INVESTING IN IDEAS

The Case for Foreign Direct Investment in Research & Development in India

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Overview of Research & Development (R&D)

**IMPORTANCE OF R&D**

There is ample global evidence that R&D is a key driver of productivity and economic growth. It has been observed that two-thirds of economic growth in Europe between 1995-2007 was attributed to R&D, which accounted for 15 per cent of all productivity gains for this period. An increase of 10 per cent in R&D investment leads to 1.1-1.4 per cent increase in productivity.

The global R&D expenditure has been rising over the last decade. In 2017 it was estimated to be USD 1.7 Tn in Purchasing Power Parity (PPP) terms. US, China and Japan were the leading countries in R&D. India’s share was around 2.8 per cent. Government of India is continuously focussing and emphasising on science and technology to increase its efforts and make improvements in R&D.

R&D has contributed to capital formation, export of services and Foreign Direct Investment (FDI). This is in addition to the fact that the contribution of R&D to social well-being is also phenomenal. Our society grapples with many complex and urgent challenges that affect the quality of life of our citizens- like energy efficiency, security, climate change or an ageing population. R&D has played a crucial role to anticipate and respond to these needs. Although, there is little data to support these aspects of R&D yet their impact is felt across all sections of society. Investing in R&D is fundamental to India’s national security and to address the multiple uncertainties stemming from climate change and the global meltdown.

**R&D leads to economic growth by:**

- **Sourcing**
  - FDI
- **Sourcing for**
  - *trade in services*
- **Offering**
  - *productivity* & product differentiation
- **Capital formation**
  - which in turn results in economic growth
- **Increasing market participation**
  - of the investing companies
FDI IN INDIA

India today is a part of the top 100 club on Ease of Doing Business (EoDB) and globally ranks first in the greenfield FDI ranking. FDI inflows in India stood at USD 45.15 Bn in 2014-15 and have consistently increased since then. FDI inflows increased from USD 55.56 Bn in 2015-16, USD 60.22 Bn in 2016-17, USD 60.97 Bn in 2017-18 to USD 62.00 Bn (provisional figure) during 2018-19 which was the country’s highest ever FDI inflow.

Total FDI inflow in the last 19 years (April 2000-September 2019) has been USD 642 Bn while the total FDI inflow received in the last five years (April 2014-September 2019) is USD 319 Bn which amounts to nearly 50 per cent of total FDI inflow in last 19 years.

“\nWe all agree that the research and development investment leads to disproportionate positive rewards in today’s world. Meeting our sustainable development goals, mitigating the consequences of climate catastrophe, striving for a circular-economy, ensuring health and well-being for our people, conserving biodiversity, ensuring food security, and national security— all these are inalienable components of our ambition to be a USD 5 trillion economy”

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Prof K VijayRaghavan
Principal Scientific Advisor to the Government of India
India’s Value Proposition

R&D IN INDIA: THE PROMISE IT HOLDS

According to United Nations Educational, Scientific and Cultural Organisation (UNESCO) Institute of Statistics, India is amongst the top ten R&D spenders in the world, i.e. USD 48.1 Bn R&D spending (adjusted for PPP) constituting 2.7 per cent of the global share. India improved its ranking in the Global Innovation Index by five places to 52nd in 2019 and is likely to get into the list of the top 25 nations by 2027.

With growing globalisation, engineering and R&D market in India is estimated to grow at a CAGR of 14 per cent to reach USD 42 Bn by 2020. In 2019, India had close to 7000 R&D institutions. The maximum number of R&D institutions i.e. 1392 (20.3 per cent) are in the state of Maharashtra followed by Karnataka, Tamil Nadu, Andhra Pradesh and Gujarat with 685 (10.0 per cent), 672 (9.8 per cent), 570 (9.7 per cent) and 547 (8.3 per cent) respectively.

FDI IN R&D: THE OPPORTUNITIES

• There was a major inflow of FDI in R&D in 2015-16 (to the tune of USD 235 Mn). It has dropped in subsequent years. There is an opportunity in this space.

• There are only 26 Indian companies in the list of the top 2,500 global R&D spenders compared to 301 Chinese companies. 19 out of 26 firms, in India, are in just three sectors: pharmaceuticals, automobiles and software.

• India has no firms in five of the top ten R&D sectors as opposed to China that has a presence in each one of them.

NEED FOR FDI IN INDIA’S R&D SECTOR

• Diverse intellectual capital
  - India adds 6000 PhDs, 200k engineers, 300k non-engineer postgraduates, and 2.1 Mn other graduates to its workforce annually.

• In 2016, India produced the maximum number of graduates worldwide with 78 Mn fresh graduates, of which 2.6 Mn were from Science, Technology, Engineering and Math (STEM).
• **Frugal innovation advantage**
  - Frugal innovation is a strength for India. Investment in R&D within frugal innovation would result in substantial economic advantage.
  - Successful examples of frugal innovation include startups that have emerged out of the Stanford-India Biodesign project (involving Stanford University, USA) and the GE portable ECG machine.
  - Kwid by Renault and the solar/coconut husk energy source by Siemens are some other notable success stories of frugal innovation.

• **Availability of a low cost R&D talent pool**
  - Cost of hiring a researcher in India is 1/5th of the cost in US.

• **Opportunity to address India and similar markets**
  - According to a World Economic Forum (WEF) report, India is poised to become the third-largest consumer market by 2030 globally, with consumer spending growing to USD 6 Tn, from USD 1.5 Tn in 2018.
  - The Asia-Pacific will be responsible for the overwhelming majority (90 per cent) of the 2.4 Bn new members of the middle class entering the global economy.

• **Conducive IPR policy**
  - Compliant with Trade-Related Aspects of Intellectual Property Rights (TRIPS).
  - India was one of the top three countries to show a strong growth in Patent Cooperation Treaty (PCT) filings in 2018.

• **Massive startup ecosystem**
  - Ranked second after US to host the largest number of startups.
  - Accelerator programs mentoring startups powered by global giants.
  - 1500+ global in-house centers operated by MNCs across India.

• **A progressive policy environment**
  - India's ranking in the World Bank's Ease of Doing Business index rose by 14 spots to 63rd in 2018-19.
  - Resolving insolvency, dealing with construction permits and trading across borders are areas of strength for India.
  - One of the primary aims of the Science and Technology Policy, 2013 is to increase private sector investment in R&D.

• **Robust academic and research infrastructure**
  - Currently, over 1,140 centers in India are dedicated to R&D which employ over 900,000 professionals.
  - India has been ranked as the top innovation destination in Asia and second in the world for new innovation centres. It accounts for 27 per cent of Asia's new innovation centres.

• **Low cost of operations**
The Case for FDI in Research and Development in India

MNCs PLACING THEIR BETS ON INDIA

- India is fast becoming a top R&D outsourcing destination with 60 per cent of new MNCs having established global in-house R&D centres. This is likely to accelerate as new MNCs eye India to set up their bases.

- As per a study by Confederation of Indian Industry (CII) published in 2017, from among the top 100 global R&D spenders, around 83 of them have a presence in India in some shape or form.

