Towards strong and meaningful university – industry collaboration and creation of sustainable competitive advantage in manufacturing – Missing links and way forward

1. **Introduction:** The goal of the science, technology and innovation policy brought out in 2013 by the Ministry of Science and Technology, Government of India is to create a strong and viable **S**cience, **R**esearch and **I**nnovation **S**ystem for **H**igh technology-led path for **I**ndia (SRISHTI).

2. **Key policy initiatives in STI policy, 2013**

   2.1. Linking contributions of science, research and innovation system with the inclusive economic growth agenda and combining priorities of excellence and relevance.

   2.2. Seeding S&T-based high-risk innovations through new mechanisms.

   2.3. Special and innovative mechanisms for fostering academia-research-industry partnerships will be devised. Mobility of experts from academia to industry and vice-versa will be facilitated. Success stories in S&T-based innovations from Indian experience would be replicated and scaled up. Regulatory and legal framework for sharing of IPRs between inventors and investors will be put in place. Measures to close gaps in the translation of new R&D findings and grass root innovations into the commercial space will be taken.

   2.4. Fostering resource-optimized, cost-effective innovations across size and technology domains.

   2.5. Creating a robust national innovation system.

   2.6. Supply side interventions have hitherto been the main strategy for public investment in R&D. This needs to change. There should be equal emphasis on both supply side interventions and demand based investments.

2.7. Around 10 sectors of high impact potential will be identified for directed STI intervention and deployment of requisite resources. Enabling policy instruments that facilitate both institutional research and R&D enterprises to focus their efforts in these areas will be put in place.

2.8. The complex value chain of innovation – from idea to market - often calls for STI intervention at all levels: research, technology inputs, manufacturing and services. In the priority areas of socio-economic importance, the policy will enable a holistic approach to intervention, support and investment. Measures taken in this direction will be in consonance with the programmes initiated by the NlnC.

2.9. STI inputs to the manufacturing sector can lead to enhanced employment generation. The innovation ecosystem for the sector, however, depends on the nature and size of the enterprise and the context. India's share of global trade in high technology products is at present only around 8% and the present technology intensity of the sector is a low of 6-7%. The aim is to double these through greater technology inputs from R&D. A strategic selection of some industry sectors, where India can aspire for leadership, would be made for stepping up R&D intensity and increase India's share in high-technology trade.

2.10. Small and Medium Enterprises (SME) generally have low R&D intensity. Special schemes to support R&D as well as related services at the firm or collective level, will be devised and put in place. The R&D intensity of the service sector is generally low. This needs to be enhanced considerably and the skill base also expanded significantly. For rapidly accomplishing the tasks of modernization of technology-based services, missions in some select service sector areas, will be identified. Deployment of technology-led services for transparent Government machinery will also be supported.

2.11. A National Science, Technology and Innovation Foundation will be established as a Public Private Partnership (PPP) initiative for investing critical levels of resources in innovative and ambitious projects. The focus of the policy, inter alia, will be:

2.11.1. Facilitating private sector investment in R&D centres in India and overseas.

2.11.2. Modifying IPR policy to provide for marching rights for social good when supported by public funds and for co-sharing IPRs generated under PPP.

2.11.3. Launching newer mechanisms for nurturing Technology Business Incubators (TBls) and science-led entrepreneurship.

2.11.4. Providing incentives for commercialization of innovations with focus on green manufacturing.

3. Missing links

3.1. The ability of a country to sustain its economic growth, increase the standard of living of its citizens, and improve human health depends directly upon successful development and access to new products, processes, and services. The country, therefore, needs to address issues that block technology transfer, such as the lack of applicability of research at the industrial level, absence of an active technology transfer mechanism to industry (lab to market), lack of funds for taking forward primary inventions to a transferable level, and institutional attitudes that limit research to just publishing in journals.

