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Harnessing Science and Technology for Development: A Governance Challenge in Indian Context

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Introduction

There are several components of India's growth story. Some are dependent on our demography, size of youth work force, market potential, growing aspirations and factors like that. The others are driven by the increasing role of knowledge and technologies in economic activities. With the highly competitive world that we live in, becoming increasingly knowledge dependent, the balance of trade is strongly dependent on our ability to leverage knowledge to add value or even better, to create new technological products that have competitive market appeal both in India and abroad. Thus, our ability to leverage S&T to create innovative products and processes, and to nurture a right innovation ecosystem to take them to the market place assume greater importance now than any time before. Creating and nurturing people capable of doing so in large numbers, and empowering the institutions that host them to deliver on this count, are the two most important governance challenges in contemporary India.

Today, total expenditure in R&D in India is comparable to or larger than such expenditure in countries like Israel, Canada, Sweden, UK, Switzerland, Finland etc. [1]. Further a simple back of the envelope calculation would indicate that our spending per full time equivalent in R&D is also comparable with most of the high performing countries. Considering the large population and the size of our economy, there is clearly a strong case to significantly enlarge our investment in S&T. However, with the level of current investment, clearly, India should have been a power house for new technologies that leverage the latest in research at least on par with the countries mentioned above. Our economy, however, is still very dependent on other countries, including some of those listed here, for our technology needs. Further, there is a serious disconnect, by and large, in terms industry investment and engagement in

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S&T system in the country. Under such conditions, we end up doing what others have already done, in our laboratories as well as in our industries. While instead of to importing products, making them here, is decidedly a superior option, developing competitive technologies here and leveraging them for manufacture of products in the country, considerably adds to our competitive advantage both in terms of sustaining competitiveness in our manufacture as well as bringing out new products ahead of others.

Innovation Ecosystem

For this purpose, as mentioned earlier, we need to enhance excellence in our R&D as well as ensure its deeper engagement with industry and entrepreneurship. This requires a conducive innovation ecosystem that picks up and encourages a potentially promising idea and facilitates leading to its translation to a successful commercial product. Such an ecosystem must support high quality teaching that takes a student all the way up to the current frontiers of knowledge, supports research that pushes these knowledge frontiers forward, supports translation of that research into new and robust technology products and nurtures entrepreneurship that commercialises the newly developed products. An important characteristic of such an ecosystem is the freedom for participants to interact with potential collaborators across different domain boundaries to translate research to business in a win—win mode.

In a world bank report [2] on 'The Challenge of Establishing World Class Universities', concentration of a very high level talent pool that is a magnet to attract more talent from outside, abundant financial resources and favourable governance with a high level of flexibility to preferentially carry a good idea forward, were identified as three key characteristics for a world class university. Clearly, such institutions that nurture a high level of creativity must have the patronage that assures them of the required financial resources, and at the same time provides complete immunity from external factors except for the expectation that they must excel in their respective domains, as judged by their peer community. Since quality education, skills, research and technology development, creating a culture of innovation and entrepreneurship etc. are the areas that must be of the key concerns to the Government with widest possible access to all those who are deserving. we need state funded institutions of excellence in such creative areas and a system of governance that meets the requirements as stated above.

Autonomy encompassing all its dimensions, e.g. functional, administrative and financial is crucial to achieving an effective system of governance in institutions of high excellence that nurture creativity. The institutions must be free to decide the programmes they wish to pursue within the stated objectives of the institution with a holistic interpretation as guided by the peers within and outside. While the institutions must be free to conduct themselves within the available capital assets, promised recurring expenditure and other resources generated by the institution, there must be assurance on availability of these resources and a supportive attitude to further

augment them on the basis of justified needs. As a minimum, inflation correction would be one such need. The institution must have the freedom to administer itself including making all appointments on the basis of its needs duly driven by the institution management and broadly guided by the peer system in and around the institution. As a matter of fact, Dr. Bhabha had enunciated the principle, "find a right scientist and build the lab around him rather than the other way around". On the functional front, the institution should be guided by its peers on the basis of its charter. The peer community should represent all stakeholders consistent with the charter of the institution at the right level of eminence. Performance appraisal in the institution at various functional levels including at the level of individuals, should be done with a judicious combination of external and internal peers at sufficiently high level of excellence with a value system that covers all dimensions of expected performance.

