Science Technology and Innovation Policy 2020 Can Transform India

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The current exercise in framing a new Science, Technology, and Innovation Policy for India 2020 led by the Principal Scientific Adviser to the Government of India is unprecedented in scope and scale. Consultations have included a wide range of stakeholders across the entire spectrum of India's STI ecosystem, and have gone in-depth into all the key issues. The aim is ambitious, to frame a policy that will be a springboard for India's science and technology leap into the future. This article deals with some of the macro aspects of India's STI ecosystem and the STIP.

Compared to the four such exercises have been conducted since independence - Scientific Policy Resolution 1958 (SPR1958), Technology Policy Statement 1983 (TPS1983), Science and Technology Policy 2003 (STP2003), and Science Technology and Innovation Policy 2013 (STIP2013), the STIP2020 process is much wider and deeper. It comes amidst several challenges facing India – slowing economic growth, development challenges as embodied in the sustainable development goals (SDGs), weak manufacturing sector resulting in high trade deficits, rising population needing to be skilled, the recent Covid-19 pandemic induced economic losses, and the geostrategic threats from China, the world's second-largest economic power and R&D spender after the USA.

India is already the world's fifth-largest economy with a nominal gross domestic product (GDP) of about $ 3.2 trillion. In purchasing power parity (PPP) terms, India is the third-largest economy with a GDP (PPP) of $ 8.1 billion. India has ambitious plans to further grow and diversify its economy and international economic engagement through trade and investment, in order to achieve the best possible quality of life for its population. To do this India must transform its STI ecosystem to deliver the necessary R&D products to the economy and make India's economy competitive and strong. In the strategic sphere, S&T is even more critical in developing capabilities in defence systems and meeting external threats. The STIP2020 exercise should, therefore, be bold, forward-looking and ambitious, leading to a strong and resilient future India.

A country's STI capability depends on its STI ecosystem. Human resources in the form of STEM researchers are a necessary but not sufficient requirement. Other essential components are - R&D institutions, funding for R&D, and translation of R&D into economic or strategic activities. Higher education as well as R&D institutions are involved in training researchers. Hence, the national education policy (NEP) 2020 is extremely important for the new STIP2020 and both should reinforce each other. In particular, the NEP 2020 should revitalise STEM education from age 8 upwards, in schools. Children have a natural sense of curiosity, and by igniting their interest in STEM and a spirit of questioning and inquiry, we can unleash a whole generation of knowledge seekers, who can fuel India's R&D.

If the STI ecosystem has deficits, then the skilled STEM researchers will move to a better ecosystem in another country, leading to external brain drain, or to non-STEM professions (internal brain drain). Therefore, the development of India's STI ecosystem as a whole is necessary. The translation of R&D activity into economic activities depends on the national economic ecosystem, especially the environment for creating IPRs, new businesses including funding for startups and scaleups, and market and regulatory conditions. Conversely, if India can create a world-class STI ecosystem, it will be an attractive place for researchers from other countries to migrate to, including the Indian diaspora STEM professionals. Countries such as the US have benefited from the attraction of their STI ecosystem, and others such as Canada, EU, and China are trying to do so. Our STI ecosystem must be able to compete in the future with the best in the world if we are to retain our best talent.

However, in terms of key macro STI indicators, India has considerable space to cover. The Gross domestic expenditure on R&D (GERD) is only 0.71%, well below the UNESCO benchmark of 2%, and far less than the 2 to 3.5% of countries such as Japan, Germany and the Republic of Korea. The number of researchers per million population is also quite low, about 255 in 2017 improving from 110 in 2000. However, this is far below than countries like Israel (8,342), Denmark (7,899), Sweden (7,597), Republic of Korea (7,498) and Finland (6,722) during 2017. Fig 1 gives a good overall picture of where India stands. India must seek to move into the place occupied at present by Japan and the Republic of Korea, and set a target of 3-3.5% GERD of GDP

