded but the contacts you have and how high are you on the scientocratic ladder. I bet, even if the govt pours in billions of dollars, there would be very little progress until and unless we change our existing mentality. There is something wrong in the system as a whole. One of them is the lack of transparency in the evaluation process and the second being the "old age system" of training we impart. We are trained or are forced to become "followers of the western science" and not the leaders. We don't promote innovativeness and when at all we do, we brag about it a lot. The govt of India

has fellowships to fund novel and crazy ideas. But guess what, no information is given to put up in public domain as to who had been funded and what his/her crazy/novel idea was? Moreover, they prune the talent by putting age, institution, recommendations barriers. Why not keep it open, let all people compete without any barrier, evaluate it with strict rules by blinding it both ways (both the evaluatee and evaluator) and put all the entries in public domain so that others are stimulated to think through them. To me, it seems that we aspire to have innovativeness and novelty only on papers but not in reality. We lack focus and direction in the true sense. I will just cite an excellent example. In most cases of research being done/given to a new student, the standard dialogs by the supervisor is "kaam shuru karo, dekhte hain kya aata hai, phir aage soonchenge" (First, start the work, we will see what we get and then we will decide what we can do!). I would like to ask with all due respect, why the hell did you take the student if you had no idea what you want to do at the first place? I have written very tough words which might hurt many people but there is nothing personal about it. This is fact and we need to face it. We must stop self patting and "really think" about doing something. Lets be more open and be friends with our colleagues and students and not be demi-gods. Lets develop professionalism, lets be bold to think out of the blue and speak it out instead of saying "no no, it is not true, nobody has shown it earlier, it can't be so simple, it can't be true etc etc". Let there be a reward and punishment system based on performance and not on links, or position on the scientocratic ladder. Its the change in attitude which can help progress Indian science. Money and salary won't help much. A total transparency in the system is required. I would be happy to see your comments.

- 1) Develop a criteria and measures to define MERIT beyond (only) the number of publications. This could be based on contribution to science as a whole (teaching, training, learning, participation in academic responsibilities, participation in science organizations, collaborations, direct commercial value based research, etc)
- 2) Give preference in hiring to Indian postdocs with MERIT as defined above for faculty positions (if we can have quotas for all sorts why not preference to our own postdocs). And have tenure-track kind of system so that the tendency of "*I have this job no one can take it from me*" goes away.
- 3) New pay commission will take care of the total salary a new faculty receives and hopefully it will be equivalent if not at par with the software engineers (but again excitement of doing science should be the first criteria for a postdoc who wish to stay in science rather the sum he/she receive in salary)
- 4) Develop infrastructure to commercialize the ground breaking ideas (out of many themes one theme here in big US schools is that grad-students/post docs once gets a clicking idea from basic science can commercialize it very fast...number of companies starting right out of schools are very many if we visit MIT, Harvard, Purdue, Stanford, CIT kind of campuses and around)

At the part of mentor/ guide (and if any post-doc committee)

- 1) Not to see postdoc (or for that sake even grad (PhD) –student) as cheap labor but rather work with them to develop a bigger picture of science
- 2) Generate a system where performs of a postdoc can be judged and reviewed during the postdoc tenure rather than commenting after three yearno publication....no development...it will be hard to get a position I can not recommend you....(Where the hell was you when a postdoc was struggling in developing the best possible experiment).
- 3) Treat postdoc as colleague and friend to help him/her realize his/her dream

At the part of the postdocs

- 1) Publication is the first criteria that we will be judged on but to bring the MERIT, we need to be working even extra hours to keep ourselves associated with the peers, getting involved in scientific associations...just not as a member but as an active participator, training grad students etc etc along with the publications.
- 2) Bringing the drive of excellence in ourselves...Till the grad (PhD) studies we learnt and did what our guide/mentor wanted including replacing, reformatting, redesigning the smallest number/line on the figure legend for the publication.....Now as a postdoc can we push even further for excellence to THE BEST it can be done.
- 3) And again creating value based leading science will be the theme of success. We might be working on the most abstract concepts in the world however if it is not generating enough interest among our peers, if it is not solving existing scientific problem (or not appealing to the market place where we want to cash it in) give a second thought to it.