Such autonomous institutions of high excellence and their members should be free to collaborate with others with complimentary capabilities. When one realises an eco-system encompassing the full range of capabilities necessary to translate a new idea or research finding into a new product and commercialise it in the market place, one develops the capability to make a high level contribution to the economic growth and the strength of the country.

As an example of the impact of such an excellence, it is worth recalling a study [3] compiled by PitchBook, a US—based private equity and VC research firm that ranked the top 50 universities that have produced venture capital—backed founders. The study that took into account funding data between 2009 to July 2014, and sifted through educational backgrounds of over 13,000 founders globally has revealed that the top universities have produced founders that have succeeded raising up to $3.5 billion capital in a period of five years (Please see the table below). It is heartening to see IITs figuring in the list as 4th top institution in terms of number of founders produced and the 3rd top institution in terms of capital raised by them. If such a thing can be done by IIT graduates in USA, clearly, there is a huge potential if we can leverage institutions like IITs on the Indian domestic scene. More importantly, if most of our higher technical institutions become like IITs, India becoming a global technology power house should be well within our reach. Today, however, we are far away from such a goal. Realising this potential in full is the real governance challenge before us.

Some Policy Initiatives

Over and above what can come out of knowledge institutions through their engagement with finance and business world, there are several other initiatives that the State needs to take. Let us now deal with them one by one:

1. Barring a few exceptions. we still have an issue of low industry investment in research This is a result of low industry confidence in such investments producing results. This perhaps is true not only for investments in public funded R&D, but many times also in the context of internal investments for R&D when the gestation periods are large and loss through technology diffusion is likely to be high. A supportive framework for public funding of pre–competitive research assumes importance in this context. This not only could become a good basis for industry involvement in academics and R&D, but also could significantly shorten the period for new product development at the industry level. CII sponsored Prime Minister's fellowships for Ph.D. Research is a good initiative in this regard. Such initiatives need to be scaled up overcoming the issue of finding eligible project takers in large numbers. There could be more such initiatives. Industry association funded and guided centers in specific areas, working with individual industry in a research park are some examples.
2. Another mode to seek larger private investment in R&D would be to call for competitive proposals for development of new technology products needed in large numbers from consortia of industry and academic/R&D institutions. The

requirement could be spelt out in terms expected functional performance. Partial support through public funding could be made available to a few best proposals along with a promise of minimum initial business (through public procurement) to successful product developers. Such mode is practiced in countries like US (DARPA, eARPA) and Japan. Such a modality is almost non-existent in India. Government Departments where technology plays an important role in their programme implementation should be tasked to proactively pilot such efforts.