3.2. It will be difficult for India to implement the policy objectives laid down in STI Policy, 2013 in the absence of sound and progressive structural and institutional mechanisms for encouraging research relevant to industry, particularly in manufacturing, and the subsequent licensing/ transfer of knowledge and technology from universities to industry.

3.3. In the absence of institutional mechanisms, intellectual properties generated through public funded research could tend to focus on scientific publications in journals and may not be relevant to industry. Few researchers take interest in projects relevant to industry. Their technological watch is limited to scientific conferences in their respective fields and publication of their work in scientific journals.

3.4. While Entrepreneurship Development and Incubation Centres such as the one in IIT, Delhi (FITT- Foundation for Innovation and Technology Transfer) and the one in the National Institute of Technology in Tiruchirapalli (CEDI – Centre for Entrepreneurship Development and Incubation) besides others are promoting innovation and entrepreneurship by converting and translating technology ideas in various disciplines of science and engineering into products, processes and services for commercial exploitation and the benefit of society, the country lacks an enabling policy framework to create an ecosystem of creation and transfer of knowledge from the lab to the market.

3.5. The Global Innovation and Technology Alliance (GITA), incorporated as a PPP company, is working in a different area. It manages GoIs funds towards providing funding support to Indian industry for strengthening private sector R&D. Such initiatives require to be strengthened for enabling private sector to carry out commercial R&D.

3.6. India does not have the advantage of a law such as the one passed in Japan in 1998 promoting the establishment of technology licensing/ transfer organisations (TLOs) with authority to license some university inventions and to channel royalties back to the inventors, their laboratories and their universities. The TLOs in Japan are approved and subsidised by the Government and serve as an effective interface between university and industry for licensing/ transfer of technology.

3.7. India also does not have a mechanism by which R&D relevant to industry can be incentivised through structures which can stimulate significant growth in university–industry technology transfer and research collaboration.

3.8. India does not have a mechanism by which promotion of incremental innovation can be stimulated, particularly in the SME sector. While the IP facilitation centres in India are striving to build a greater awareness among SMEs about IPR issues and provide insights to them on the creation, ownership and protection of intellectual property, India lags behind in IP applications, globally[1]. In 2010, while 490,226 patent applications were filed in the USA; 391,177 in China; 344,598 in Japan; 170,101 in Korea; 150,961 in European Patent Office and 59,254 in Germany, only 39,400 applications were filed in India along with 7,589 design applications. The office of the Controller-General of Patents, Design and Trademarks had received 43,000 patent applications[2] from business houses and institutions across different sectors in 2012-13. A

[1] Business Standard, August 5, 2013
[2] The Hindu – Business Line, July 26, 2013

5-10 per cent increase in the number is expected in 2013-14. However, the share of applications from Indian companies and institutions, which stood at 18-20 per cent over the last few years, rose marginally to 22 per cent in 2012-13. It is felt that given the inventions being carried out in India, the number of patent applications should have been much higher. This can possibly be attributed to the lack of awareness and absence of a proper intellectual property ecosystem in the country.

3.9. India does not have a mechanism by which access of industry to environment friendly patents from across the world can be facilitated.

3.10. Global investments in science, technology and innovation are estimated at $1.2 trillion as of 2009. India's R&D investment is less than 2.5% of this and is currently under 1% of the GDP. Increasing Gross Expenditure in Research and Development (GERD) to 2% of the GDP has been a national goal for some time.[3]

3.11. Time to market for the R&D outputs emanating from public funded R&D in India needs to be minimized and extent of commercialization of Intellectual Properties generated through public funded R&D needs to be increased significantly.