- The total patents in India have doubled (from 30,822 in 2008 to 60,777 in 2017).

- Companies like Microsoft, Oracle, Motorola, Intel, IBM and GE have set up their R&D or design centres in India.

- Companies like GE and Bosch have their largest and second largest R&D facilities respectively in India.

Growing Importance of India as a R&D Destination: (1)

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>LOCATION OF R&amp;D LAB IN INDIA</th>
<th>R&amp;D PERSONNEL</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astra Zeneca</td>
<td>Bengaluru</td>
<td></td>
<td>One of the largest R&amp;D labs outside Sweden. Most of Astra Zeneca's R&amp;D on tropical disease happens here</td>
</tr>
<tr>
<td>Cummins</td>
<td>Pune</td>
<td>4,000</td>
<td>Second largest R&amp;D centre (after the US)</td>
</tr>
<tr>
<td>Emerson</td>
<td>Pune</td>
<td>4,000</td>
<td></td>
</tr>
<tr>
<td>Bosch</td>
<td>Multiple Locations</td>
<td>13,500</td>
<td>Second largest facility</td>
</tr>
<tr>
<td>General Electric</td>
<td>Bengaluru</td>
<td>5,300</td>
<td>GE’s largest R&amp;D facility in the world. Highest concentration of Chemistry and Chemical Engineering PhDs</td>
</tr>
<tr>
<td>Schneider Electric SE</td>
<td>Bengaluru</td>
<td>1,500</td>
<td>For Schneider Electric, in terms of number of people employed in R&amp;D, India ranks third</td>
</tr>
</tbody>
</table>

Source: MNCs R&D in India – A Glimpse, Confederation of Indian Industries, 2017
Growing Importance of India as a R&D Destination: (2)

<table>
<thead>
<tr>
<th>NAME OF THE COMPANY</th>
<th>PARENT COUNTRY</th>
<th>INDUSTRY</th>
<th>NAME OF COMMITMENTS</th>
<th>AMOUNT IN INDIAN RUPEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualcomm</td>
<td>USA</td>
<td>Telecommunication, Mobile</td>
<td>“Design in India” programme to mentor select hardware companies. They have also setup an innovation lab in Bengaluru.</td>
<td></td>
</tr>
<tr>
<td>Foxconn</td>
<td>Taiwan</td>
<td>Electronics</td>
<td>R&amp;D and hi-tech semiconductor manufacturing facility set up in Maharashtra.</td>
<td>INR 34,000 Cr (USD 5 Bn over five years)</td>
</tr>
<tr>
<td>Huawei</td>
<td>China</td>
<td>Information Technology</td>
<td>New R&amp;D campus opened at Bengaluru. A telecom hardware manufacturing plant is to be set up in Chennai.</td>
<td>INR 1,130 Cr (USD 170 Mn)</td>
</tr>
</tbody>
</table>

Source: MNCs R&D in India – A Glimpse, Confederation of Indian Industries, 2017

- Notable R&D private investments
  - GE established its first research center in Bengaluru in 2000. Apart from Bengaluru, research centers are located in Hyderabad, Mumbai and Chennai. The John F Welch Technology Center, Bengaluru is GE’s largest R&D center in the world.
  - Intel has the largest R&D centre, outside of USA, in India.
  - Google, Amazon, Apple have significantly stepped up their R&D activities in India.
SIGNIFICANT EMPLOYMENT GENERATION POTENTIAL

• For every USD 1 Mn invested in India, per year for the purpose of R&D by MNCs, it is likely to create demand for around eight to ten researchers.

COVID-19: TURNING A CRISIS INTO OPPORTUNITY

The Covid-19 pandemic has forced the world into a recession. However, India is one of the only two countries in the world to witness a positive growth rate with further projections of India’s faster recovered growth trajectory. This growth rate is predicted to be one of the highest in the world.

The Covid-19 pandemic also brings with it a unique opportunity for India to attract FDI especially from large companies seeking to diversify their investments into new geographies with the aim to mitigate risks and to ramp up production. Government of India has already taken active steps in this direction by setting up of an Empowered Group of Secretaries headed by the Cabinet Secretary, to make India a more ‘investor-friendly destination’.
Distribution of R&D Spending in India

R&D EXPENDITURE TRENDS IN INDIA

- The gross R&D spending in India has shown a healthy growth in the past few years, increasing from USD 3963.45 Mn in 2005-06 to USD 11298.46 Mn in 2014-15 at a CAGR of 12.3 per cent.

- Gross Expenditure on R&D (GERD) has shown a consistently increasing trend over the years. It has tripled in the last decade in nominal terms – from USD 3193.46 Mn in 2004-05 to USD 13885.59 in 2016-17.

- As a fraction of GDP, public expenditures on R&D has been stagnant – between 0.6-0.7 per cent of GDP – over the past two decades.

R&D AND EXIM

As per data received from the Reserve Bank of India (RBI), R&D exports have grown from USD 1,486 Mn in 2015-16 to USD 3,603 Mn in 2017-18. Whereas, R&D imports have grown from USD 339 Mn in 2015-16 to USD 464 Mn in 2017-18. It is noteworthy that India enjoys a positive balance of trade in the R&D sector which means that India is a net exporter of R&D to the rest of the world.

R&D and EXIM: Growth Trends

Source: R&D Expenditure Ecosystem, Current Status and Way Forward, EAC-PM, July 2019.
SEGM ENT WISE R&D EXPENDITURE TRENDS

• The expenditure on R&D is undertaken almost entirely by the central government.

• Within the Central Scientific Ministries/Departments, the top three spenders in 2017-18 were Department of Atomic Energy, Department of Space and Department of Science and Technology.

• Private investments in research have severely lagged behind the public investments in India. The top three companies which have contributed to R&D in private sector in 2017 were SAP Labs India Pvt Ltd, Mphasis Ltd and Olympia Tech Park Pvt Ltd.

• Out of 257 profit making Central Public Sector Enterprises (CPSE) in 2017-18 only 25 per cent contributed to R&D. The top three companies which have contributed to R&D in 2017-18 were: Hindustan Aeronautics Ltd, Bharat Electronics Ltd and Bharat Heavy Electricals Ltd.

• State governments also spend on R&D. The top R&D spenders on agriculture, research and education in 2018-19 were Maharashtra, Tamil Nadu and Karnataka.

SEGMENT-WISE INVESTMENT IN R&D: BRIEF ANALYSIS

• Public expenditure is the dominant driving force of R&D expenditure in the country. This is in sharp contrast to the pattern in most advanced countries where the private sector is a dominant force. However, the share of public expenditure in total R&D spend has come down from three-fourth of all expenditures to about three-fifth since the last few years. Further, the government is not only the primary source of R&D funding but also the primary user of these funds.

• The major player in the R&D expenditure ecosystem is the central government.

• Other public authorities like CPSE, state governments and universities are also key players in the ecosystem though their combined contribution to overall R&D spend is less as compared to the central government.

• The private sector, which is an important player in other countries, is not a potent source of R&D spend in India.

