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India has a wide gap in research and innovations with its BRICS partners, as well as with the major economics of the world. Therefore, inspite of being home to 16% of the world Population, India has only 2.1% share in the world manufacturing vis a vis a 22% share of china, which has even pushed the U.S. at number two with a 17.2% share. China has scaled up very rapidly since 1991, when it was also having just 2.4% share in world manufacturing[1]. Today, the Chinese universities as well, are ranking at top in the intellectual property creation, through innovative researches and ever growing number of frequently cited international publications. Education can remedy this poor state of research and innovations in India, as education is key to development, which largely shapes the economy, technology, civilization and culture of a nation. The potential of higher education, in this regard, needs to be harnessed through university-industry collaborations in India, to foster job creating industrial and commercial activities. India has a huge enrolment of 3.3 crores students in higher education[2], almost equal to the total population of Canada[3]. Yet, India lags far behind in creating intellectual property, for want of requisite research and innovations into various knowledge based and intellectual property-centric subject areas.

Poor State of Research in India

India lacks in quality research and productive intellectual property generation. According to the data released by the World Intellectual Property Organization (WIPO)[4], India has seen a drop in international patent applications to 1,423 under the Patent Cooperation Treaty in 2015, while US has 57,385, Japan (44,235), China (29,846) and Korea (14,626) figured in the top-10 list, registering a rise of 20%, 14% and 7%, respectively, from last year. India fared no better in terms of global trademark filings as well, under the Madrid System. It ranked 36th with only 150 trademarks filed in 2015, down from 153 in 2014, when it had seen a more than 70% increase in trademark registrations. It shows a very miserable scene on the front of new product and brand launches. Against a paltry figure of 150 filings, the trademark filings of the US (7,340), Germany (6,831), France (4,021), China (2,401), Japan (2,205) are 14 to 48 times. Data from the aforesaid WIPO report reveal that even the IITs, though endeavoring to move ahead on research in nanotechnology over other Indian Universities with over 5,000 scientific papers and 14 patents since 1970, are miles behind China, as the Chinese Academy of Sciences tops with 29,591 publications and 705 patent filings in nanotechnology. The country has a long distance to go in promoting innovation and research. The figure on comparing with China is embarrassingly low for the elite institutes, constituting an icon at home.

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University Industry Collaboration: The Way-Out

However, collaborative research with a consortium approach, inter se the academia, industry and government can prove to be a big game changer for breakthrough research and innovations[5] in the country. A well facilitating eco-system for collaborative researches and innovations across a wide range of knowledge-based and intellectual property centric subject areas has to be cultivated to kick start development of job creating commercial products and services for absorbing the 1.2 crore youth attaining the age of employment every year (one million per month) in the country. Collaborative consortia, tripartite as well as bipartite, throughout the innovations' value chain and transforming such innovations and researches into job creating products and services may be fostered via 4 discrete forms of university-industry collabration modes.

(i) Industry consortiums i.e. Udhyog Sahayata Sangh: Such full fledged consortia may be tripartite comprising industry, relevant university department(s) and the government, or bipartite- comprising university and industry. Industry clusters in different part of country and the university (ies) can form that industry specific consortium.

(ii) Technology Development Cooperative Associations: Such association of the firms of any industry and university (ies) may come together for pursuing target oriented researches for current or future needs.

(iii) Technology Development Cooperative Agreements: A memorandum of understanding or a legal contract may be signed for shared researches with well defined targets.

(iv) University-Industry-Government-Round Table: Such Round tables can prove collaborative research.

(v) University-Industry Round Table: Frequent knowledge sharing round tables or for identifying the mutual expertise, can be organized between industry and university (ies).

The aforesaid modes of university-industry collaborations can go a long way even to invoke techno nationalistic interventions, for homegrown innovative technologies. In US, Europe, Japan, South Korea, Taiwan etc hundreds of industry consortia are active in pre-competitive research, technology development, market research, product development and brand promotions. In US, there are more than 1200 consortia for industries ranging from Photonic, Automobile, Technology, IT, Pharma, Energy, Agrochemicals, Biotechnology and so on. China has single mindedly pursued this path of techno nationalism and has moved towards techno globalism.

