Innovation and Collaboration: The Trends and Role of Science & Technology in the Indian Business Sector

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Abstract- The private sector has significantly enhanced its role in India's economy, especially after 1990, with Indian enterprises excelling globally in sectors like software, pharmaceuticals, metals, and auto components. These firms actively engage in innovation, technology absorption, and R&D to climb the technology value chain. Collaborating with international firms helps bridge knowledge gaps, enabling access to advanced technologies, fostering innovation, and attracting foreign investments. This paper explores the technological development of the Indian private sector: the private sector's growing importance, the national innovation system, performance of high-tech industries, technical collaborations with a pharmaceutical case study, and conclusions with suggestions.

Keywords: Innovation, Technology, Patents, Research & Development, Collaboration

1. INTRODUCTION

In the modern digital era, where knowledge-driven systems dominate, the creation, accumulation, and assimilation of knowledge have become crucial for the advancement of both enterprises and nations. India is progressing along this path and has emerged as a key player in the realm of Science and Technology (S&T) (Mashelkar, 2008). Initially, the Indian public sector spearheaded investments in S&T with a mission-oriented approach. Over time, the private sector has also taken a proactive role in funding research and development (R&D) (Chakravarthy et.al, 2016). Among developing nations, India holds a first-mover advantage in investing in high-tech industries, demonstrating remarkable progress across multiple domains.

India continues to generate new knowledge in several cutting-edge sectors, including software, automobiles, chemicals (particularly pharmaceuticals), biotechnology, electrical machinery, electronics, renewable energy (Specially solar), defence manufacturing, food processing, space and satellite communications, and thermal power. These sectors contribute significantly to India's diverse and high-value industrial base. This progress has positioned India among the world's leading economies, alongside global powers such as the United States and China.

Across all major industries in India, the adoption, integration, and widespread dissemination of new technologies have been substantial. This technological diffusion encompasses the generation of technical expertise, investment in research and development, human resource development, establishment of technical partnerships and industrial clusters, skill enhancement, allocation of financial resources, and the linkage of domestic and global markets. Understanding the necessity for Indian industries to achieve global competitiveness and generate employment opportunities, the Government of India launched the 'Make in India' initiative.

The private sector has become an increasingly vital contributor to India's overall economy. The country's global competitiveness largely depends on the strength and capabilities of private enterprises. Since the 1990s, Indian businesses have gained international recognition across various industries, including software, pharmaceuticals, metals, and auto parts and components. These enterprises are actively engaged in innovation, technology absorption, and development.

India's evolving innovation ecosystem has significantly enhanced the global standing of its enterprises. The government has played a key role in fostering this growth by offering a robust framework of incentives and institutional support to promote research and development (R&D) (Abhyankar, 2014). In response, the private sector has made substantial investments in R&D to advance along the technology value chain.

Beyond in-house R&D, Indian firms are also forming strategic collaborations with international companies to gain access to advanced technologies and bridge knowledge gaps (Khanna & Sahay, 2020; Elango & Pattnaik, 2007). Many enterprises have already established partnerships with global firms,

allowing them to adopt and integrate the latest technological advancements. These collaborations drive knowledge creation, accelerate new product development, and enhance the innovative capacity of Indian firms. Additionally, they serve as a catalyst for attracting foreign investment in science and technology ventures, further strengthening India's position in the global market.

This paper aims to examine the current landscape, achievements, and impact of strategic partnerships in driving technological growth within India's private sector.

2. TECHNO-GLOBALISM AND TECHNO – NATIONALISM IN INDIA

India has changed her position from an imitator to innovator. She has created a potential in many fields specially Software, nuclear power, space exploration, Pharmaceuticals, automobiles and electronics (Narasimha, R, 2008). Mashelkar (2008) identifies four key pillars of India's Science and Technology (S&T). First, India's S&T progress is largely driven by techno-nationalism, where the country has independently developed advanced technologies in fields such as space exploration, software, and nuclear power. Second, India emphasizes inclusive growth, striving to develop technologies that benefit all segments of society. Third, India is rapidly emerging as a global R&D hub, leveraging its highly skilled workforce to provide research and development services to companies worldwide—an approach Mashelkar refers to as techno-globalism. Finally, India's S&T efforts focus on fostering a robust innovation ecosystem, aiming to position the country as a global leader in technology, with the aspiration of creating its own versions of Silicon Valley in the near future. In the Global Competitiveness Index, India ranked at 43rd position in 2019-20. It has improved from 55th position in 2015-16 out of 144 countries. The Global Competitiveness Index captures the fundamentals of an economy, which includes basic and higher education, institutions, infrastructure, technological readiness, innovation, development of financial, labour and goods markets along with all the recent developments including currency, commodity price fluctuations, geopolitical uncertainties, and security issues. If we look at India's productivity, it has improved in Total Factor Productivity and is almost at par with the top grossers and the most efficient & productive economies. (See fig.1)

