SCIENCE AND TECHNOLOGY
## Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Summary</td>
<td>3</td>
</tr>
<tr>
<td>Advantage India</td>
<td>4</td>
</tr>
<tr>
<td>Market Overview</td>
<td>6</td>
</tr>
<tr>
<td>Growth Drivers</td>
<td>17</td>
</tr>
<tr>
<td>Opportunities</td>
<td>28</td>
</tr>
<tr>
<td>New Developments</td>
<td>33</td>
</tr>
<tr>
<td>Key Industry Contacts</td>
<td>34</td>
</tr>
<tr>
<td>Appendix</td>
<td>36</td>
</tr>
</tbody>
</table>
Executive summary

1 Huge talent pool

- Third-largest technical manpower in the world.
- As of October 2020, there were 958 universities in the country.
- In November 2020, 1,494 Indians were listed among the top 2% scientists in the world.
- India ranks 8th in the world in terms of the number of students graduating in science and engineering stream.
- India stood at third spot in the number of science and engineering publications in the world.
- Between January 2019 and September 2020, there were ~2,359 R&D projects, 989 fellowships, 1,371 publications, 14,163 ongoing projects and 452 innovations.

2 Policy framework

- Policies aimed at projecting India as a Science and Technology powerhouse and promoting both public and private sector involvement in the R&D practice.
- In December 2020, the Minister for Petroleum & Natural Gas and Steel, Mr. Dharmendra Pradhan, appealed to the scientific community to ‘Innovate for India (I4I)’ and create competitive advantages to make India ‘Aatmanirbhar’.

3 Rising investment

- With more and more multinational companies setting up their R&D centres in India, the sector has seen an uptrend in investment in recent years.
- Under the Union Budget 2020-21, the Government announced the largest ever allocation of Rs. 6,302 crore (US$ 901.70 million) to the Ministry of Science and Technology, Rs. 2,787 crore (US$ 398.77 million) to the Department of Biotechnology and Rs. 5,385 crore (US$ 770.50 million) to the Council for Scientific and Industrial Research.

4 Growing biotechnology sector

- The biotechnology sector, due to its multidisciplinary approach, holds the potential to provide innovative solutions for improving crop varieties, that may increase production and provide better yields to farmers, while reducing the dependence on heavy consumption of water and energy.

5 Global Innovation Index

- At rank 48, India stands among the top 50 countries in the Global Innovation Index 2020.

Source: RBI, India Budget
Advantage India

1 Robust Demand
► Rising income and evolving lifestyles have led to higher demand for aspirational products.
► India’s gross expenditure on R&D (GERD) has been consistently increasing over the years. India’s GERD as a percentage of GDP stood at 0.86% in 2020.
► Indian players are set to benefit from expiration of patents.
► Expanding middle-class and increasing affordability are demand drivers for technologically advanced products.

2 Rising private activity
► Establishment of CoEs in various areas. NMITLI initiative on PPP basis.
► Increased investment by private players. setting up of R&D centres.

3 Policy Support
► The Ministry of Science & Technology has started various schemes such as Biomedical Research Career Programme (BRCP) and Ramanujan Fellowship to provide Indian researchers living in foreign countries with attractive avenues and opportunities to work in Indian institutes and universities.
► Indian Institutes of Information Technology Laws (Amendment) Bill, 2020, was introduced to provide knowledge in the IT field.

4 Attractive Opportunities
► India’s medical technology (MedTech) sector is forecast to reach US$ 7.8 billion in 2020 and US$ 9.6 billion in 2022.
► India is the top exporter of IT products and has the third-largest pharma sector and a fast-growing contract research segment.
► For designing and testing the product, Government is setting up high-tech R&D facility by bringing together scientific research and commercial activities under one roof.