• The R&D spend, as a percentage of GDP, has remained stagnant over the last decade even though R&D expenditure in total and in absolute terms has been increasing over the last couple of years.

R&D: PROMISING SECTORS

• **Healthcare** - The healthcare industry spent USD 782 Bn on R&D in 2018 and is poised to have the highest R&D expenditure by 2020. The healthcare market in India is expected to be among the top three in the world by 2020 and therefore, presents a tremendous opportunity to investors within the sector.

• **Automotive** - In 2018, the automotive industry spent USD 130 Bn on R&D, marking a growth of 6-7 per cent from 2017. A key sub-sector driving the investments in R&D is electric mobility.
The Case for FDI in Research and Development in India

• **Software and IT** - In 2018, the Software and IT sector accounted for USD 117 Bn of the R&D spend, registering a growth of 18-19 per cent over 2017. In India, this is reflected by the fact that USD 1.6 Bn is spent annually on training workforce and growing R&D.

• **Semiconductors** - With a 7-8 per cent growth rate, the semiconductor sub-sector is among the top five industry spenders on R&D with an investment of USD 61 Bn. The sector is characterised by rapid technological changes, which demand high levels of spending on R&D.

**INDIA’S AIM IN THE R&D SEGMENT**

• More than double the expenditure on R&D to about two per cent of GDP by 2022.

• Target 50 per cent of the global R&D market.

• Double exports of R&D from USD 3 Bn to USD 6 Bn.

• Create 30 dedicated R&D export hubs.

• Target FDI investment of USD 500 Mn by 2022.

• Aspire to be one of the top ten global R&D institutions in emerging technologies.

**KEY FOCUS STATES FOR R&D**

The key states for R&D operations are Karnataka, Telangana, Tamil Nadu, Haryana, Uttar Pradesh, Maharashtra, Gujarat and Rajasthan.

**Consistently Top Performing States in Terms of FDI**

(with the approximate share in FDI)

<table>
<thead>
<tr>
<th>State</th>
<th>Approximate Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delhi</td>
<td>~20%</td>
</tr>
<tr>
<td>Gujarat</td>
<td>~10%</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>~30%</td>
</tr>
<tr>
<td>Karnataka</td>
<td>~20%</td>
</tr>
</tbody>
</table>
Initiatives, Incentives and Programmes

**FISCAL INCENTIVES**

To encourage investments in R&D, Government of India offers various tax incentives. Some of these incentives are given below:

- **The corporate tax rate for existing companies has been reduced to 22 per cent plus surcharge under section 115 BAA.** This has certain implications for scientific research not only affecting companies but IITs, government-run research labs, deemed universities and private technology institutes as well. The implication for companies availing reduced corporate tax rate with respect to scientific research is as follows:
  - Section 35 (2AB): will not be able to claim weighted tax deduction at 150 per cent for capital and operating expenditure for scientific research carried out in DSIR approved research laboratories but will be able to claim 100 per cent deduction on operating expenditure u/s 35 (1)(i) and capital expenditure u/s 35(1)(iv) along with 35(1)(2ia).
  - Section 35 (2AA): tax deduction of 175-200 per cent provided for research funding to Indian Institute of Technology, government-run research labs and universities.
  - Section 35 (ii): tax deduction of 175 per cent for carrying out scientific research at research association, universities and college.

- **Section 35 (iia):** tax deduction of 125 per cent for carrying out scientific research with companies.
- **Section 35 (1)(iii):** tax deduction of 125 per cent for carrying out social or statistical research with research association, universities or colleges.
- **Section 35 (2AB):** weighted tax deduction of 200 per cent on R&D expenditure to companies.

Other incentives include:

- **Accelerated depreciation allowance at 40 per cent for investment on plant and machinery and on indigenous technology as against 15 per cent for normal depreciation as per rule 5(2) of IT rules.**

- **Customs and central excise duty exemption to in-house R&D units of industry.**

- **Excise duty waiver for three years on goods designed and developed by a wholly owned Indian company and patented in any two countries out of India: USA and Japan; and any one country under the European Union (to be viewed in relation with the GST regime).**

- **Exemption from customs duty on imports made for R&D projects funded by the government in industry.**
• Specified goods for use in pharmaceutical and biotechnology sectors are allowed to be imported duty free by an importer registered with DSIR.

• Sector specific stimulus like a INR 100 Bn nano-mission project has been initiated by the government to develop R&D infrastructure around nanotechnology in India.

• The Indian Institute of Technology, Delhi (IIT-D) is targeting external R&D funding of USD 72.83 Mn this year, up from USD 52.97 Mn last year. In addition, the institute will also get a grant of USD 132.42 Mn from the government over the next five years after it bagged the coveted Institute of Eminence (IoE) tag.

ACADEMIA-INDUSTRY COLLABORATION

• In order to help the potential investors to enter into technical textiles, the Ministry of Textiles has set up Focus Incubation Centre in Technical Textiles (FICTT) at IIT Bombay. This incubation center serves as the transnational platform for the best minds from academia, R&D labs and industries to collaborate and collectively work towards disruptive innovation in the field of technical textiles.

• The Department of Textile Technology at IIT-D has established a research group on Smart and Innovative Textile Materials (SMITA). SMITA group has significant funding from both government and Indian industry.

INTELLECTUAL PROPERTY (IP) REGIME

Indian laws are compliant with TRIPS norms, which is an international agreement administered by the WTO. It sets down minimum standards for many forms of IP regulations as applied to the nationals of other WTO members.

According to the World Intellectual Property Organization (WIPO) report, India has emerged as one among the top three countries that have shown strong growth in the PCT filings in 2018. It filed 2,013 international patent applications in 2018 with the WIPO, registering the highest growth of 27 per cent, globally.

INTERNATIONAL COLLABORATION

Presently India has bilateral S&T cooperation agreements with 83 countries and active cooperation with 44 countries. During the recent years the cooperation has strengthened significantly with Australia, Canada, EU, France, Germany, Israel, Japan, Russia, UK and USA. Cooperation with African countries has also been strengthened through India-Africa S&T Initiative.
Some Notable Collaborations and Initiatives

- Indo-French Centre for Promotion of Advanced Research (IFCPAR/CEFIPRA)
- Indo-US Science & Technology Forum (IUSSTF)
- Indo-German Science & Technology Centre (IGSTC)
- Global Innovation and Technology Alliance
- ASEAN-India Science & Technology Collaboration
- India-Sweden Collaborative Industrial R&D Programme has been financed by the Indian Department of Science & Technology (DST) and Sweden’s Innovation Agency – Vinnova.

**RECOMMENDATIONS**

There is a need for an enabling ecosystem with policy support, innovative solutions, risk mitigation to make R&D in India attractive. The following focus areas may be considered:

- More participation by states.
- Tracking of MNC’s R&D activity.
- Developing human capital for R&D work.
- Improving contract enforcement.
- Foster linkages between MNCs and local entities.
- Improving land and infrastructure.
- Providing incentives based on expectations of MNCs.