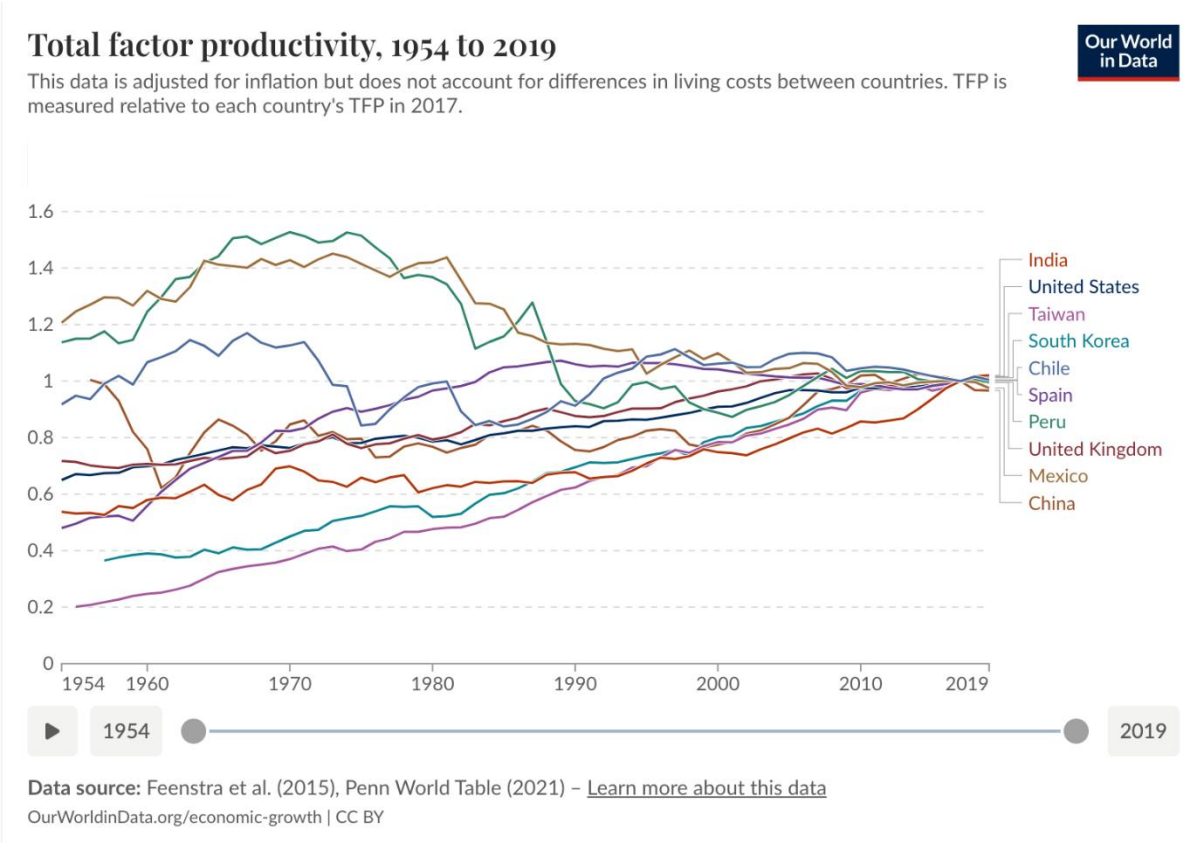


Fig 1: Total Factor Productivity in Select countries and india

2.1 What led to a thriving innovation system?

The improved factor productivity has been due to continuous efforts towards quality higher education, investment in R&D, innovation, and technology development. In India, from the beginning, the Government has played an important and a positive role in structuring its innovation system.

2.1.1 Research and Development

Regarding R&D investments, if we compare India's R&D as a share of GDP to other countries ratio investing in R&D, we observe that according to 2020 world bank data, India is at the 70th rank. It has a very low R&D share in GDP. Fig.2 exhibits the top 12 countries R&D share in comparison with India. Nevertheless, the absolute amount spent on R&D as a whole has been increasing as GDP and as a share of GDP has been rising (Fig.3). R&D expenditure and GDP, in absolute terms have shown a consistent rising trend over the years. The annual growth rate of R&D (both at current and constant prices) remained higher than that of GDP prior to 2000–01.

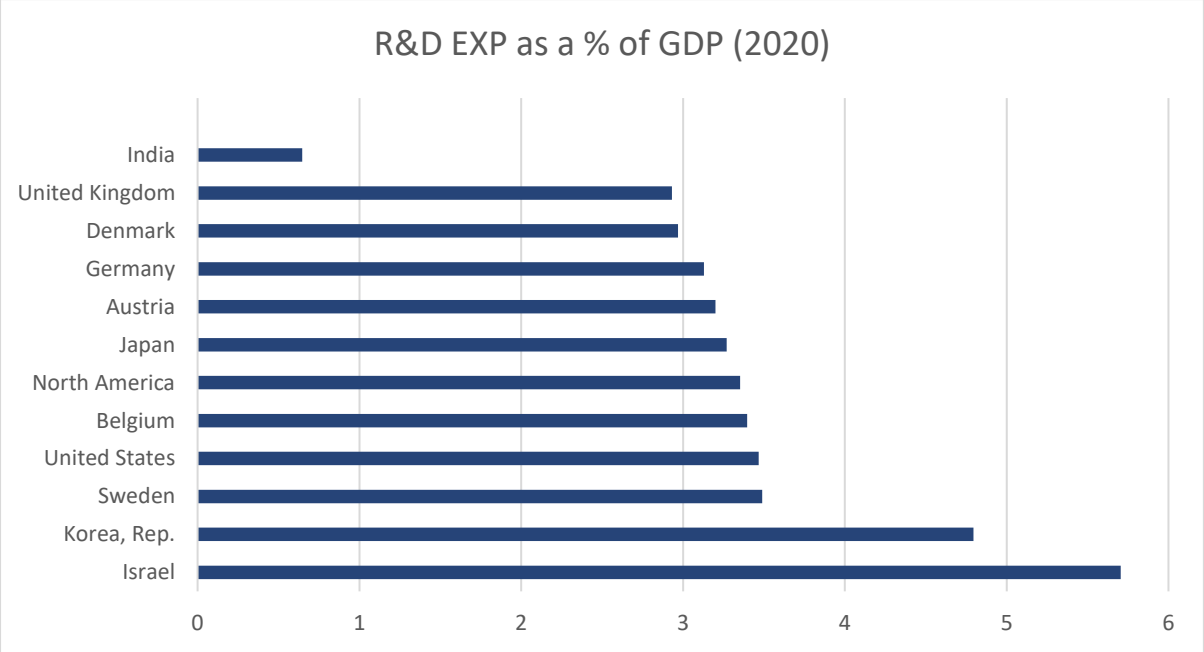
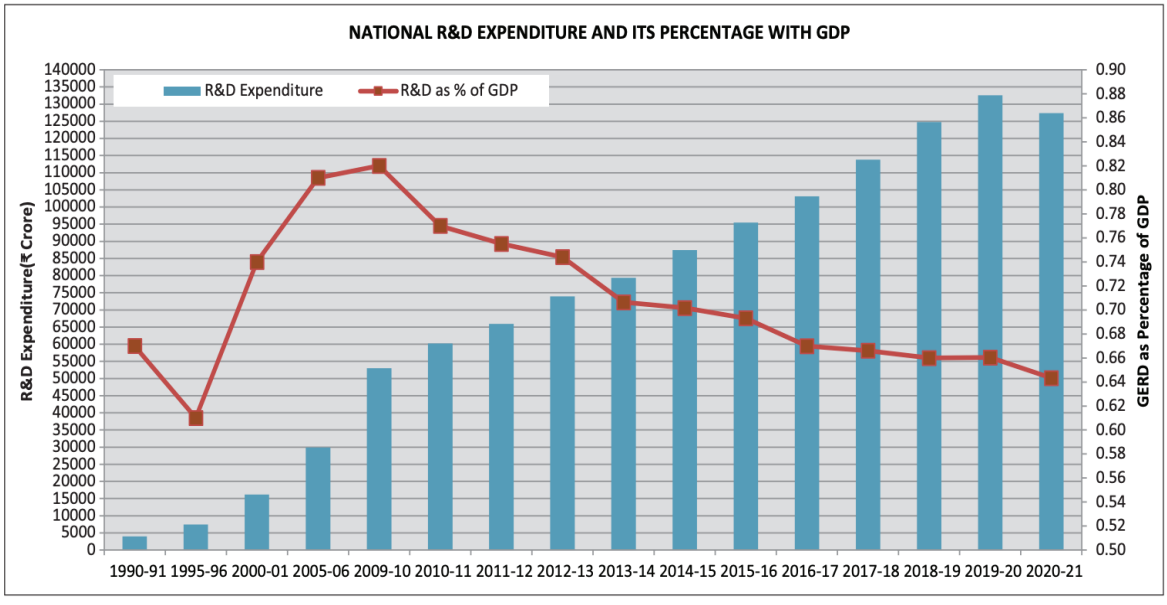