Notes: CoE - Center of Excellence, PPP - Public Private Partnership, TRIPS - Trade Related Aspects of Intellectual Property Rights, NMITLI - New Millennium Indian Technology Leadership Initiative, NIC - National Innovation Council; Figures mentioned are as per latest data available

Source: IPI India Annual Report, PWC report
Market Overview
# Evolution of science and technology policy framework in India

<table>
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<tr>
<th>Year</th>
<th>Key Initiatives</th>
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| 2013 | - Science, Technology and Innovation Policy aims to develop synergies between science, technology and innovation. Ethnic diversity and varying demographics attracted investment from various players  

- "Innovation of Science Pursuit for Inspire Research (INSPIRE)" initiative was launched to communicate with the youth population and attract talent to the scientific field  

- The total plan outlay allocated under the Union Budget 2015-16 for the Department of Science and Technology is around US$ 557.1 million | |
| 2014 | - New Initiatives such as SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds), etc. have been taken to support young talent and attract innovation  

- Scientific and Technological (S&T) Activities Survey 2015-16 aims to collect data on resources devoted to R&D in science and technology. The information is collected from about 5000 R&D organisations present across the country | |
| 2015 | - New Initiatives such as the Science, Technology, Innovation and Creation of Knowledge (STICK) framework has been taken by the Indian Government to support innovation | |
| 2016 | - Achievement: Indian Space Research Organisation (ISRO) made history after placing 104 satellites into space in a single mission through its Polar Satellite Launch Vehicle (PSLV)  

- Science, Technology and Innovation Policy 2020*: The new policy revolves around the core principles of being decentralised, evidence informed, bottom-up, experts-driven and inclusive approach. | |
| 2017 | | |
| 2020 | | |

*Source: Department of Science and Technology, Ministry of HRD, Government of India, Union Budget 2015-16, "Draft Stage"
Indian science and technology system

1 Government funding and development agencies
2 Academic sector
3 Socio-economic Ministries
4 Industrial R&D systems
5 R&D by Multinational companies
6 R&D in NGO groups
7 R&D bodies

Note: STI refers to Science Technology and Innovation
Source: Changing Indian STI Landscape Presentation, Department of Science and Technology
India among the world’s leading R&D investors

- India’s gross expenditure in R&D was forecast to reach US$ 96.50 billion by the end of 2020.
- India moved up to fifth rank in Global R&D Funding Forecast 2020.
- R&D investment has helped Indian companies to overcome tight competition with affordable products internationally.
- Indian Robot Mitra, designed in Bengaluru and made in China, which can recognise people by their nationalities and guide customers in a bank, has attracted the attention of Chinese manufacturers at an information technology (IT) event held at Dalian, China.
- At a webinar organized to celebrate 50 years of the Department of Science and Technology (DST), on December 7, 2020, the Vice Chairman of NITI Aayog, Dr. Rajiv Kumar stated that the Indian economy will be among the top economies worldwide in the next few years, using science, technology and innovation in all sectors and bouncing back from the aftermath of COVID-19.

Notes: R&D - Research and Development, F - Forecast., * in Purchasing Power Parity terms
Source: Nature Magazine, Battelle, R&D Magazine
**Manpower and investments**