4. Way forward – Suggestions and recommendations

4.1. India needs to create an enabling policy framework for a strong and meaningful university – industry collaboration and creation of sustainable competitive advantage in manufacturing through a seven pronged approach:

4.1.1. **Targeted investments by Government in R&D projects of national importance over a reasonable horizon, say 5 years:** The GoI needs to fund technology projects that translate scientific

[3] Science, Technology and Innovation Policy, 2013

discoveries and cutting-edge inventions into technological innovations, and accelerate technological advances in high-risk areas that industry is not likely to pursue independently. It need not fund minimal improvements to existing technologies as such technology can be supported through existing programs. Instead it should look at funding technologies and R&D that are likely to leapfrog India to the next generation of products, processes and services. The projects and programs to be taken up for such Government funded research should be created through a process of rigorous debate surrounding the technical/scientific merits and challenges of potential research areas and must satisfy both concepts of “technology push”—the technical merit of innovative platform technologies that can be applied to priority areas of national importance—and “market pull”—the potential market impact and cost-effectiveness of the technology. India needs to identify key strategic areas of importance to the country which need the attention of publicly funded R&D institutions and for which funds have been earmarked over a reasonable horizon, say 5 years, to achieve broadly defined targets. The areas could cover (i) Textiles and Garments (ii) Agriculture, agro processing and food processing (iii) automobiles and auto components (iv) Pharmaceuticals (v) Chemicals and Petrochemicals (vi) Electrical and Hybrid Transport (vii) Aerospace and avionics (viii) Advanced materials Nano Technology (ix) Green energy and Environment (x) Information and Telecommunications (xi) Electronic System Hardware and Manufacturing and Optoelectronics (xii) Medical Devices and Biomedical Technologies etc. The STI policy of 2013 talks about 10 sectors of high impact potential. India should focus on technologies that can transform manufacturing, business, quality of lives of its people and India's economy in the years to come. After the basic government funded R&D, the ideas can be taken forward through the value chain leading to technology licensing/ transfer for commercial use.

4.1.2. **Enactment of the Indian version of a law such as the one passed in Japan in 1998 for promoting the establishment of technology licensing/ transfer organisations (TLOs) with authority to license some university inventions and to channel royalties back to the inventors, their laboratories and their universities:** These TLO like entities will be approved and subsidised by the Government and can serve as an effective interface between university and industry for licensing/ transfer of technology. These entities will carry out legal activities such as patent documentation, prosecution of patents, contract documentation, negotiation besides marketing and sales. In 1998, Japan's Technology Transfer Promotion Law was enacted and TLOs were established. Japan had 51 TLOs by 2009[4]. These entities will also play an important role in supporting start-ups from Universities. After the enactment of the Technology Transfer Promotion Law in Japan in 1998, invention disclosures and patent applications from Universities in Japan have increased dramatically [From less than 2000 in 1998 to about 7500 in 2008.]. The managers of TLO like entities could also benefit from participation in the annual meetings of the

[4] Technology Licensing from University to Industry by Toshiya Watanabe, Professor, Research Center for Advanced Science and Technology (RCAST), University of Tokyo

"Association of University Technology Managers" (AUTM) which is the platform for academic research institutions, industry, technology transfer professionals and entrepreneurs to meet and discuss the latest issues related to commercialisation of technologies.

4.1.3. **Enabling stronger University-Industry collaboration through joint research and contract research in select universities**: In joint research, industry can finance the research and send co-researchers to a University. Researchers from both universities and industrial firms can work together and depending on the contract, a joint research could be conducted at universities as well as industrial firms. The patents from the joint research result would then be usually co-filed by both entities. In contract research, universities could receive projects from industry and carry out research. The result of research would belong to universities but would have to be reported to industry who may be given the priority to get the license of research results.