Fig. 2: Countries with highest share of R&D as a % of GDP and India
(Source: www.worldbank.org)



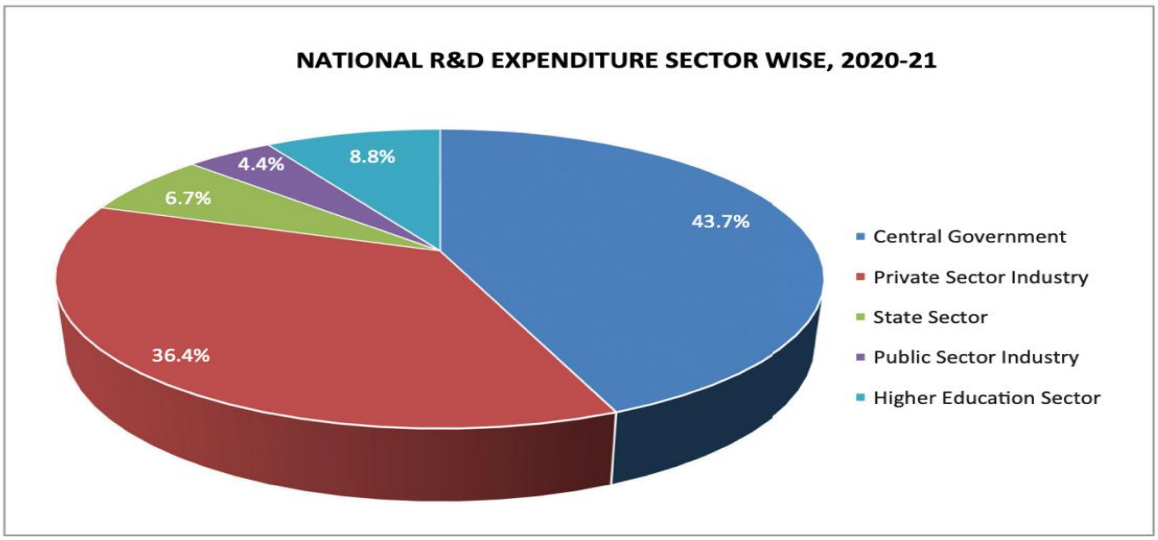
Source: NSTMIS, Department of Science & Technology, Government of India

Fig. 3: India's share of R&D expenditure as share of GDP

On the other hand, the government worked hard towards the literacy of the vast population and tried to give quality education to its people since independence. India is ranked India stands at 33rd rank in quality of education according to the 2020 survey. It was ranked 43rd in 2015-16, 40th in 2018, and 35th in 2019. This clearly indicates an improvement in the quality. In the global innovation index, in 2020, we were at 48th position which was an improvement of four places from 2019, and the first time India made it into the top 50 countries. India is still behind top innovators and need to increase its capacity to innovate, indulge in patentable innovations, work on its R&D spending and improve technical man power. We also observe that we are still behind the top economies because our quality of education doesn't match the required R&D inputs and efforts. There is a shortage of skilled labour in this ever-increasing demand for specialised skills. There are challenges with respect to the quantity and quality of the institutions required for keeping pace with the top economies. Massive investments in infrastructure and education sectors are required to enhance both the quantity and the quality of the labour force.

2.1.2 Efforts done in Research & Development

The business sector has realized its potential and scope in the global markets and is investing significantly in building R&D capacities. Besides building their own capacity, they are increasingly getting into collaborations with major brain powers so as to obtain and absorb new ideas & technologies. India is making major moves in building a strong National innovation system (NIS) in order to be one of the best economies in science and technology. The Indian Government has created a widespread S&T network based on public-private alliance. The main input component is the R&D expenditure. It is important to see how much an economy is investing towards R&D. The following fig.4 shows India's sector wise total amount spent on R&D.