- Formulate long term government priorities for R&D ecosystem to enable industry alignment.
- Develop forward looking policy measures benchmarked to global best practices to help innovations.
- Engage young generations in R&D for a strong foundation for a career in research. Industries should collaborate with professors for research-based activities.
Sector-wise Outlook for FDI in R&D

OVERVIEW AND MAJOR PLAYERS

- The Indian logistics sector, already a USD 200 Bn market, is set to grow at over 10 per cent CAGR in the next five years to reach around USD 320-330 Bn by 2024-25.

- Technical textiles in India have already established a market size of USD 17 Bn, nearly seven per cent of the world market size of USD 250 Bn.

- Government of India seeks to realise the electric dream of 400 Mn customers by the year 2030. Investment in Electric Vehicle (EV) startups has grown from USD 20 Mn in 2017 to USD 406 Mn in 2019.

- The Biotechnology sector of India is highly innovative and is on a strong growth trajectory. The sector, with its immense growth potential, will continue to play a significant role as an innovative R&D and a manufacturing hub. It is already a USD 62.5 Bn market and is set to reach USD 150 Bn by 2025.

- The ESDM sector in India has witnessed exponential growth in the past five years and is estimated to generate USD 100-130 Bn in economic value by 2025. Government of India has taken value initiatives to promote electronics manufacturing in the country, with a target of achieving positive net exports by 2025.
## Major Players (Global and Domestic)

<table>
<thead>
<tr>
<th>SECTORS</th>
<th>MAJOR PLAYERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logistics</td>
<td>TVS, white data, Stellar, Delhivery, Loadshare, BlackBuck, RIVIGO</td>
</tr>
<tr>
<td>Technical Textiles</td>
<td>Reliance, Arvind, Welspun, Ahlstrom Munksjö, Trident Group, Dupont, Johnson &amp; Johnson, Alok, Supreme, 3M, SRF, PG, Kimberly-Clark</td>
</tr>
<tr>
<td>Future Transport</td>
<td>Suzuki, Toshiba, Denso, Hyundai, Mahindra, Ola Electric, Ather, yulu, Lithium, Tata, ZYPP, Smart</td>
</tr>
<tr>
<td>Biotech</td>
<td>Biocon, Serum Institute of India Pvt. Ltd., Panacea Biotech, Dr. Reddy’s, Bharat Biotech, Wockhardt, Biocon Biologics, GVK Bio, Shantha Biotec, Novo Nordisk, Rasi, Jubilant Life Sciences</td>
</tr>
<tr>
<td>ESDM</td>
<td>1+, Oppo, Foxconn, Havells, Mediabrief, Bosch, Samsung, Nokia, Intel</td>
</tr>
</tbody>
</table>
LOGISTICS

Logistics: a sector that holds promise

• The logistics market in India is forecasted to grow at a CAGR of 10.5 per cent between 2019-25.

• India ranked 44th (out of 160 countries) in the Logistics Performance Index, 2018.

• Logistics costs in India are 13-15 per cent of the product cost, while the global average is 6 per cent.

• The government is planning to launch a National Logistics Policy aimed at bringing logistics costs below 10 per cent.

• Manufacturing in India holds the potential to contribute up to 25-30 per cent of the GDP by 2025 which will drive the growth of the warehousing segment in India.

• The logistics sector in India is expected to provide employment to 13.9 Mn people, up from the current 10.9 Mn, over the next four years (2018-22), making it the largest job-creator in the infrastructure space.

R&D avenues

• Internet of Things (IoT) – A company of the size of Union Pacific, the largest railroad in the US, uses IoT to predict equipment and component failures and saves up to USD 40 Mn in damages per incident.

• Automation – By eliminating manual intervention, the Qingdao New Qianwan Automatic Container Terminal has been able to reduce labour costs by up to 70 per cent and increase efficiency by 30 per cent.

• Seamless technology – With 100 per cent toll collection on national highways via FASTag, we stand to save as much as USD 1588.98 Mn per annum in terms of fuel as well as man-hours.

• Big data analysis – Companies with massive scale of operation such as GE and Cisco use their own analytics platforms like Predix8 or Unified Computing System (UCS) Integrated Infrastructure for Big Data9 respectively to manage and implement complex statistical analysis, data mining, and retrieval processes for big data that help identify key insights and trends.

• Blockchain technology – It can be used to create common networks among entities unwilling to share information, without compromising on the integrity of the data. This technology becomes especially relevant in the Indian context, given the fragmented nature of the sector and lack of common platforms to exchange information.
Outlook for Indian freight sector

- The port capacity is expected to grow at a CAGR of 5-6 per cent by 2022, thereby, adding a capacity of 275 - 325 MT.

- Indian Railways aims to increase its freight traffic from 1.1 Bn tons in 2017 to 3.3 Bn tons in 2030.

Benefits of coastline

- Over 80 per cent of India's goods travel by roads.

- India is blessed with a large coastline of 7500+ kms.

- Cost for coastal shipping is INR 0.15-0.2 per ton km compared to INR 1.5 for railways and INR 2.5 for road.

- Coastal shipping is energy-efficient, eco-friendly and reduces logistics costs.

E-Commerce factor

- India’s e-commerce revenue is expected to jump from USD 39 Bn in 2017 to USD 120 Bn in 2020, growing at an annual rate of 51 per cent, the highest in the world.

- In 2018, e-commerce alone accounted for 23 per cent share of the growth of warehousing facilities and the demand for warehousing shall increase exponentially in the future.

Government initiatives

- The logistics industry has been awarded infrastructure status which has made it easier for investment inflows and has become a major growth driver of the logistics industry.

- Introduction of the E-Way Bill.


- Setting up of a logistics division under the Department of Commerce.

- Development of dedicated freight corridors and logistics.

- Government of India is in the process of preparing an Integrated Transport and Logistics Policy.

- The government has also announced the Sagarmala Program which focuses on development along four thematic areas – port modernisation and new port development; port connectivity; port led industrialisation and coastal community development.

- The government has planned large-scale investments aimed at bringing down the cost of logistics from 14.4 per cent of GDP to about a 10 per cent level which will make the sector competitive.
The Case for FDI in Research and Development in India

TECHNICAL TEXTILES

• The USD 140.4 Bn textile market in India is expected to grow to USD 223 Bn by 2021. This sector which generates second largest jobs in India (45 Mn direct) is undergoing a massive transformation from conventional to technical textiles.

• Technical textiles in India have already established a market size of USD 17 Bn, seven per cent of the world market size of USD 250 Bn.

• Technical textiles has become a focus, sunrise sector for the government of India.

Business potential of technical textiles in India

• The current Indian technical textiles market is estimated at USD 17 Bn, growing at a CAGR of 12 per cent since 2013-14.

• Exports of technical textiles were at USD 1.97 Bn in 2018-19 growing at a CAGR of five per cent since 2013-14.

• Imports of Technical Textiles were at USD 2.2 Bn in 2018-19 growing at a CAGR of eight per cent since 2013-14.

R&D avenues –

• The production of technical textiles requires large investment in developing specialised high-performance fibre, high technology and modern production facilities.

• Companies in India have started developing technical textiles for automobiles, safety related textiles used by soldiers at high altitudes, ballistic fabrics etc.