The Paradoxes to Take Care

our share in world shipbuilding is mere 0.1 percent. South Korea which accounts for less than 5 percent of geographical area and population of India, and having far less than 70 percent of our GDP, today accounts for 40% of world-shipbuilding. Needless to say India is the 3rd largest steel producer with a large pool of skilled manpower and 7100 Km coast line can easily capture at least 10% of world shipbuilding if proper

policy, design, R&D and fiscal support is extended by the government. Overall, the South Korea has been spending 4 % of its GDP on R&D while India spends less than 1 percent of its GDP on R&D, inspite of our repeated assertions to raise our R&D outlay to 2% of our GDP in the science and technology declarations being made since 2003.[6] Indeed this constraint can partly be overcome by promoting university-industry collaborations. Our pursuits in promoting quality education in pharmacology and IT have placed in a position to lead in the world. To the contrary, A single policy support to pharma sector extended in 1970 by replacing the provision of product patents with process patents in the Indian Patents Act of 1970 and quality education, India could acquire record 10% share in the world Pharma-Manufacturing by volume. Besides, we have ushered in a new era in the area of pharma education and Research & Development just by virtue of this policy support. Though it is also now bound to erode with our reverting back to product patents since 2005 and our gradual succumbing to Euro-American pressure in the field of IPR.

Collaboration between academia and industry is an increasingly critical component[7] for facilitating efficient national innovation systems. It is useful to examine the experience of developed countries to better understand the different types of university-industry collaboration, motivations and barriers to such cooperation, as well as the role of public policy in fostering such linkages. Developing countries and especially India faces even greater barriers to such alliances, calling for a bold initiative to promote university-industry collaborations. Such collaborations between universities and industries are critical for several purposes viz (i) for capacity building and skills development via joint teaching and training, (ii) for the generation of new and fresh knowledge and foster innovations through technology sharing, and (iii) for the promotion of entrepreneurship through incubation for start-ups and spin-offs, and also through R&D Partnerships.[8]

Miscellaneous Modes

Besides the consortium approach some other modes to promote university-industry collaboration and cooperation can also be evolved. Such modes may be like: (i) R&D incentives and grants (ii) Performance-based funding of universities and reward systems for researchers (iii) Intellectual property rights regime and technology transfer offices (iv) Science parks, spin-offs, and business incubators (v) Shared Education and training programmes [9]

Experiences from across the globe suggest that businesses can structure their relationships with universities in ways that make them much more valuable[10]. The idea of "gap between research done in academia and its translation into marketable products, is not new[11]. But, successful partnerships are growing. Both academic institutions and companies are making rapid strides to bridge the gap[12]. The focus of all such collaborative research endeavors has to be to invoke techno-nationalistic interventions to take a leap ahead in employment generating industry and commerce.

Need to Involve Techno-Nationalism as a pathway to Techno Globalism

To develop and promote homegrown technologies necessary to promote employment creating industries, products and brands. India has to pursue the course of techno-nationalism, with an ultimate aim of techno-globalism.[13] China has single mindedly pursued this path of techno-nationalism and several other countries like Taiwan, South Korea, Japan and even U.S. too has this inclination.[14] The Chinese have got rich dividends out of their strong quest and initiatives aimed at pursuing techno-nationalistic approach.[15] The Chinese ideal of developing home-grown technologies, promulgating regulatory norms in favour of such home-grown technologies, development of substitutes for foreign technology with certain modifications and supporting such modified substitutes through stringent technological standards for excluding foreign competition is being perceived as Techno Nationalism. China has also succeeded in developing world class technologies ahead of others by initial adherence to even inferior domestic and home-grown technologies through prescribing own nationalistic technical standards. This pathway of taking technological lead in the world by promulgating technical standards in favour of home-grown technologies is called Techno-Globalism. Some examples of moving from Techno Nationalism to Techno Globalism are being given hereunder:

(i) TD-SCDMA to TD-LTE: At the time of launch of third generation telecom technologies China has developed its own 3-G telecom technology, the TD-SCDMA. It was relatively inferior and imperfect vis-à-vis Western 3-G technology.[16] But, China laid its technical standards in favour of TD-SCDMAin spite of its being inferior and tortuous technology. By adopting this Techno-Nationalism China could generate enough resources TD-LTE technology, the most advanced technology, ahead of Euro-American Companies. Today, 45% 4G networks has been using TD-LTE technology or 4G telecommunications. Reliance and QUALCOMM operating in India have also adopted these technologies.