<table>
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<th>India has a strong network of science and technology institutions and trained manpower</th>
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<td>▪ India is among the top-ranking countries in the field of basic research.</td>
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<td>▪ It has the third-largest scientific and technical manpower in the world.</td>
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<td>▪ The Council of Scientific and Industrial Research runs 44 research laboratories.</td>
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<td>▪ India ranks 7th among highly productive countries in science and technology research.</td>
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<td>▪ Britain and India’s research partnership will reach GBP 400 million (US$ 544 billion) by 2021, which include 175 different UK and Indian research institutions and more than 100 industry partners.</td>
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<td>▪ TechnoPro, a Japanese tech firm, plans to hire 10,000 engineers and researchers in India by 2022-23.</td>
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<td>▪ HCL Technologies plans to hire 10,000 freshers in FY20.</td>
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<td>▪ Similarly, in February 2020, Capgemini announced plans to hire 30,000 employees in the country by 2021.</td>
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<td>▪ India’s largest IT giants including Tata Consultancy Services (TCS), Infosys, Wipro and HCL Technologies added &gt;17,000 people including freshers and lateral hires in the second quarter of FY21 amid the COVID-19 pandemic.</td>
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<th>Strengthening India’s position in research through investment</th>
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<td>▪ India ranks third in global research publication output.</td>
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<td>▪ India’s R&amp;D expenditure is expected to double with government and private sector funding.</td>
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<td>▪ A series of new investments were recently announced by Cisco India to enhance cyber security infrastructure in India. It will enable to build transparent and secure digital infrastructure environment for accelerating India’s digital transformation.</td>
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<td>▪ Cisco India has signed an memorandum of understanding (MoU) with Indian Computer Emergency Response Team (CERT-In) to establish a threat intelligence sharing programme.</td>
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<td>▪ Under the National Initiative for Developing and Harnessing Innovations (NIDHI) programme, Indian Government plans to invest US$ 29.75 million for setting up 100 incubators across the country in the next 4 years to support start-ups.</td>
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<td>▪ In the last three years (2017-20), ~Rs. 310 crore (US$ 42.23 million) have been invested to support the use of biotechnology in agricultural applications, including in organic farming through Biotech-KISAN programme.</td>
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*Notes: R&D - Research and Development  
Source: R&D Magazine, JLL*
Strong growth in R&D investments in India over the years

- By 2022, R&D expenditure is targeted to reach at least 2% of the GDP by 2022.
- To facilitate protection and commercialising of IPRs, these schemes will be providing access to high-quality intellectual property services and resources. Moreover, under these schemes, the central Government will bear the fees for facilitators for patents, trademarks or designs that a start-up may file. Start-ups will only bear the cost of the statutory fees payable.
- As per the Union Budget 2019-20, the Government set up National Research Foundation for R&D.

Notes: R&D - Research and Development, F - Forecast, in Purchasing Power Parity terms
Source: R&D Magazine, International Monetary Fund, World Bank, CIA Fact Book, OECD, Department of Science and Technology, WIPO
India is also garnering the benefits of R&D outsourcing

- India has become one of the most preferred location for engineering offshoring. Companies across sectors (such as IT, consumer electronics, personal devices, medical electronics, telecom and automobiles) are now offshoring complete product responsibility.
- Engineering R&D products and services are growing at the fastest rate in the technology sector in India.
- The engineering R&D and product development market in India is forecast to grow at a CAGR of 10.65% to reach US$ 42 billion by FY22 from US$ 31 billion in FY19.
- Newer capabilities such as supply chain, regulatory compliances and manufacturing engineering are being developed by Engineering R&D service providers.
- Service providers in Europe are scaling up and setting offshore operations in India to access cost effective large talent pool.

Notes: R&D - Research and Development, IT - Information Technology; Figures mentioned are as per latest data available
Source: The IT-BPM Sector in India 2020 report by NASSCOM
### Organisation Business description

#### Council of Scientific and Industrial Research (CSIR)
- CSIR is India’s largest R&D organisation, with 38 national laboratories, 39 outreach centers, 3 Innovation Complexes, 5 units, 4600 active scientists supported by about 8000 scientific and technical personnel. On an average, CSIR files about 200 Indian patents and 250 foreign patents per year. About 13.86% of CSIR patents are licensed, a number which is above the global average.
- CSIR is ranked 84 among 4,851 institutions worldwide and was the only Indian organisation among the top 100 global institutions in 2014.
- In April 2020, Institute of Genomics and Integrative Biology (CSIR-IGIB) and TATA Sons signed an MoU for licensing of KNOWHOW for FNCAS9 Editor Linked Uniform Detection Assay (FELUDA) for rapid diagnosis of COVID-19.