It is one of the fastest growing sub-segments in India, a staggering 12 per cent as compared to the four per cent world average since 2013-14.

• Already contributing to about 0.7 per cent to India’s GDP at present, the technical textile sub-segment accounts for approximately 13 per cent of India’s total textile and apparel market which is all set to double in terms of revenue and production in the next five years.

• Technical textile sector in India has the ability to tap the global market worth USD 200 Bn.

• The penetration level of technical textiles is low in India, varying between 5-10 per cent as opposed to 30-70 per cent in developed countries.
**Companies investing in the technical textile sector**

- Number of multinational giants such as Procter & Gamble, Johnson & Johnson, Kimberly-Clark, Ahlstrom, SKAPs, 3M, Toray and Du Pont are actively engaged in the Technical Textiles sector and have set up their industrial plants in India.

**Foreign companies setting up GIC’s with foreign companies**

- Toray, a Japanese company joined hands with Kusumgar India to form Toray Kusumgar Advanced Textile Private Limited (TKAT) in India in 2014 as a Joint Venture (JV) for airbag fabric, and started production in 2016.

- Global Corporate giants - Lalbhai Group from India (Arvind) and PD FibreGlass group from Germany came together to start a JV to produce world class glass fibre, woven and nonwoven products in Ahmedabad, India. The JV formed in 2011 with the target to serve the growing Indian composite market with special focus on windpower, marine, pultrusion and automotive industry.

- US-based DuPont has tied up with textiles firm Arvind in 2011 to manufacture and market its Nomex branded fire resistant and industrial apparels in India.

- Kineco Kaman Composites India (KKCI) is a multinational JV between Kaman Aerospace Group (USA) and Kineco Limited (India). The JV is set up with its headquarters and manufacturing facility based in Goa with an objective of addressing the growing needs of global aerospace and defence companies.

- Strata India, established in 2004, is a JV with Strata Systems Inc., USA (part of the Glen Raven Group of Companies) to produce geotextiles. Strata India began manufacturing in its ISO certified manufacturing facility at Daman in early 2009.

- Vardhman Yarns & Threads Limited (VYTL) is a JV between Vardhman Textiles Ltd. (India) and American & Efird LLC (USA) engaged in manufacturing a range of specialty threads across different applications.

- Big domestic players like Reliance, Alok Industries, Welspun, Trident, Arvind, Aditya Birla, Kusumgarh Corporates, SRF, Century Enka, Supreme Nonwovens, Techfab India, Entremonde Polycoaters, Union, Pacific Non-Woven, Garware Wall Ropes, and Vardhman are also investing in the textile sector.
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State-specific strengths

- Gujarat contributes more than 25 per cent to the national technical textile business and has more than 800 technical textile units involved in each of the 12 sub-sectors of the functional textiles sectors.

<table>
<thead>
<tr>
<th>STATE</th>
<th>STRENGTHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tamil Nadu</td>
<td>Medical technical textiles, nonwovens, sport technical textiles and geotextiles</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>Woven technical textiles, coir fibre, ropes and corsages, and agrotech</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>Polyester textiles</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>Agrotech</td>
</tr>
<tr>
<td>Punjab</td>
<td>Sportech</td>
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## Centres of Excellence

<table>
<thead>
<tr>
<th>NAME</th>
<th>AREA OF WORK</th>
<th>ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern India Textile Research Association (NITRA)</td>
<td>Centre of Excellence for Protective Textiles</td>
<td>Sector-23, Raj Nagar, Ghaziabad, UP-201002</td>
</tr>
<tr>
<td>Ahmedabad Textile Industry's Research Association (ATIRA)</td>
<td>Centre of Excellence for Composites</td>
<td>Ambawadi Vistar, University Area, Ahmedabad, Gujarat-380015</td>
</tr>
<tr>
<td>Bombay Textile Research Association (BTRA)</td>
<td>Centre of Excellence for Geotech</td>
<td>Lal Bahadur Shastri Marg, Ghatkopar(W), Mumbai, MH-400 086</td>
</tr>
<tr>
<td>South India Textile Research Association (SITRA)</td>
<td>Centre of Excellence for Medical Textiles</td>
<td>13/37, Aavinashi Road, Coimbatore Aerodrome Post, Coimbatore, Tamil Nadu- 641014</td>
</tr>
<tr>
<td>Man-Made Textiles Research Association (MANTRA)</td>
<td>Centre of Excellence for Technical Textiles</td>
<td>Textile Market, Telephone Exchange, Ring Road, Surat, Gujarat-395002</td>
</tr>
<tr>
<td>Indian Jute Industries’ Research Association (IJIRA)</td>
<td>Centre of Excellence for Jute Geotextiles</td>
<td>17, Taratala Road, Kolkata, WB-700088</td>
</tr>
<tr>
<td>Wool Research Association (WRA)</td>
<td>Center of Excellence for Sportech</td>
<td>Akbar Camp Road, P.O. Sandoz Baug Kolshet Road, Thane, MH-400607</td>
</tr>
</tbody>
</table>
Government Initiatives

- The Indian government cleared a USD 195.97 Mn scheme to boost research, production, use and export of technical textiles.

- The bulk of the funds, USD 132.42 Mn, will be used to promote research and development in the field.

- The Cabinet Committee on Economic Affairs (CCEA) cleared a plan to set up a National Technical Textiles Mission (NTTM) under which steps will be taken in the four years up to 2024 to boost the industry. The NTTM aims at an average growth rate of 15-20 per cent a year, taking the domestic market size to USD 40-50 Bn by 2024.

- The Mission shall be set up for a four-year implementation period from 2020-24 and will have the following four components:
  - Component - I (Research, Innovation and Development)
  - Component – II (Promotion and Market Development)
  - Component - III (Export Promotion)
  - Component- IV (Education, Training and Skill Development)

Other schemes

- Harmonized System of Nomenclature (HSN) Codes for technical textiles
  In 2019, the Ministry of Textiles dedicated 207 HSN Codes to technical textiles to help in monitoring the data of import and export, in providing financial support and other incentives to manufacturers.

- Government of India allows 100 per cent FDI under automatic route
  International technical textile manufacturers such as Ahlstrom, Johnson & Johnson, Du Pont Procter & Gamble, 3M, SKAPS, Kimberly Clark, Terram, Maccaferri, Strata Geosystems have already initiated operations in India.

- Technotex India
  It is a flagship event organised by Ministry of Textiles in collaboration with Federation of Indian Chambers of Commerce and Industry (FICCI) and comprises of exhibitions, conferences and seminars with participation of stakeholders from across the global technical textile value chain.

- National Technical Textile Mission
  With a view to position the country as a global leader in technical textiles, the CCEA has given its approval to set up a National Technical Textiles Mission with a total outlay of USD 194 Mn in February 2020.

- Scheme for Integrated Textile Park (SITP)
  To boost entrepreneurship by providing financial support and state-of-the-art infrastructure, the scheme was launched in 2005 and has recently been extended for the period between 2017-20.
- **Centres of Excellence**
  Ministry of Textiles had launched Technology Mission on Technical Textiles (TMTT) with two mini-missions for a period of five years (2010-15) which entailed the creation of eight Centres of Excellence to provide infrastructure support, leading research and conducting tests of various technical textiles.