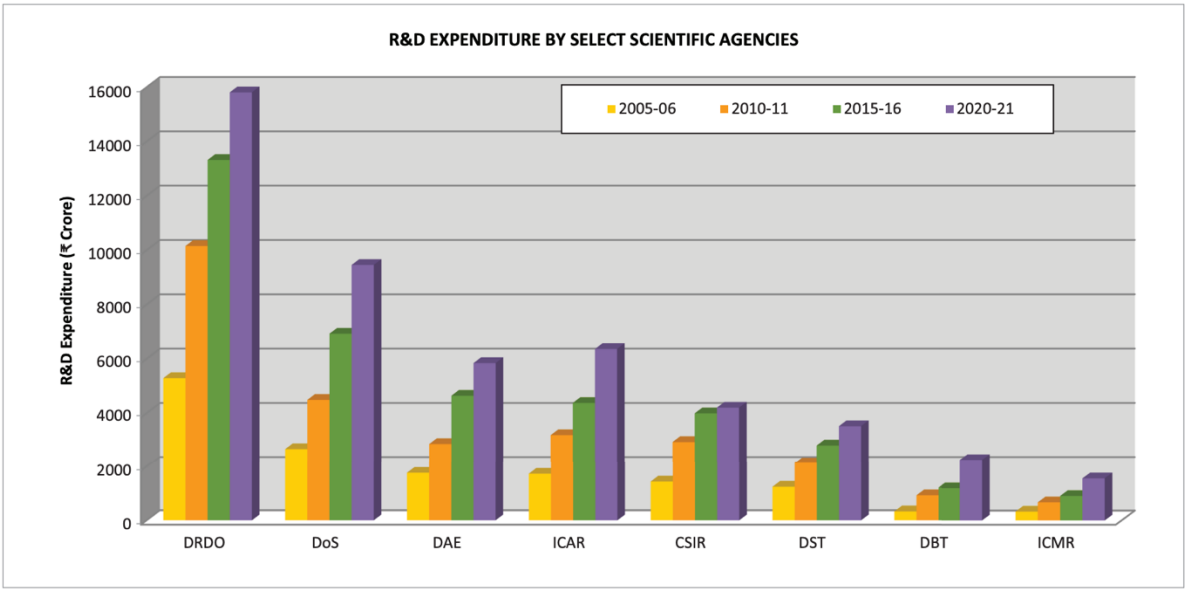


Source: NSTMIS, Department of Science & Technology, Government of India

Fig.4: Sector wise R&D expenditure in India (2020-21)

If we look at the main spenders in terms of Government and Private sector, we find that government spends a much larger amount on R&D as compared to the private sector though the share of private has been increasing gradually. Gross Expenditure on R&D is mainly driven by the Government sector comprising of Central Government; State Governments; technical government Universities like IIT and Public Sector Industries contributing approximately 70% with Private Sector Industries contributing the rest of the share.

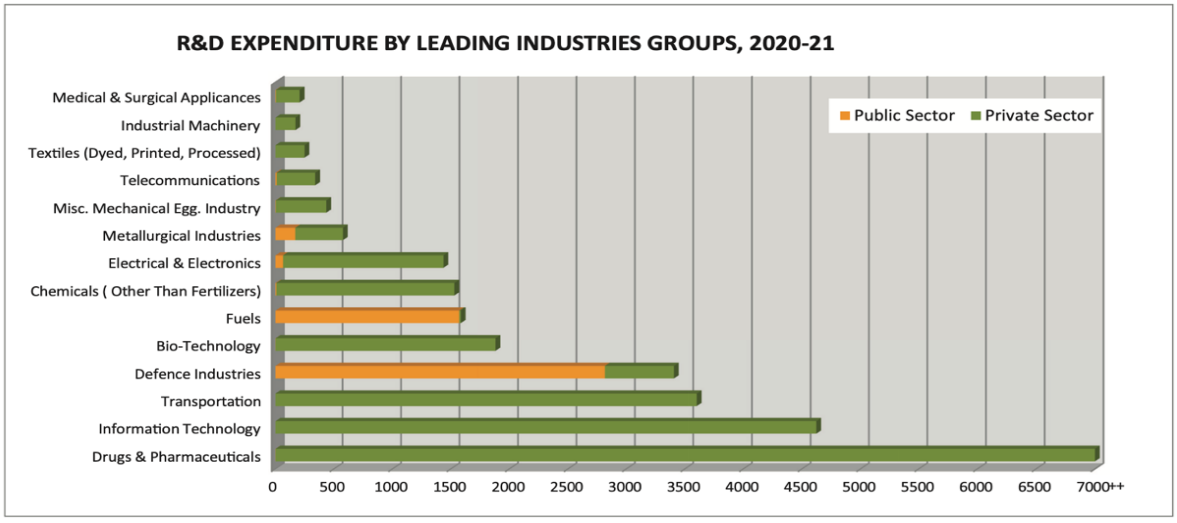
During the year 2020–21 (Fig.5), 84% of the R&D expenditure incurred by Central Government sources came from 12 major scientific agencies. ™ Amongst the 12 Central Government major scientific agencies, DRDO accounted for the maximum share of 30.7% of R&D expenditure followed by DOS (18.4%), ICAR (12.4%), DAE (11.4%), CSIR (8.2%) and DST (6.8%), DBT (4.4%) and ICMR (3.1%), MeitY (2.2%), MoES (1.5%), MoEFCC (0.8%), and MNRE (0.1%) during 2020–21.



Source: NSTMIS, Department of Science & Technology, Government of India

Fig. 5: Scientific Agencies trend of R&D expenditure from 2005-2020

If we look at the industries which are investing in Research and innovation, we find that during 2020–21, Public Sector R&D was led by Defence Industries followed by Fuels and Metallurgical Industries while Drugs and Pharma, Textiles, Information Technology, Transportation, Biotechnology Industries, etc., dominated the Private Sector R&D. In industrial R&D, Drugs and Pharmaceuticals occupied the first place with a share of 33.6% followed by Information Technology 9.9%, Transportation 7.7%, Defence Industries 7.3% and Bio-technology 4%, respectively during 2020–21 (Fig. 6).