3. Beyond the supply driven and demand driven product development, as discussed above, a large country like India also needs capability to develop and build large technology platforms such as aircraft, ships etc. Today there is some capability in key strategic areas. We need to build such capability in different sectors of economy. In the Indian context, this is best piloted in mission mode by identified agencies/SPVs, at least to begin with. For each such platform type, one would need at least one major laboratory to be the knowledge leader which can assimilate, hold custody and eventually develop the requisite technology. With progressive emphasis on 'Make in India', it is important that such laboratories wherever they exist are main streamed or created in case they do not exist. Establishing such laboratories in academic institutions has the added advantage of concurrent human resource development. A major gain with such an arrangement is the national capability to keep the technology continually rejuvenated without allowing obsolescence to set in. With encouragement to private sector in such development, it would be logical to expect private sector to also invest in such laboratories in academic and research institutions. Over a period of time, one should expect a national capability build up to build such large technology platforms on its own. A precondition for sustaining such a capability would be continuity of programme and business for the laboratories, architect/engineers and manufacturing workshops along with related HR activities so that the investments remain productive.
4. All new technology products face barriers to market entry from those whose business is likely to be threatened by the entry of the new product or technology. Depending on the larger strategic objective served by the new technology such as elimination of vulnerabilities, sustainability, environment protection, favourable balance of payment, job creation etc., there should be policy support for preferential market entry of such new technologies. In particular, wherever a product development has been supported through public funds, there should be assured market entry as long as the developed product meets the pre–specified functional requirements and the costs have the potential to become competitive at the commercial scale of production. It should be realised that translation of a newly developed product into a commercially robust product is an evolutionary process that does need to be supported till the product becomes self-sustaining in the market place.
5. Major expenditure routinely takes place in procurement of high technology items. The recent thrust on 'Make in India' is an important policy initiative to create jobs and value addition in the country. Linking knowledge activities (academics as well as research) with such asset/infrastructure build up would benefit both

the manufacturing domain by way of better assimilation of technologies and capability to build upon as well as the knowledge domain by way of better human resource development.

6. One very important aspect of governance in the context of development planning is knowledge—informed autonomous decision making in contrast to vendor driven decision making that has become very prevalent. This is of particular importance in the context of technology choices which necessarily require a more holistic decision making with a long term view in the overall national context. Mass transportation on water front as well as on ground, waste management, water—energy—agriculture and environment nexus etc. are some examples of issues that need a holistic knowledge—informed decision making. Availability of a high quality research environment well engaged with the on-ground situation is a pre-requisite for such decision making capability.

Focus on Rural Areas

Rural areas need greater attention because a large fraction (around two third) of our population still lives there, and bringing the level of livelihood in rural areas (today average per capita earning in rural areas is about half of their urban counterparts) at least on par with urban areas is important to bridge the serious divide between the two. According to socio-economic and cast census 2011 (SECC 2011), manual casual labour (51%) and cultivation (30%) constitute the main source of income in rural households. About 9.7% of rural households run on salary income. 56% households are landless. There is thus a need to infuse relevant technology that enhances income in rural areas. This would also reduce the migratory pressure on urban infrastructure, enhance food security by making agriculture remunerative enough as a result of greater value addition, access to wider markets, and stabilisation of prices, and would further add to supplementary livelihood opportunities through adoption of technologies. A sustainable model for technology enabled development in rural areas is thus necessary in my view to realise such an objective. In such a model Integrated Education, Research and Development Complexes, a knowledge domain that can attract best of researchers and teachers on one side, and remain engaged with meeting human resource and technology development needs in the rural neighbourhood on the other, would need to be developed. Such complexes (which could be called CILLAGE—a knowledge bridge between City and a village) should provide best of city amenities along with opportunities for spouses and education of children, and would become a place for world class research on technologies for value addition opportunities in rural surroundings and help promote knowledge enabled development in rural areas. A critical mass of high quality researchers in a CILLAGE complex with a number of livelihood demonstration centres in the neighbourhood duly backed up by micro—finance could nucleate sustainable development process that perhaps could replicate itself and spread.

Integrated Area Development

Planning for national development has to comprise a combination of top–down and bottom–up processes. Large projects that can benefit large areas such as communication and transportation infrastructure, large hydro and power projects, large industries etc. that require large outlays are better done as a part of centralised effort implemented in a top–down mode. On the other hand, there is a strong merit to a decentralised approach to planning and development since the resources can be put to best possible use taking into account the local needs. With knowledge becoming an integral part of the local development process as described above, the bottom—up planning and development can in fact become more effective and efficient. One would need to decide on an appropriate unit for integrated local area planning and development. Doing this at the block level may be most optimum.

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