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REVIEW ARTICLE

Scientific Development in India after Independence and Its Impact on Society: A Critique on Technological Development for the Public of India

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Abstract

India is a developing country with second largest population. Never the less, for a developing country, like India, scientific and technological development is a necessity. Even though India was a pioneer in the field of science and technology 1500 years ago, it had lost its glory by the time of independence. The first prime minister of India, Pt. Jawaharlal Nehru had aimed for a technologically developed India. There was an appreciable increase in growth rate of scientific development but it is still not up to the mark. We will look into the scientific developments in India after 1947 along with associated concerns. Associated concerns would include brain drain, trade off between research and public science, frivolous research and corruption. We shall discuss about the impact on the world due to technological development in India. Modern scientific culture would put some light on supported and collaborated researches, start-ups, intellectual property acquisition and research exchanges. We shall analyse these developments on the basis of its impact on society. For instance, India is the highest producer of low grade workforce for the world. But, we would see, how prevalent employment crisis in the country can be addressed by improvising the quality of workforce. Finally, we shall also discuss how development of side stream sciences like art, craft, agriculture institutes, etc. can help the society in overall development of the country.

Introduction

India is a country of 1.35 billion people, which comprise 17.74% of world population in 2018. As a result, any impact on the country's economy affects the globe significantly. Scientific and technological development is arguably one of the major influencer of world economy, hence, it is an important matter of concern for India.

Never the less, for a developing country like India, Brazil, etc. scientific and technological development is a necessity. India was a pioneer in the field of science and technology in 1500 years old world. But foreign invasion and repeated loots left the least for the country. It got independence in 1947 to become a republic nation, after which there was an appreciable increase in growth rate of scientific development. Even if the current growth rate is remarkable, it is still not up to the mark. We will look into both the sides of this concern through this article.

Achievements in Science after Independence

Pt. Jawaharlal Nehru, the first Prime Minister of India, was the first person to initiate schemes to promote science and technology in India. For Nehru, scientific temper is something to be inculcated in society at large. He had said, "Science was not merely an individual's search for truth; It was something infinitely more than that if it worked for the community".

He also aimed "to convert India's economy into that of a modern state and to fit her into the nuclear age and do it quickly". The Indian Institute of Technology's were conceived in 1950s to promote research and technical education. These institutes were setup with assistance from German, US and Soviet government. These institutes have world class research facilities to compete with technological advancements across the globe.

The hostile situation at China and Pakistan border led to the demand for military preparedness. With cooperation from Soviet Union, Defence Research and Development Organisation (DRDO) was setup in 1958 for advanced military technology. DRDO has been able to develop its own intercontinental ballistic missiles (Agni Series) and combat aircraft (HAL Tejas). Brahmos developed by DRDO is the world fastest cruising missile with Mach number 3. With the help of Vikram Sarabhai, Indian Space Research Organisation (ISRO) was established by Government of India in 1969 for advanced research in space technology.

The first Indian satellite, Aryabhatta, was launched by Soviet Union in 1975 for research in x-ray astronomy and solar physics. Apart from developing various successful launch vehicles for sending satellites for 28 nations, it has conducted two super-successful space exploration projects, Chandrayaan (Lunar Orbit Mission: 2008) and Mangalyaan (Mars Orbit Mission: 2014).

Only six countries in world have achieved such milestones. Under the direction of nuclear physicist Raja Ramanna, Indias first nuclear bomb was successfully tested in 1974 at Pokhran Test Range. With this India became the sixth nation to possess a nuclear warhead. Economic liberalisation in 1990s led to formation of technological hubs in Bangalore, Hyderabad and Chennai. These cities became backbone for Indian manufacturing, R&D and information technology.