Source: NSTMIS, Department of Science & Technology, Government of India

Fig. 6: R&D by leading high technology industries

R&D institutions can be classified based on ownership into five main types. Government-funded research centers rely on public money to advance national priorities. Private research organizations focus on innovation for commercial gain. Public-private partnerships (PPP) combine government and corporate resources to drive applied research. Universities conduct academic research, often supported by government grants and industry collaborations. Non-profit research institutions, often backed by philanthropy, work on specialized scientific and policy issues. Each type shapes research directions based on its funding and objectives. Fig. 7 exhibits that 66% are in private sector.

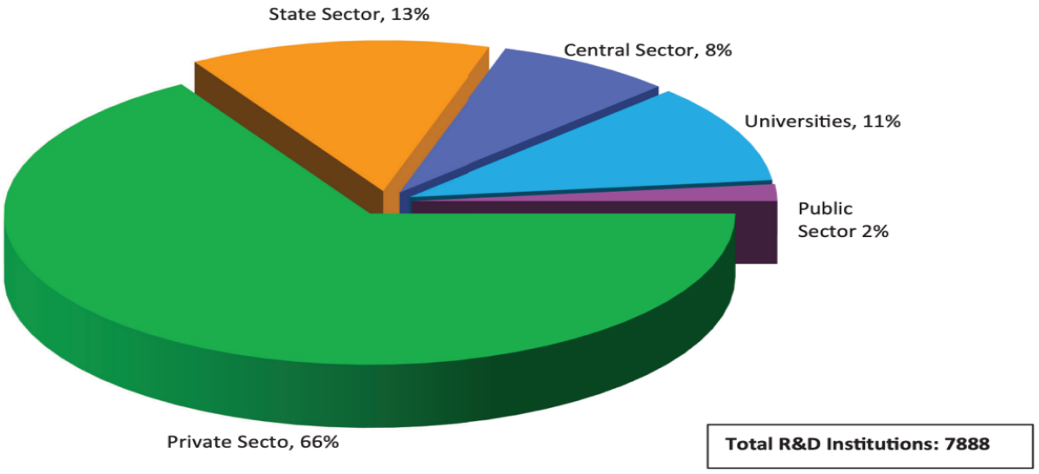


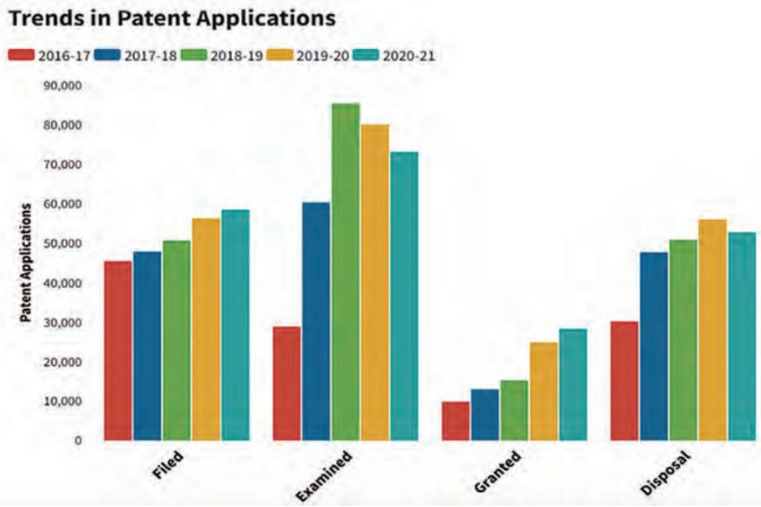
Fig. 7. Distribution Of R&D Institutions In India, 2020

2.1.3 Patenting Trends

Another way to judge the growth of science and technology as well as innovation in India is by looking at the trend of patenting. During this year, a total of 58503 patent applications (Fig. 8) were filed exhibiting an increase of about 3.97% as compared to previous year. Domestic filing of patents applications has also increased to 24326, which is 41.58% of total filing as compared to 37.05% in 2019-20.

Trends in Patent Applications

Year	2016-17	2017-18	2018-19	2019-20	2020-21
Filed	45444	47854	50659	56267	**58503**
Examined	28967	60330	85426	80080	**73165**
Granted	9847	13045	15283	24936	**28385**
Disposal	30271	47695	50884	55945	**52755**



Source: Annual Reports of the Controller General of Patents, Designs and Trademarks, Government of India

Fig. 8. Trend in Patent Applications in India

If we observe the trend of patenting in India in the last 2 decades, we find that out of total 58503 applications filed, the number of applications filed by Indian applicants stood at 24326, which shows 16.71% increase over the last year's figure of 20843. Domestic filing is 41.58% of the total applications filed as compared to 37.05% during last year. Thus, in consistent with the growing trend in past years, this year too, applications filed by Indian applicants have shown remarkable increase. The number of applications filed by foreign applicants during the year (34177) has shown a marginal decline of 3.52%