(ii) EVD in place of DVD: DVDs and DVDs players are popular across the world. But, China developed a variant of DVD and DVD players to stop the outflow of 4.5$ as royalty for DVD player. This variant was EVD(Enhanced Versatile Disk) and EVD players and promulgating technical standards to favour EVD and EVD players in China.[17]

(iii) WAPI in Place of Centrino of Intel:[18] All the wireless telecommunication products across the world are based on Centrino structure of Intel. China developed and alternative encryption language WAPI (WLAN Authentication and Privacy Infrastructure). Then in 2004 China promulgated its technical standard in favour of WAPI and announced that the wireless telecom product to be sold in China must be WAPI encrypted. This technical standard was going to prohibit the entry of Euro American Companies into China. Either the Euro American Companies had to encrypt their products in WAPI by paying royalty to China or they had to forgo the lucrative Chinese market. After high level negotiations with the offer of several other benefits to China and on the intervention of the then American President China agreed for not making WAPI encryption mandatory. According to some of the observers China has reluctant because

WAPI is still not WIFI friendly. China has been working to make WAPI, WIFI friendly. The day they would succeed they would make all telecom products WAPI encrypted mandatory. India is also considered as the software capital of the world. So, If India too tries, it can also make such breakthroughs.

(iv) Red Flag Linux:- China has been endeavoring to promote its home grown alternative for the Microsoft operating system windows, the Red Flag Linux.[19]

(v) COS in place of WINDOWS:- To further save the royalty going out for the Microsoft operating system WINDOWS, China has developed, the Chinese Operating System (COS).[20] The COS has many enhanced security features then the windows. China has launched this new operating system on October 27, 2014 and has announced that every year windows would be replaced by COS on 15% of the computers installed in the public sector and government departments. India has a larger battery of software engineers than China, but has not yet endeavored replace WINDOWS to prevent outflow of billions of rupees in foreign exchange as royalty for foreign operating systems like Windows, Android etc. . China now aims to say goodbye to Windows and Android by adopting the COS and by further improving it to completely replace windows and android by COS.

Cost of Ignoring Homegrown Capability by India vis a vis Chinese Technonationalism:

The lapses of India had severe in ignoring the homegrown capacities, against foreign technologies, which have led to loss of several opportunities of growth and indigenous technology developments. It has happened in telecom, power, shipbuilding etc.; wherein doling out the bounties of supply-orders to foreign player has deprived the domestic sectors in several fields. For instance, India had made a praiseworthy breakthrough corDECT technology for 2G[21]. But, undue haste was shown by the government to adopt GSM technology, instead of the home grown CorDECT technology. To the contrary China, thereafter without much to its credit in telecom technology over-stretched to overtake the Euro-American companies in developing the 3rd generation telecom technology (3G) but it could develop only a very primitive and tortuous technology, the TD-SCDMA (a modified version of 2G SCDMA technology). Notwithstanding this it kept pursuing a techno-nationalistic course and permitted to roll out only indigenously developed 3G network in China, pursuing further research to improve upon it inspite of the fact that this Chinese indigenous technology was far inferior to the Euro-American 3G technology. But, China did not adopt Euro-American technology. So, out of the resources generated from rolling out their indigenous 3G technology alone, China succeeded to develop very superior 4th generation telecom (4G) technology ahead of, and also better than the EuroAmerican companies. They (Chinese) developed the TD-LTE as 4G telecom technology from the same tortuous, but indigenous TD-SCDMA technology[22]. Now, according to various estimates, the Chinese TD-LTE has been adopted by 45% of world's 4G networks, including Reliance, Qualcomm etc. in India, inspite of having the first generation technology in early 90s, much superior to that of Chinese has got badly crippled and become fully dependent upon external supplies for 2G, 3G and 4G telecom technologies and largely upon China, a security threat of first order for the

country, solely because of patronizing foreign firms in 1990s. Now, China has been working on 5th generation telecom technology from the revenues generated from the indigenously developed 3G and 4G technologies, while we missed the train from the time of 2G till date inspite of having developed a unique proto-type for 2G, the corDECT. China could take this escalator in developing the indigenous telecom technology and pursue techno-globalism solely by the techno-nationalistic approach.

India can take a quantum leap with techno-nationalist focus in research and innovations, and the first step would be to identify the focus areas for the collaborative researches or coordinated studies, based upon the capabilities in the universities and the industry and the nation. The first step to move ahead in this direction would be needs to break the ice through university-industry round tables to be organized at the location of each of the 400 industry clusters in the country for brainstorming and identifying areas of strength and cooperation. Such round tables would help to pin-point the areas of common interest, relative strengths and scope to collaborate. Industry specific 'University-Industry' consortia or technology development cooperative associations and agreements would automatically follow. The Association of Indian Universities (AIU) being the sole umbrella organization of the academian can take initiative and move ahead in this direction to coordinate with the multiple industry bodies like FICCI, ASSOCHAM, CII, PHDCCI, Laghu Udhyog Bharti and also to rope in the Union and state governments.

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