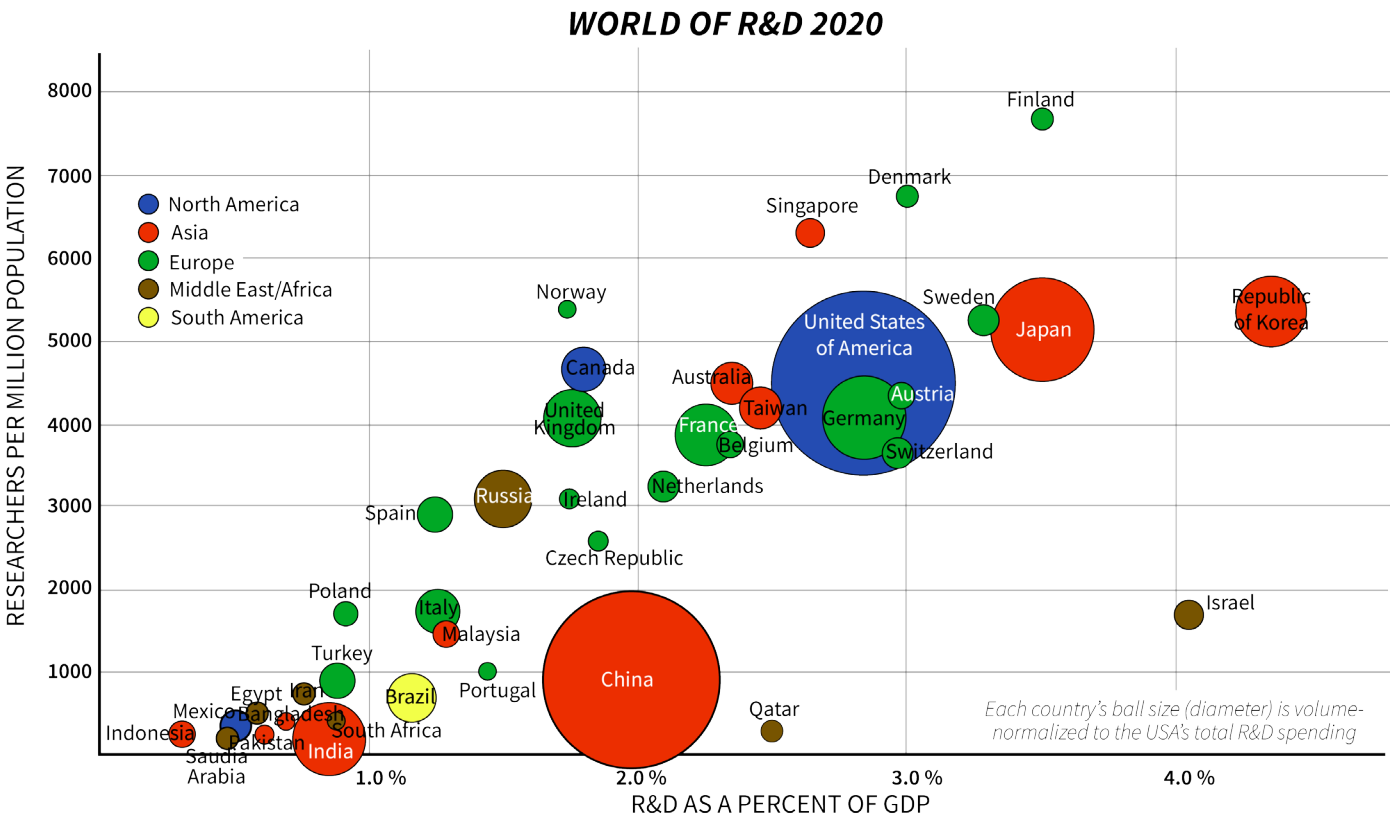

Figure 1. GERD as per cent of GDP and Researchers per million

and at least 4000 researchers per million. Both these targets must be achieved simultaneously, as a capacity to absorb R&D funding depends on the numbers of researchers.

Another important indicator is the share of the private sector in R&D. R&D spending is dominated by the Government sector - Central Government 45.4%, State Governments 6.4%, Higher Education 6.8% and Public Sector Industry 4.6% with Private Sector Industry contributing 36.8% during 2017. In a developed

STI ecosystem, the share of R&D of the Higher Education sector and the private sector should be higher. In many developed and emerging economies, the participation of Business Enterprises in GERD is generally more than 50% and more than 70% for China, Japan, Korea and the USA.

As outlined above, brainpower is an essential component for STI. The Higher Education sector has a critical role as the young brainpower for R&D is generated there. Both in quality and quantity, the expansion in the number of researchers and R&D spending depends on transforming our Universities into robust R&D institutions. NEP 2020 presents an opportunity for upgrading the quality of STEM education at high school and university levels. The close interaction of Universities and Industry is necessary to drive R&D along paths that lead to fruitful commercialisation. The CSIR lab network was an attempt to push R&D along areas that could be useful for the Indian economy, but this approach needs to permeate the University system which has an excessive preoccupation with teaching. Mobility of researchers, faculty and students across Indian and foreign universities can help improve research quality. Europe has made such reforms in its universities (Bologna Process) and has embarked on new ideas such as the European Research Areas (ERAs) which are worth adapting to Indian conditions. The recent clarification that CSR funds can be used for R&D is a welcome development. NEP 2020 has also endorsed the idea of a National Research Foundation (NRF) as a key funding vehicle for R&D. The NRF can play a vital role in stimulating R&D providing it moves aggressively to mobilise funding from all sources and adopts simple and clear priorities, guidelines and processes for approving funding for R&D activities, and equal treatment solely on merit for R&D proposals from public and private bodies. It should avoid the trap of excessive bureaucracy and caution, and be bold, as many R&D projects are a leap onto the dark and success cannot be guaranteed in advance.

The detailed contours of the STIP2020 are emerging as the very dynamic and inclusive consultation process is still ongoing. At some stage, consultation should include the policymakers from various political parties, and legislators who would be called upon not only to support the policy but also the various subsequent steps to implement it. Getting them on board would be an important step. STIP2020 implementation cannot proceed in isolation. It requires transformations as envisaged in the NEP 2020, as well as reforms to free up India's business environment and make it comparable with the best.