- **Scheme for Integrated Textile Park (SITP)**
  ATUFS's larger objective is to improve exports and indirectly promote investments in the textile machinery. Under ATUFS technology upgradation and CIS are offered to entities that are engaged in manufacturing textile and technical textile products under the guidance of Technical Advisory Monitoring Committee (TAMC).

### Electric Vehicles

- According to a World Economic Forum report, India is poised to become the world's third-largest consumer market with consumer spending growing to USD 6 Tn by 2030, from USD 1.5 Tn in 2018.

- India is a ready customer base and the government of India seeks to realise the electric dream of 400 Mn customers by the year 2030.

- Under the National Electric Mobility Plan (NEMMP) 2020, there is an ambitious target to achieve 6-7 Mn sales of hybrid and EVs year on year from 2020 onwards.

- NEMMP also targets 400,000 passenger Battery Electric Vehicles (BEVs) by 2020 avoiding 120 Mn barrels of oil and 4 Mn tons of CO₂. Total investment required for this will be around USD 3 Bn.

- Around 3600 electric cars were sold in 2019, which is about 0.1 per cent of 31.6 lakh fossil fuel-powered cars sold in the same year. This reflects the immense potential of investment in the electric mobility sector.

- Prominent companies such as Tata Motors, MG and Hyundai, have lately stepped up plans to create an EV ecosystem in India.

- Investment in EV startups has grown from USD 20 Mn in 2017 to USD 406 Mn in 2019. EV market penetration is only 1 per cent of total vehicle sales in India, and of that, 95 per cent of sales are electric two-wheelers.

- Besides the centre, eleven other states including Tamil Nadu, Kerala and Karnataka have designed and launched a comprehensive EV policy.
R&D priorities with respect to electric mobility

- Vehicle systems integration and lightweighting
- Rechargeable energy storage systems
- Advance chemistry cell and battery technologies e.g. Sodium-ion batteries
- Second-life battery usage, management and disposal
- Drives, power electronics and charging systems

Companies taking a head start

- In July 2019, automobile manufacturer Hyundai, pledged to invest USD 200 Mn over the next three years to develop affordable EVs for the Indian market.
- The Tata Group has announced plans to make electric cars and batteries, set up charging stations and build a battery recycling plant.
- Car manufacturer Mahindra & Mahindra is investing INR 18 Bn over the next three years into EV production to ramp up its four-wheeler production.
- Automotive Electronics Power Private Limited (AEPPL), a JV between Japanese companies Toshiba, Suzuki, and DENSO, has already invested USD 170 Mn to manufacture lithium-ion batteries in Gujarat. The JV is planning to invest an additional USD 520.1 Mn to start building the second phase of the battery manufacturing plant.

Contribution by academia in R&D

- IIT-D, in May 2019, inaugurated the Centre for Automotive Research and Tribology (CART), with a vision to become an internationally recognised centre in teaching, research, and technological service in the areas of EV, energy storage and monitoring, automotive health monitoring, calibration and diagnostics and tribology.
- The International Centre for Automotive Technology (ICAT), Manesar, located in the northern automotive hub of India, is a leading world class automotive testing, certification and R&D service provider under the aegis of National Automotive Testing and R&D Infrastructure Project (NATRiP).
The startup environment

• In India, the investment in EV startups soared to USD 406 Mn in 2019 from USD 20 Mn in 2017. With a funding of USD 300 Mn, Ola Electric Mobility emerged as the biggest beneficiary of that investment spree. Ola Electric was followed by startups such as Ather Energy, Lithium Cabs, Yulu, Zypp and SmartE.

• Startups such as Ather Energy have already invested sizable human capital for further R&D growth in the sector.

• Charging infrastructure startup, Exicom, has also partnered with MG Motors to ensure proper management of second-life batteries.

• In addition to development in EV and component manufacturing, Indian startups have been leading the micro-mobility and last-mile connectivity landscape. Bounce and BLive have played an important role in identifying universal application of green mobility.

• India’s fleet of battery-operated three-wheelers has expanded from 4,000 in 2010 to more than 1.5 Mn within less than a decade. Every month, 11,000 e-rickshaws are being produced in India.
Investment opportunities and government initiatives

- In order to promote the sale of EVs in the Indian market, the government launched the Faster Adoption and Manufacturing of Hybrid and Electric vehicles (FAME) scheme, under which, the government would provide certain incentives to lower the purchasing cost of EVs.

- Recently, the government notified Phase-II of the FAME Scheme, with an outlay of USD 1324.15 Mn for a period of three years commencing from 1 April 2019. The scheme includes demand incentives to the customers for purchasing EVs, incentives to the manufacturers for R&D besides developing the charging infrastructure.

- Recently, the GST Council reduced the taxes on EVs from 12 per cent to five per cent.

- Import duty on raw materials associated with lithium-ion batteries has been removed.

- The government has decided to fund up to 60 per cent of the R&D cost for developing indigenous low-cost electric technology that will help power two-and-three-wheelers and commercial vehicles operating in public spaces.

Benefits to the environment

- Leapfrogging to electric mobility can help India move towards its Paris Agreement commitment of reducing carbon emission intensity (emission per unit of GDP) by 33-35 per cent of 2005 level over 15 years.

- The country can save 37 per cent of carbon emissions in 2030 by pursuing a shared, electric, and connected mobility future.

- This would result in a reduction of 156 MTOE (Million Tonnes of Oil Equivalent) in diesel and petrol consumption for that year.

Projected demand in EV sector by 2026:

<table>
<thead>
<tr>
<th>AUTOMOBILE</th>
<th>PROJECTED DEMAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public EV chargers</td>
<td>~2 Mn</td>
</tr>
<tr>
<td>Buses</td>
<td>~250,000</td>
</tr>
<tr>
<td>Three-wheelers</td>
<td>~500,000</td>
</tr>
<tr>
<td>Passenger Cars</td>
<td>~1-2 Mn</td>
</tr>
<tr>
<td>Two-wheelers</td>
<td>~5-7 Mn</td>
</tr>
</tbody>
</table>
“I see a one-time opportunity for government and industry to work together to invest in manufacturing, R&D and the supply chain and make India the undisputed global hub of the EV world.”

— Anand Mahindra
Chairman, Mahindra & Mahindra

BIOTECHNOLOGY

• The potential of the sector is well recognised by the central government. The Department of Biotechnology (DBT) has introduced several initiatives to promote development of biotechnology in the country, across sectors like agriculture, affordable healthcare and medical technology, food and nutritional security, animal biotechnology, environmental safety, clean energy and bio-fuel, bio-manufacturing etc.

• Indian research services’ contribution to bioeconomy along with the Bio-IT and IT healthcare portfolio is estimated at USD 9.5 Bn.