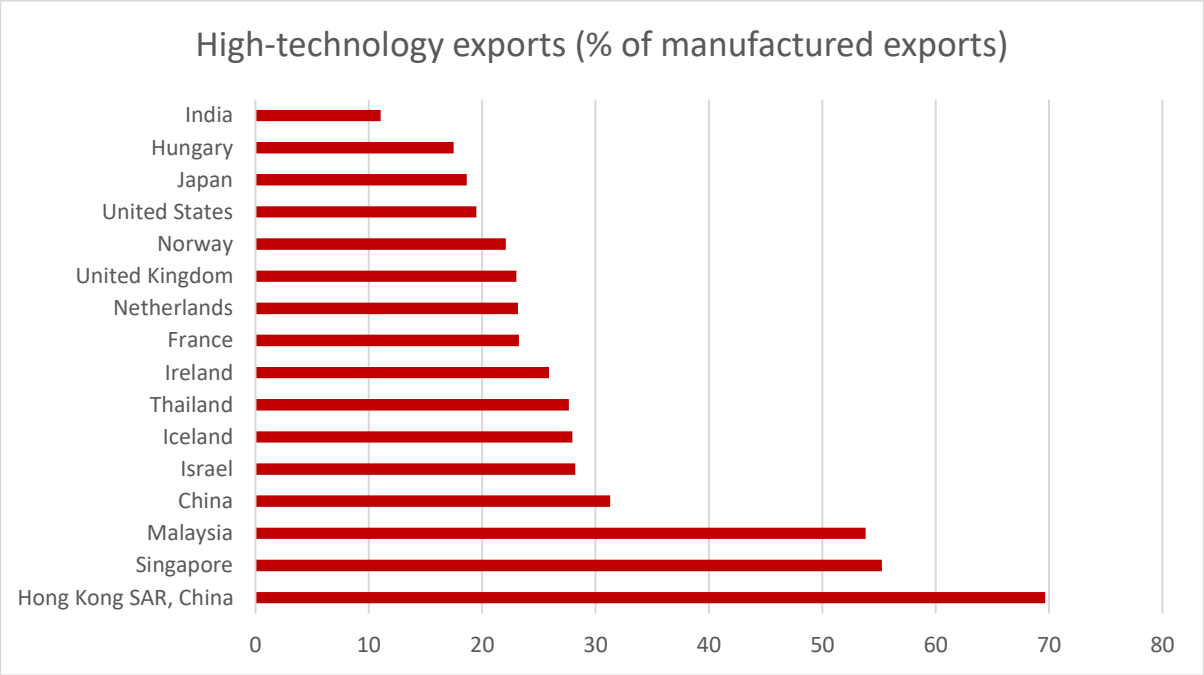
as compared to the number of applications (35424) filed during 2019-20.

2.1.4 High Technology Exports

High-tech exports have grown globally, with significant variation by country. High-tech exports are products that require a lot of research and development (R&D), such as those in aerospace, pharmaceuticals, and computers. Technology and technological capabilities are recognized as a prime driving factor for growth and competitiveness in trade and industry. Share of technology intensive trade in world trade has been steeply increasing in recent years, generally dominated by developed countries. However, many developing countries including India are now emerging as competitive sources for technology based products, projects, processes, services, and are aiming at enhancing their technological and innovation capabilities for larger export share in world trade.

India is at 45th position (2020) in high technology exports as a part of manufactured exports. Fig.9 shows India's comparison with top 15 countries.

The share of high technology exports in India as a percentage of India's exports was almost nil till 1990s, but the situation improved by the turn of the century (though it has stayed below 10%). In figure 7, we see that the share of high technology exports started rising and rose to 5.8% by the year 2005. This further increased to 9.1% in 2009 but fell again to 6.6% by the year 2015.



Source: www.worldbank.org

Fig. 9: India's comparison with top 15 High-technology exporting countries

3. TOP INDIAN SECTORS INVOLVED AND MOVING FORWARD IN S&T AND INNOVATION

India has come a long way from its socialist ideology to economic liberalization triggered primarily in 1991. While India has held prominent position in some sectors like space, defence which are primarily managed by the government. The other sectors which have emerged in recent years are IT, Pharmaceuticals, automotive, electrical and non-electrical machinery, telecom and energy. The huge domestic market, cost benefits and availability of skilled manpower at reasonable costs have made India an attractive R&D destination, which has led the investment focus to be directed towards S&T.

This section examines the three primary private business sectors central to science and technology: Information Technology, Pharmaceuticals, and the Automobile Industry. It provides an overview of their historical and current trends, anticipated advancements, and future developments.

3.1 Information Technology (IT)

India's Information Technology sector has demonstrated exceptional performance over the past several years, consistently ranking among the leading global IT industries. Currently, it is the

fastest-growing segment of the country's economy. Even amid challenging global economic conditions, the software and services industry has exhibited significant growth, surpassing that of other sectors in the nation.

In the financial year 2016, the total revenue earned by IT sector is $143 Billion, out of which $111 Billion are due to exports[1]. The United States and the United Kingdom were the primary destinations for India's IT exports. It is growing approximately at a Compound Annual Growth Rate (CAGR) of 8.3 per cent year-on-year basis. In 2020, India's electronics and IT sectors grew consistently, and the country exported services worth $151 billion[2]. The sector contributed about 9 per cent of India's Gross Domestic Product (GDP) in 2020.

There were reportedly approximately 1.7 lakhs firms with more than 50000 start-up firms. Notable Indian IT companies include Infosys, Tata Consultancy Services (TCS), Wipro, Tech Mahindra, and HCL Technologies. Moreover, the new start-ups are redefining India's innovation capabilities and are reaching out worldwide. As compared to 2014, there has been a 40% growth in the number of start-ups.

This sector employs around 4.4 million people in India. The IT industry has also created significant demand in the Indian education sector, especially for engineering and computer science.

The current government is actively pursuing the Digital India Mission, which aims to develop smart cities, digital villages, and gram panchayats with integrated smart infrastructure. The primary objective of this initiative is to establish a robust digital infrastructure accessible to every citizen, thereby promoting digital empowerment. Since 2006, the government has been implementing the National e-Governance Plan, designed to facilitate seamless access to government services for the general public. The key pillars of this plan include broadband highways, public internet access, electronic service delivery, and comprehensive information dissemination through digital platforms.

If we look at the Gross R&D expenditure (GERD) in this sector, it has been consistently increasing over the years and has more than doubled from Rs. 60,196.75 crore in 2010–11 to Rs. 127,380.96 crore in 2020–21. It is 9.9% of the total GERD in this period.

Overall, the firms in the Information Technology sector are making significant advancements and increasingly engaging in collaborations with various domestic and international enterprises, universities, and research institutions. This industry has played a pivotal role in transforming the country's economic landscape and reshaping India's position in the global economy. The IT sector has the potential to enhance long-term economic growth by improving productivity across multiple industries. Having demonstrated its expertise in delivering both onshore and offshore services to global clients, the sector is now poised to capitalize on emerging technologies, presenting new opportunities for leading IT firms in India. Consequently, India has established itself as the premier destination for IT enterprises worldwide.