Concerns

The growth in science and technology since the independence of India looks remarkable in records, but actually, the growth rate was never appreciable. There is still a lot of friction to the flow in the path of development. Like problems to other developing countries, India faces corruption, misuse of power, frivolous publications and patents, threat to whistleblower and brain drain. In between 2000 and 2015 it has been evident that number of scientific publications has increased fourfold overtaking Russia and France. It was also evident that the number of citations per paper is less than average. Also the number of researchers (216 in 2015) per million people is less than average. In a country of 1.35 billion people, only few research centres like BARC, RRCAT, CSIR, ISRO, DRDO and few technical institutes like IISc, IIST, IITs, IISERs really contribute towards public research. [3] A major fraction of industries do not have R & D facilities. Only large industries like Tata, Birla, Mahindra, TVS, Ashok Leyland, Reliance etc. have their own R & D laboratories. The best in class industrial R&Ds in India are owned by foreign MNCs like Qualcomm, Samsung, GE, Boeing and Fluent. Many small and medium industries do not bother to improve or modernise their product as frequently as it should unless there is a market need.

Another major problem for scientific development in India is significant brain drain. The academic system in India consists of a lot of competitive examinations. The system ultimately screens the best students into top universities like IITs or IISc. But a significant number of these students end up migrating to US, UK, Germany or other developed countries for jobs and higher studies. It has been occurring since these institutes were started. Very few of the migrants turn up to continue their career in India. There were times in 1990s and early 2000s when more than 70% of students from IITs migrated to foreign countries. It was nearly 30% in 1970s and however, it has again reduced to 30% in late 2000s.

But the number of migrants has been growing with increasing rate ever, since the beginning. The best researchers produced in India work for non-Indian research agencies. It is also evident from the fact that out of 4 Indian Nobel laureates, 3 of them were migrants. The percentage of researchers in ISRO and DRDO hailing from IITs or NITs is nearly 2%. As per Nehru's vision, institutes of national importance like IITs and IISc were successfully established. But they always need a large amount of funding for smooth and sustained operation. Such institutes are heavily funded by the Government. So, the brain drain is always accompanied by investment drain from the country.

Again, even though Government was able to produce world class experts, it failed to accommodate them and get returns from its investment. The migrated citizens often complain about low scope for development in future. Even with low opportunity, if they were lucky, either they were unsatisfied with their low salary or degradation of their

expertise due to inappropriate job offers. It is still the case today since the system started. Many students do engineering and end up with non-technical job, which does not entertain them gradually. After few years of job, they opt for a career in foreign countries which would boost their career in their own field of expertise.

India is not just about few experts and researchers. There has always been a trade off between research science and public, even though they ultimately serve the public and society. India is a vast country dealing with dealing with illiteracy, unemployment, corruption and many more issues. It is a difficult task to develop scientific temper in the Indian society due to the above mentioned reasons. Also, due to reasons, even though the number of companies in India is large but they are not large enough to cater the whole population. Many companies which are not based on metro cities do not really face competition in market due to low intersection of market domains. It is evident that minor and small scale industries in small cities like Bhubaneswar, Patna, Raipur and Jaipur make monopoly markets for their products. These industries have a regional market and being sole manufacturer of a particular product in the region there is a low market competition. So, company owners do not feel like focusing on developing their products for future, unless there is a need.

There has been certainly evolving a need for producing better quality products and involving R&Ds by consulting or collaborating with research institutes across the country. According to the World Bank India spends only 0.6-0.7% of its GDP towards R&D, while world average is nearly 2.3% of GDP. According to UNESCO, this is a very small fraction but unfortunately it is still stagnant at the same number since a decade.

The government of India has been drafting numerous policies and schemes for auto growth of R&Ds in industries. Moreover, government is also focusing on increasing market size. The 'Make-in-India' Movement was initiated in 2014 to promote indigenous products. It encourages companies to manufacture products in India instead of importing from other nations. Subsequently 'Startup India' and 'Digital India' movements were launched. These initiatives helped in product quality development and market expansion. They brought down the rank of India from 190 to 100 in the list of Global Ease of Doing Business Index by World Bank, within a span of four years. In recent years, this movement has been able to marginally increase the job opportunities in India.