Indian Bioeconomy at a Glance

| USD 12 Bn | 1 Mn | 2500+ | 15,500+ |
|———|———|———|———|
| India’s Biotech Industry Revenue | India’s Biotech Workforce | Biotech Companies in India | Biotech Graduates Every Year |

Source: ABLE (Association of Biotechnology Led Enterprises)

• India is among the top 12 biotech destinations in the world and the third largest in the Asia-Pacific region. India also has the second highest number of US Food and Drug Administration (USFDA)-approved plants, outside of the US and three per cent share in the global biotechnology industry.

• The country is also a leading supplier of the DPT, BCG and measles vaccines and supplies them across 150 countries. India already has 2600+ startups and a biotech workforce of a million.
Government initiatives for growth in R&D

- The New Drugs and Clinical Trials Rules, 2019 were released by the Ministry of Health and Family Welfare. These were launched to provide time-bound approvals i.e. 30 days for a drug developed in India, 90 days for a drug developed outside the country. This expedited clearance facilities led to an increase in R&D and clinical trials in India and has so far been positively received by industry.

- DBT has established the Biotechnology Industry Research Assistance Council (BIRAC), a PSU created to support startups, R&D and industry-academia collaboration in the sector. Under it, 50 bio-nest incubators have been set up, along with six bio-clusters and four regional centers.

- National Policy on Biofuels, 2018 allows production of biofuel from damaged and surplus food grains, a viability gap funding scheme for 2G ethanol Bio refineries of USD 662.08 Mn. This will support India reach its indicative target of 20 per cent blending of ethanol in petrol and 5 per cent blending of biodiesel in diesel, proposed by 2030. The DBT has made significant R&D efforts in this direction, major focus has been on development of second-generation biofuels. Three demonstration plants have been commissioned at Goa, Hyderabad and Mumbai. The department is supporting four DBT-Bioenergy Centres with specific goals and targets in accordance with the National Biofuel Policy.

- Small Business Innovation Research Initiative (SBIRI) scheme of the DBT aims to boost PPP efforts in the country. SBIRI is a first of its kind initiative that facilitates innovation, risk taking by small and medium companies and brings together private industry, public institutions and the government under one roof to promote research and innovation.

- Genetic Enhancement on Pulses Mission aims at providing farmers with improved and productive varieties, disease, and climate resilience. Under the programme DBT has funded a first network project entitled ‘Genetic Enhancement of Minor Pulses: Characterisation, Evaluation, Genetic Enhancement and Generation of Genomic Resources for Accelerated Utilization and Improvement of Minor Pulses’ with Institute of Life Science (ILS), Bhubaneswar as the coordinating centre. The project has 13 participating Institutions across the country.

- The Lok Sabha has passed the DNA Technology (Use and Application) Regulation Bill that allows regulated use of DNA, as the bill has provisions to establish National and Regional DNA Data Banks for the maintenance of the national forensic DNA database for the purposes of identification of missing persons/offenders/suspects/unknown deceased persons.

- National Guidelines for Stem Cell Research were formulated by DBT and ICMR, to ensure R&D remains ethical and responsible. Guidelines state that any stem cell use in a patient is investigational and it must only be done within the purview of an approved and monitored clinical trial and not offering it as therapy.

- India-UK Cancer Research Initiative launched in collaboration with Cancer Research UK (CRUK) is focusing on
affordability of cancer prevention and care and the potential to make significant progress against cancer consequences. Both CRUK and the DBT will invest USD 5 Mn each in this initiative.

- National Bio-Pharma Mission launched in May 2017 with a total cost of USD 250 Mn is co-funded by the World Bank. This is an industry-academia mission to accelerate bio-pharmaceutical development in India. Under this Mission, the Government has launched Innovate in India (i3) programme to create an enabling ecosystem to promote entrepreneurship and indigenous manufacturing in the biopharma sector. BIRAC is the implementing PSU for this.

- DBT also held India's first Biotechnology Summit, ‘Global Bio India 2019’ in November, at New Delhi. This three day summit convened industry, academia, state and central governments.

- The Indo-US Vaccine Action Programme (VAP) is a bilateral program of the DBT and the National Institute of Allergy and Infectious Diseases (NIAID) of the National Institutes of Health (NIH), USA and is under implementation since July 1987. The programme was extended for period of five years (up to 2022). It encourages vaccine development.

- Biotechnology Information System Network (BTISnet) aims to support database development and R&D activities in bioinformatics. Under this programme 152 bioinformatics centres are established in various universities and research institutions across the country.

- DBT has also established 16 theme-based institutions across the country. These institutions are pursuing basic, discovery and translational research in line with the national missions in the areas of agriculture biotechnology, animal biotechnology, medical biotechnology, clean energy and bioresource development, secondary agriculture etc.

- DBT under the innovations partnership with VINNOVA, Sweden had announced a joint call for proposals on ‘Artificial Intelligence for Advancing Healthcare across India and Sweden’ in 2018. The joint call aims to ensure sustainable and equitable spread of technology in advancing healthcare access and affordability.

- Genome India: The project will focus on the whole genome sequencing of representative populations across India and development of a genome wide association chip for Indian population to facilitate cost-effective large-scale genetic studies. The mega project hopes to form a grid after collecting 10,000 samples in the first phase from across India, to arrive at a representative Indian genome. The National Genomics Core has also been launched by DBT. The core national facility is at the National Institute of Biomedical Genomics, Kalyani, and two regional facilities are in north-central region (University of Allahabad) and south-central region (Centre for DNA Fingerprinting and Diagnostics, Hyderabad). The Core is intended to be a one-stop-shop for all genomics services through encouragement of startups, skill building in genomics and provision of specialised genomics facilities and expertise.

- DBT has spent an estimated USD 100.88 Mn to support autonomous R&D institutions and USD 195.31 Mn on biotechnology R&D, human resource development and research resources facilities.
State incentives

India's biotech sector has attracted a significant amount of attention over the past two decades. Several global companies have aggressively joined hands with Indian companies due to India's strong generic biotechnology potential. Several states have recognised the potential of the sector and constituted their own biotechnology policies, with several identifying it as a thrust sector within their industrial policies also.

Other than policies, Karnataka and Telangana have been organising their flagship biotech specific mega events called India-Bio and Bio-Asia respectively every year to attract, develop and retain high-quality investments in biotech sector in the state.
Advantages of investing in R&D

• With the country offering numerous comparative advantages in terms of R&D facilities, knowledge, skills and cost effectiveness, the biotechnology industry in India has immense potential to emerge as a global key player.

• India has a biotechnology workforce of over a million (2019) and offers potential cost savings of 30-40 per cent compared to western markets for human capital. India also benefits from a demographic dividend as India has one of world’s youngest workforces, with an average age of 29.

• DBT has also supported 695 research institutions, 116 colleges and trained 1200 teachers. It has also established 16 theme-based institutions across the country. These institutions are pursuing discovery and translational research in line with the National Missions in the areas of agriculture biotechnology, animal biotechnology, medical biotechnology, clean energy and bioresource development, secondary agriculture, etc.