4.1.4. **Enactment of the Indian version of the Bayh Dole Act (passed in US in December, 1980) with a distinct Indian footprint which addresses the country's concerns**: In the US, this Act allows patenting and licensing by US universities of inventions based on federally funded research. A similar Act in India with an Indian footprint can incentivise research relevant to industry in certain selected institutions. It will be important for the government to specify clear guidelines on issues and conditions in which the government should retain rights, what is expected of ownership by Universities and private ownership and the situation in which the government may intervene to correct licensing and monopoly practices. It may be mentioned that a proposed bill entitled "Protection and Utilisation of Public Funded Intellectual Property (IP) Bill, 2008" was introduced by the Department of Science and Technology in January, 2009 in the Rajya Sabha and was referred to the Parliamentary Standing Committee on Science, Technology, Environment and Forests. The proposed bill attracted criticism at that time on the grounds that it failed to address the actual issues such as lack of focused research, the absence of effective technology transfer programmes, the bureaucracy involved in taking inventions forward, safeguarding public interest and lack of safeguards to ensure that exclusive licensing of publicly funded technologies does not create a market monopoly for private players. Before the enactment of the Bayh- Dole Act, American universities could and did patent. Indeed, several of the most lucrative patents in the post- Bayh-Dole era were filed before the Bayh- Dole came into force in 1981. But there was variation in rules and procedures for doing so across the numerous government agencies funding university research. The Bayh-Dole legislation created a standard set of rules for funding[5]. It also provided government endorsement for more active university involvement in patenting and licensing. Many American universities had previously avoided these activities, reflecting concerns that they might compromise their missions to advance and widely diffuse science and technology. The legislation for a Bayh Dole type of Act was passed in Japan in

[5] The Bayh-Dole Model in Developing Countries: Reflections on the Indian Bill on Publicly Funded Intellectual Property - UNCTAD - ICTSD Project on IPRs and Sustainable Development by Shri Bhaven N. Sampat, October, 2009

1999 by the name of "Industry Revival Law". This law makes it possible for IPRs of National Universities, which used to be seen as national property and not allowed to be transferred, to become transferable. This law has greatly prompted university's IPR licensing activities[6]. There is a general view that university patenting and licensing have increased dramatically since 1981, in USA as has licensing income from university research. These data provide a main impetus for initiatives to emulate Bayh-Dole in developing countries. The positive and negative impacts of a Bayh Dole type of legislation need to be looked at in the light of requirements in India along with guidelines about when it is appropriate to take out IP, and when outputs of public research should instead be placed in the public domain. A fresh attempt needs to be made with an eye on stronger University – Industry collaboration and a Bayh Dole type of legislation with a distinct Indian footprint.

4.1.5. **Introduction of utility model for promotion of incremental innovation, particularly in the SME sector**: If the patentability criteria as laid down in the Indian Patents Act as amended in 1999, 2002 and 2005 are applied to incremental innovations such as the onion seed transplanter, clay refrigerator, electric/telephone pole climber, ribbed pan (tawa), gas stove switch, none of them would be eligible for grant of a patent under present Indian law[7]. However, in a resource constrained economy like ours, it could be argued that these minor technical

[6] Technology Licensing from University to Industry by Toshiya Watanabe, Professor, Research Center for Advanced Science and Technology (RCAST), University of Tokyo

[7] Discussion paper by DIPP on utility models at: http://dipp.nic.in/english/Discuss_paper/Utility_Models_13May2011.pdf

inventions which frugally use local resources in a sustainable manner need to be encouraged by providing a legal framework for their protection and commercial exploitation. Such useful, low cost and relatively simple innovations which create new mechanical devices or contribute to the optimal functioning of existing ones may have commercial value only for a limited time period, before they are replaced by other products or rendered redundant by change of technology. Given that such products will primarily be driven by the Small and Medium Enterprises (SME) sector, protection would be useful and relevant only if it were provided through a legal framework which is simultaneously quick, cheap, simple and does not require a high degree of inventive thresholds. All these requirements can be met through a suitably designed utility model framework for India. It may be mentioned that Japan, Korea and China have their own versions of utility models with different characteristics related to the twin dimensions of costs and intensity of examination that the innovation is subjected to.

4.1.6. **Human resource development for strengthening the innovation eco-system:** This will be required across the entire value chain from idea to the market – in R&D, licensing/ technology transfer, management of patents and commercialisation of technology.

4.1.7. **Facilitating access of industry to environment friendly patents and other technology patents, particularly in manufacturing:** For example, WIPO Green.

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