3.2. Chemical industry- Pharmaceuticals and non-Pharmaceuticals

With Asia's growing contribution to the global chemical industry, India emerges as one of the focus destinations for chemical companies worldwide. India's chemical industry has grown rapidly in the last decade, with a compound annual growth rate (CAGR) of about 9%. According to available data, the Indian chemical industry export witnessed a significant growth trend between 2014 and 2020, with a substantial increase in export value, primarily driven by the rising demand for agrochemicals and intermediates, recording a growth of approximately 105% during this period[3]. The sector is highly diversified, with more than 80,000 chemicals and currently accounts for 15 per cent of India's industrial output, which makes it very crucial for the economic development of the country. This industry in India is the largest consumer of its own products, consuming 33% of its output. With promising growth trends in the chemicals industry, this internal consumption is also set to rise.

Of this, the Indian pharmaceutical industry is the world's 3rd largest by volume and 14th largest in terms of value. Total Annual Turnover of Pharmaceuticals was Rs. 2,89,998 crore for the year 2019-2020[4]. Major Segments of Pharmaceutical Industry are Generic drugs, OTC Medicines and

[1] Report on IT services by NASSCOM
[2] NASSCOM report
[3] Department of Science & Technology Report, 2020
[4] Department of Science & Technology Report, 2020

API/Bulk Drugs, Vaccines, Contract Research & Manufacturing, Biosimilars & Biologics. India has the second-highest number of US FDA approved plants outside the US. India is a global leader in the supply of DPT, BCG, and Measles vaccines. With the development of Covid vaccine, India has proved its strength and developed a worldwide reputation. India consistently supplied vaccines, essential medicines, and medical supplies during the pandemic. Furthermore, its active pharmaceutical ingredients (APIs) market attained a revenue of $6 billion by the end of 2020. According to a report on the Indian pharmaceutical industry, the source of APIs is a crucial part of the pharma industry's strategic plan to combat the COVID-19 pandemic. The majority of APIs for generic drug manufacturing across the globe are sourced from India, which also supplies approximately 30 percent of the generic APIs used in the US[5].

The pharmaceutical sector contributed 1.72% to India's GDP. India's pharmaceutical exports were $24.4 billion, while imports were $7 billion, resulting in a trade surplus of $17.5 billion. Foreign direct investment (FDI) in the pharmaceutical sector increased by 200% compared to the previous year. India is also a medical tourism hub, offering cost-effective treatments with the latest technology.

3.3 Heavy machine and Automobile industry

Automotive and heavy industry in India is one of the major strengths of the economy. With strong backward and forward linkages, it is a key engine of our economic growth. Liberalization and right policies over the past few years has created a strong, competitive market, and brought several new players, resulting in capacity expansion in automobile industry and generation of huge employment.

In the decade 2011-2020, the heavy machinery industry in India has seen significant growth, primarily driven by the government's focus on infrastructure development, rapid urbanization, and increased investment in construction projects, leading to a rising demand for construction equipment like excavators, backhoe loaders, and cranes. Also includes manufacture of engines and turbines, except aircraft, vehicle and cycle engines. The industry grew by 3% in the decade of 2011-2020. The export of heavy machinery grew from $447 million in 2011-12 to $816 million in 2019-20. The automobile sector was named as the 'Sunrise Sector' of the economy. Its current contribution to India's GDP is 7.1%. The automotive industry accounts for 45% of the country's manufacturing gross domestic product (GDP), employing around 19 million people of the country. India is home for the largest motor cycle manufacturer and fifth largest commercial vehicle manufacturer.

Total 34,34,015 cars were manufactured in India in the year 2019-20[6]. Maruti was the largest production of passenger cars in India and manufactured over 1.5 million units, followed by Hyundai. Ford was the Third Largest producer of cars in India, while Mahindra & Tata came in 4th and 5th spot respectively.

If we look at the R&D expenditure in the automobile industry, Mahindra & Mahindra spent the most on R&D in the Indian automotive industry, at over USD 335 million. This was more than 3.5 times the amount spent by Maruti Suzuki, the second-highest spender.

4. ROLE OF STRATEGIC ALLIANCE IN HIGH TECHNOLOGY INDUSTRIES

Knowledge and the capability to create and utilize knowledge are considered to be the most important source of a firm's sustainable competitive advantage (Schumpeter, 1934; Arrow, 1985; Kuznets, 1972; Hagedoorn et.al, 1994; Novak, 2010). Firms use different strategies/organizational forms to create knowledge. These include forming strategic research alliances/partnerships with other firms, merging with other resourceful firms, acquiring other firms with capabilities or getting acquired by another technologically superior firm. These strategies may have tremendous influence on the rate of innovation and performance (Belderbos , 2007) by a firm. it is necessary to constantly learn from internal as well as the external resources and environment and then synthesize all of it to create something new. Besides, internal capabilities, firms want to utilize other firm's capabilities too in order to have the best of both worlds. One such strategy is

[5] https://www.europeanpharmaceuticalreview.com/article/117413/the-covid-19-pandemic-and-the-indian-pharmaceutical-industry/

[6] https://www.autopunditz.com/post/cars-production-statistics-india-fy2020#

collaboration or forming alliances for developing, sharing and absorbing knowledge in which two or more firms come together to develop and share something new. These alliances are defined as "co-operative agreements in which two or more separate organizations team up in order to share reciprocal inputs while maintaining their own corporate identities" (De Man and Duysters, 2005) and range from informal R&D partnerships to equity joint ventures. Strategic alliances are now considered one of most powerful mechanisms for combining competition and co-operation and for industrial restructuring on a global basis. A greater number of partnerships are for joint marketing, research and development (R&D) rather than production.