• The country benefits from a range of R&D incentives at the state and central levels, with several states offering co-financing of R&D projects, grants, and subsidies. The Ministry of Science and Technology has received its largest-ever allocation of funds this fiscal year (2019-2020). DBT was one of the biggest beneficiaries as it received a budget of USD 341.63 Mn, which is a hike of USD 21.05 Mn from the previous year.

• India is the second most populous nation in the world and according to the World Health Organization, accounts for about 20 per cent of the global disease and is therefore a suitable destination to conduct clinical trials for new drugs and medical techniques. It also benefits from a rich biodiversity in flora and fauna, along with tremendous genetic diversity.

• India currently has a marginal share in the global market for industrial enzymes, importing ~70 per cent of the enzymes in the country. Hence, there is an opportunity in focused R&D and knowledge-based innovation in the field of industrial enzymes, which can innovatively replace polluting chemical processes into eco-friendly processes that also deliver environmental sustainability. The food enzymes market segment is expected to witness strong growth as the application of enzymes in the industry, as well as the demand for processed food, is rising.

• DBT has come up with ‘National Biotechnology Parks Scheme’ in which it is proposed to create an ecosystem to absorb the start-ups which have graduated from the incubators and give them a platform for further scaling up their R&D activities in collaboration with the state government and industry. The Department so far, has supported 9 Biotechnology Parks in various States. These are:
  - Biotech Park, Lucknow, Uttar Pradesh.
  - Biotechnology Incubation Centre, Hyderabad, Telangana.
  - Tidco Centre For Life Sciences (TICEL)
  - Biotech Park, Chennai, Tamil Nadu.
  - The Golden Jubilee Biotech Park for Women, Chennai, Tamil Nadu;
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- Biotech Park Technology Incubation Centre, Guwahati, Assam.
- Biotechnology Incubation Centre, Cochin, Kerala;
- Biotechnology Park, Bangalore, Karnataka;
- Industrial Biotechnology Parks (IBTPs), Jammu & Kashmir
- Chhattisgarh Biotech Park, Naya Raipur, Chhattisgarh.

**ELECTRONIC SYSTEMS DESIGN AND MANUFACTURING (ESDM)**

ESDM sector in India has witnessed exponential growth in the past five years and is estimated to generate USD 100-130 Bn in economic value by 2025. Government of India has taken value initiatives to promote electronics manufacturing in the country, with a target of achieving positive net exports by 2025.

**Market Overview**

<table>
<thead>
<tr>
<th>Year</th>
<th>Imports</th>
<th>Domestic Production</th>
<th>Total</th>
<th>Exports</th>
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<td>2014-15</td>
<td>6</td>
<td>29.2</td>
<td>35.8</td>
<td>5.9</td>
</tr>
<tr>
<td>2015-16</td>
<td>5.9</td>
<td>37.4</td>
<td>43.3</td>
<td>5.9</td>
</tr>
<tr>
<td>2016-17</td>
<td>5.9</td>
<td>42.8</td>
<td>48.7</td>
<td>6.4</td>
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<td>2017-18</td>
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<tr>
<td>2018-19</td>
<td>8.8</td>
<td>70</td>
<td>78.8</td>
<td>118.2</td>
</tr>
</tbody>
</table>

Source: Ministry of Electronics and Information Technology (MeitY)
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ESDM landscape in India

- According to estimates from a research initiative conceived by the Ministry of Electronics and Information Technology (MeitY) Indian market for electronic goods is growing at a CAGR of 27 per cent and is expected to reach USD 400 Bn by 2025.
- Domestic electronics manufacturing has already witnessed unprecedented growth over the past five years. With over 2x growth, electronics production output increased from USD 29 Bn in 2014-15 to USD 70 Bn in 2018-19.

![Domestic Electronics Production Graph](image)

- India has indeed become the global hub for electronics design with almost 2,000 chips being designed every year and around 500,000 engineers employed in the innumerable aspects of this field.
- In India, VLSI and EDA make up the biggest percentage of the Indian semiconductor design industry.
- Superior digitisation across different verticals has led to the increased penetration of Indian electronics design houses in the LED illumination, communications and broadband equipment and automotive electronics. India’s strength in design systems is based on three main factors:
  - Robust abilities in entrenched systems design.
  - Enormous sum of electronics engineering graduates.
  - Increase in demand due to a sizeable number of Indian SMEs and startups.
R & D in ESDM

• R&D support for concept-to-market innovation can add enormous value in all sectors of electronics along with simplified clearance procedures for import of goods required for R&D. Hence, the Government of India has been dynamically collaborating with industry players, institutions and academia to support and produce world-class research and facilities.

• Currently, there are over 1,140 centers in India that are dedicated to product development and R&D and employ over 9,00,000 professionals.

Advantages to invest in R&D

• India adds 6000 PhDs, 200,000 engineers, 300,000 non-engineering postgraduates, and 2.1M other graduates to its workforce annually. Cost of hiring a researcher in India is one-fifth of that of the US.

• The Electronic Manufacturing Services (EMS) industry is expected to be a noteworthy contributor to the entire industry’s development.

• India has strong design and R&D capabilities in auto electronics and industrial economics.

• The Government is actively promoting the development of Electronics Manufacturing Clusters (EMCs) throughout the country in order to provide world-class infrastructure and facilities.

• Some of the major government initiatives such as Digital India, Make in India and supportive policies including favourable FDI policy for electronics manufacturing, have shortened the process of setting up manufacturing units in India.

• India is the second fastest digitising economy amongst the 17 main economies of the world.

• There is a huge demand for electronic goods in the Middle Eastern countries and in emerging markets such as North Africa and Latin America. This provides an export market for Made in India electronic goods. India has a flourishing startup ecosystem. We are second to US for hosting the largest number of startups. Several accelerator programs powered by global giants have been announced for mentoring startups.

• Intensifying the R&D ecosystem for the Indian electronics sector will be crucial for the development of indigenous technology, transfer to industry for commercialisation, and increasing the IP within the country.
• To add to its strengths, currently 1500+ global in-house centers are operated by MNCs across India. The matured ITeS firms that have reached scale and the abundance of local talent have been key drivers for India emerging as an attractive destination for offshore Engineering and R&D (ER&D) services.

• Government of India is also incentivising R&D in the country through income tax deductions to write off revenue and capital expenditure, tax deductions for any sum paid to a research association, custom duty exemption to in-house R&D units for capital equipment and consumables and accelerated depreciation for investmenton machinery based on indigenous technology.
References

- https://www.makeinindia.com/article/-/v/logistics-sect-1
- https://dipp.gov.in/publications/fdi-statistics
- https://www.ibef.org/industry/research-development-india.aspx
- https://www.makeinindia.com/article/-/v/logistics-a-bright-future
- https://www.livemint.com/
- https://www.grandviewresearch.com/industry-analysis/indian-technical-textile-market
- https://md.iitb.ac.in/node/101505
- https://www.ibef.org/industry/biotechnology-india/showcase
- https://birac.nic.in/
- Ministry of Textiles
- https://bibliotecadigital.rdc.org.br/xmlui/handle/11441/70357
- https://bibliotecadigital.rdc.org.br/xmlui/handle/11441/70357