Work is kind of addictive here, so you tend to give up more of your personal time than you would back home and often do not even realize it. It is also easier to change career paths here. We work on more basic problems in science than we would at home, where research is very structured and narrowly focused. In my opinion, scientific leadership is less hierarchical here than in India, so I find you have to be more proactive and aggressive in taking on work. Less hierarchy means that you have to delineate work issues more clearly, otherwise there may be a less equitable sharing or acknowledgement of work, which may be assigned just because "you knew how" or your colleague did not want to do it.

I feel that the reduced numbers of American post-docs has meant that the postdoctoral training aspect of the scientific career may not receive as much support from grant agencies or from institutions as it should. Primary investigators get little credit for their role as educators or mentors of mainly foreign post-docs, and institutions do not highlight or advertise the quality or placement of foreign post-docs who were trained at their institution; rather, the focus is only on scientific leaders and their projects. It would be great if academics could write in ththeir resumes about the quality or quantity of foreign post-docs they have trained for a promotion to the next level.

Bangalore, in southern India, is home to the country's best known basic science institution, the [Indian Institute of Science](#) , which has on its rolls about 2000 students. The [Tata Institute of Fundamental Research](#) in Mumbai conducts high-level research in the physical sciences. In addition, sprinkled across the country are 18 federally funded

universities with a current enrolment of about 180,000 students. These institutions have more generous research budgets than the hundreds of state universities all across India.

Private-sector opportunities

India's abundant supply of highly trained, English-speaking workers has encouraged a steady stream of overseas companies to set up R&D facilities, particularly in the southern cities of Bangalore and Hyderabad. In 2006 alone, 100 of the world's top R&D companies employed more than 15,000 scientists in India. GE's John F. Welch Technology Center in Bangalore, which employs 2200 Ph.D. scholars, is working on new materials and devices. Microsoft, IBM, DuPont, and Monsanto all have R&D hubs in India. Although today the combined annual investment by these private industrial R&D institutions may not exceed US\$1 billion, the promise for growth is huge.

Because most, if not all, of these companies have expanded to India to take advantage of lower-cost talent, the best opportunities at these companies will likely be for those willing to work at comparable pay scales. "Large numbers of researchers from lesser endowed countries of Africa, East Asia, and eastern Europe are coming to India to work here," says malaria specialist Virander Singh Chauhan, director of the International Center for Genetic Engineering and Biotechnology in New Delhi, whose institution trains researchers from undeveloped nations all over the world.

Academic exchanges

Academic institutions may offer some of the best opportunities for exchanges with India. Getting Indian students or postdocs to North America and Europe has [not been a problem](#) , but the numbers going in the other direction have been limited. Some leading American universities, however, are launching programs with Indian counterparts that offer overseas visits for American students.

Through its India internship program, the Massachusetts Institute of Technology (MIT) in Cambridge has sent about 60 American students and postdocs to India since the program's inception in 1995. MIT has just bolstered the program by [signing an agreement](#) with the Indo-U.S. Science and Technology Forum in New Delhi. The agreement increases the number of internships allowing MIT students to work in educational, academic, and R&D institutions and nongovernmental organizations in India.

Other American institutions, encouraged by authorities in both countries, are considering similar joint programs to bring their students to India. American students considering a future exchange visit should keep an eye out for announcements of these new opportunities.

Most programs for American and Western scholars going to India last only 9 months or so, but the archaeology program at the M. S. University, Vadodara, bucks this trend. The university's Indus Valley archaeology program has encouraged researchers from the University of Wisconsin, Madison, to finish their doctoral research in India.

Archaeologist Kuldeep Bhan, who heads the collaboration, says it was hard to get the required permissions--several ministries had to give approval before foreign researchers could stay in India long enough to finish the work--but the "outcome is sweet." There's much to be shared, he says, between India's 5000-year-old culture and the ultramodern American enterprise.

In dark live those for whom power alone is knowledge;

In night darker still, for whom the world is one of power.

But those combine action and knowledge

Cross the sea of death through action and

Enter immortality through knowledge.

Women scientists

Collaboration with other Indian institutions, MoU's

Post-docs, graduate students

Transferring excellence to a broader setting