In high technology sectors like pharmaceuticals, soaring research costs and time lags to commercialization are driving partnerships. A very good example is the collaboration for the Covishield vaccine, which was developed by AstraZeneca along with Oxford and it was manufactured by Serum Instituite of India. In automobile sector, General Motors (GM) has fostered many alliances over time and its partners include Isuzu, Suzuki, Fuji, Toyota and Fiat; Ford is allied with Mazda and many more. Such collaborations brings in competitive advantage such as risk reduction and access to new technologies, low cost resources and entry to new markets. It almost started when Suzuki Motor Corp. first entered the Indian market in 1982, and it started a joint venture with Maruti Udyog Ltd., an Indian state-owned firm. Despite many ups and downs, and fierce competition from other major automobile manufacturers, including the Indian giant Tata Motors Ltd—Suzuki succeeded in establishing its brand as India's 'people's car. Many more alliances in almost every industry followed. IT giant Wipro has many successful alliances with other leading technology companies which include alliances with Agiliance, Amazon, Cisco, Google, Magnasoft, Oracle and many more leading names.

4.1 The Case of the Indian Pharmaceutical Sector

We explored the strategy of technical alliances in India's pharmaceutical sector involving R&D activities with other firms or institutions for the period 2000-16. We empirically tested and analyzed the impact of these alliances on the extent of knowledge created, export performance and overall firm performance in the pharmaceutical firms.

For the empirical analysis, we selected a sample of 54 firms from the Indian pharmaceutical sector. Much of the firm level information utilized was gathered from the Prowess 4.1 database, annual reports, websites, official press releases and other reports of the 54 firms. Additional data regarding patents filed in different countries was collected from various official patent databases. The quantitative evaluation of the panel data using instrumental variables regression method clearly demonstrated discernible influence of alliances on innovativeness of the firms.

We found that the Indian pharmaceutical firms are increasingly entering into strategic alliances in the areas of drug discovery, development, technology development and clinical trials.

Moreover, the analysis of innovation measures, export intensity and firm's economic performance established a positive interdependence between innovativeness and the firm's success in terms of market share and export performance. These collaborations can be explorative and exploitative i.e. alliances are used to enhance specialization in newly discovered technologies and once a technology is explored, it has to be exploited. Table 1 lists some major alliances during the study period.

Top 10 Companies (On Basis of Market Share in 2016)	Alliances in the Period 2000-16		
	Agreements	JV	Total
Ranbaxy Laboratories Ltd	43	1	44
Cipla Ltd.	47	0	47
Dr. Reddy'S Laboratories Ltd.	9	2	11
Lupin Ltd.	14	12	28
Aurobindo Pharma Ltd.	3	4	7
Jubilant Life Sciences Ltd.	14	2	16
Cadila Healthcare Ltd.	32	7	39
Wockhardt Ltd.	17	0	17
Sun Pharmaceutical Inds. Ltd.	1	0	1

Source: Compiled from Annual Reports of various companies for the period 2000-16

Table 1. Alliances of the Top Pharmaceutical Companies for the Period 2000-16

Another major trend is number of Mergers & Acquisitions (M&A) taking place in this industry. A strong and growing domestic market, a robust pipeline of drugs and ability to cater developed global markets has made this industry attractive for M&A. India has a high population with growing

market; hence it becomes attractive for MNCs to invest in India. Major MNC acquisitions in the Indian Pharma space took off in 2008 with the acquisition of Ranbaxy by Japanese drug maker, Daiichi Sankyo for US$4.6 billion. Table 2 lists some major acquisitions during the study period.

Target Firm	Acquirer Firm	Deal Value ($ Million)	Year
Paras	Reckitt Benckiser	720.9	2010
Piramal	Abbott	3720	2010
Ranbaxy	Daiichi Sankyo	4538	2008
Dabur	Fresenius and Kabi	220	2008
Novartis India	Novartis AG	75.5	2007
Shantha	Sanofi	625	2009
Matrix	mylan	736	2009

Source: compiled from Annual Reports of various companies for the period 2000-16

Table 2. Some Major Acquisitions and their Deal Value in the Pharmaceutical Sector

We observed that the Indian pharmaceutical firms are increasingly entering into strategic alliances in the areas of drug discovery, development, technology development and clinical trials. Firms are forming alliances to specialize and to advance a technology to turn it to a marketable and approved product. Firms are discovering that they cannot do it alone and must now often turn to others to survive. Most of them have now realized that self-sufficiency is becoming increasingly difficult in a business environment that demands strategic focus, flexibility, and innovation.

Another factor which is seen to have an unambiguous positive impact on innovation is the change in the Indian Patent regime in 2005. There is increase in the level of patent protection in a country which has greatly influenced the domestic pharmaceutical industry in terms of its innovation, R&D (Research & Development) investment, technology and the overall business strategies employed by the firms. Data analysis clearly demonstrates that since the enforcement of the new patent law, a new wave of progress has swept the country. Post 2005, pharmaceutical and medical biotechnology companies have experienced some very critical changes, and since then, as the results show, one of the major differentiators has been innovation as it gives first mover advantage. Besides alliances, the results reveal that there are other factors which also play a positive role in enhancing innovation such as the firm's own market share, export performance and change in the patent regime.

5. CONCLUDING REMARKS

India has been a frontrunner in the field of science and technology since few years and has been investing in R&D and skilled human resource. The presence can be felt in the global markets especially in the field of IT, pharmaceuticals, space and nuclear energy sectors. India has become a hub especially for the IT industry and has been exporting a huge chunk worldwide and hence has a major contribution in India's GDP. Alongside, India Pharma sector is also in the top 5 players of the world. On the other hand, space and nuclear energy which is managed by the state is also becoming a favourite haunt of many countries.

However, India is still far behind in terms of investing in R&D in various fields. The percentage of GDP invested in R&D is still much below the amount invested by high technology economies like USA, Singapore, Israel etc24. they need to devote a lot more into R&D and enhancement of skilled labour force in order to match the top economies. Innovation is the main source of growth and firms have to innovate continuously for sustainable advantage and to stay in the game. Hence India has to set policies such that at least 2-3% of GDP goes into research and development. Also, policies should be such that more and more technical alliances with top players of the world are encouraged.

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