According to World Economic Forum, not just the population of India is high; the concern is the very young population. It would become the youngest population of the world by 2022, in spite of being the second largest populous country. With 65 percent of population in the working age group, this nation possesses a great resource and great potential - but with some parallel concerns. India has the second largest workforce in world, only after China.

In fact, India is the third largest scientific and technical manpower in the world. But, the quality of the workforce is very low compared to other nations. According to the 2011 census nearly only 6 percent of the population is at least a graduate. The national development plans initiated in past decades did not work out well to address these concerns. India should make sure that its great talent pool becomes both employable and able to contribute effectively towards building a developed nation. Imparting proper skills and appropriate education, this workforce can serve as an USP for the nation.

There are lot of scope for sectors like bio-technology and agriculture. India being an agricultural country, can take the most out of it. Similarly, many cross-disciplinary sectors are also evolving. The country should not produce only engineers and general science students. There should be special institutes with specialised science or applied science subjects. This transformation in course listing has been very much beneficial in many European countries. Not only the average education level of the population has to be improved but it should be taken care that they done intelligently. Also, it should be taken care that not only few institutes like IITs, but other institutes should also be taken care of. This would accelerate the process, since they have the platform, even though they are not well maintained.

Somehow, the education system in India has flaws from ground level. The ambitious students in India are very much object-

oriented. This impels students to gain quantitative knowledge rather than qualitative knowledge. Education for them, somehow, means scoring more and getting more number of degrees. Unlike the students from European countries and America, students pursue their career on the basis of parental pressure and market demand. It is often seen that students in developed nations choose their subjects on the basis of their interest and they perform really well in those. They are not only theoretically strong but also they have good hands-on skills. The current system does not help students in India to get practical skills. Most of their subjects are theoretical. The students starting from minor school should be given more practical and useful scientific knowledge.

As it was observed, Nehru's vision was not completely fulfilled. That may be due to fact that the later generations lacked the same vision to dream bigger and build bigger for a bigger cause to public and society. A vision is very much essential for common growth and development. There is a famous quote, "It is easier to take possession of a rented house in a posh locality than building your own house in outskirt".

I would also like to mention another quote, "If vision is a plan, determination is the recipe; collaboration is the boost". Almost all the developed countries in the world followed the same procedure. They had visionaries with determinations; they collaborated to get the boost. Why cannot this procedure be repeated in India too? Like Tesla and Edison, people like Sarabhai, Bhabha and Kalam followed similar steps in India, while Indian ventures where not for general public. Similar ventures for scientific developments meant for society is still lacking in India. But a good thing is that apart from government, there has been continuous support from industries. Companies like Tata had supported TIFR, IISc and many more. Birla, too, collaborated with scientific organisations. Looking at the IITs, they had started Birla Institute of Technology- Pilani, with a similar aim as of IITs. Each member in collaborated effort has a specific role. A visionary initiated an idea, which is taken into the next level with the help of industries. Industries can take any scientific plan to the next level by technology and intellectual property acquisition. They can support and promote development programmes like nothing else.

Government helps it to reach wider public and be much more effective. Such efforts like joint venture leads to collective and mutual developments. This helps everyone in the process. It has been proved to be so much effective that even nations come together and start collaborated projects. It was mentioned earlier that Nehru had joint ventures with Germany, Soviet Union and Japan. IIT Madras was supported by the Government of West Germany. IIT Bombay and IIT Delhi were supported by UNSECO and Soviet Union while IIT Kanpur was supported by American Government. Currently, a lot of international collaborations are being initialised for common good.

Conclusion

Being a vast country in terms of area and population, it is a difficult task for India to perform flawless. The growth country has shown is appreciable, but there are certainly many loopholes which are needed to be filled. There are lot of scopes for development for Indian society. A systematic and visionary step is yet to be taken. India does not lack behind in terms of potential to do the best but certainly the potential is not being utilised properly.

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