#### Defence Research and Development Organisation (DRDO)
- DRDO is engaged in design and development of weapon systems and equipment in accordance with the requirements of the military services.
- DRDO has a network of 50 labs and establishments to carry out research. As of FY20, it had over 7,410 personnel in Defence Research and Development Services (DRDS) and about 25,000 other scientific, technical and supporting personnel. DRDO offered around 450 patents for free access to industries in 2019.
- Its research areas include aeronautics, armaments, combat vehicles, electronics, instrumentation engineering systems, missiles, materials, naval systems, advanced computing, simulation and life sciences.
- In May 2020, Hyderabad based DRDO’s premier lab, Research Centre Imarat (RCI), developed an automated contactless UVC sanitisation cabinet called Defence Research Ultraviolet Sanitiser (DRUVS).

#### Indian Council of Agricultural Research (ICAR)
- ICAR is one of the largest national agricultural organisations in the world. It consist of 69 institutes and 63 agricultural universities across India.
- It is the apex body for coordinating, guiding and managing research and education in agriculture, including horticulture, fisheries and animal sciences in India.
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| **India Space Research Organisation (ISRO)**     | - The organisation has 19 centers across India to pursue R&D activities. ISRO currently has a constellation of 9 communication satellites, 1 meteorological satellite, 10 earth observation satellites and 1 scientific satellite.  
- Its research area include communication satellites for television broadcast, telecommunications and meteorological applications and remote sensing satellites for management of natural resources.  
- ISRO has planned 36 missions including satellites and launch vehicles for FY21.  
- Radar imaging satellite RISAT 2BR1 was to be launched by end of May 2019.  
- In January 2019, Polar Satellite Launch Vehicle (PSLV-C44) successfully inserted two satellites, Microsat-R and Kalamsat-V2, into their orbits.  
- In April 2019, Polar Satellite Launch Vehicle (PSLV-C45) launched EMISAT and 28 satellites from international customers.  
- India's largest liquid hydrogen storage tank was shipped in May 2019.                                                                                                                                                                                                                  |
| **Indian Council of Medical Research (ICMR)**    | - ICMR is the apex body in India for the formulation, coordination and promotion of biomedical research and one of the oldest medical research bodies in the world.  
- The council has a fleet of 21 institutes (mission oriented national institute), 6 regional medical research centres and 5 units engaged in medical research.  
- The council’s research priorities encompass the areas of communicable diseases, fertility control, maternal and child health, nutritional disorders and non-communicable diseases such as cancer, cardio-vascular diseases, blindness and diabetes.  
- In May 2020, ICMR-National Institute of Virology (NIV) at Pune developed and validated the indigenous IgG ELISA test “COVID KAVACH ELISA” for antibody detection for COVID-19.                                                                                     |
| **Centre for Development of Advanced Computing (C-DAC)** | - C-DAC is a premier R&D organisation of the Department of Information Technology (DIT).  
- It is engaged in research in the areas of supercomputers, applied electronics, technology, applications and health informatics.                                                                                                                                                                                                                     |
### Institutes and universities

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| **Indian Institute of Technology (IIT)** | It is a group of autonomous engineering and technology-oriented institutes of higher education.  
• IITs have been planning to monetise intellectual properties (IPs) by exploring tie-ups with firms that invest in "inventions".  
• Indian Institute of Technology (Guwahati, Kanpur, Madras) and Germany’s Heidelberg University are collaborating for the research training and setting first Joint Indian-German Research Training Group. |
| **National Dairy Research Institute (NDRI)** | NDRI is engaged in research, teaching and extension activities in areas of dairy production, processing, management and human resource development.  
• Its research activities focus on improving dairy productivity, innovating milk processing technologies and disseminating information to the various stakeholders in dairy business to make dairying a self-sustaining business. |
| **Indian Institute of Science (IISc)** | IISc is one of the earliest instances of PPP for a research institute in India.  
• It is engaged in research in various departments of science such as biological, chemical, electrical, mathematical, physical and mechanical sciences. A new center for Brain Research is expected to contribute to future growth. |

**Note:** R&D - Research and Development, IP - Intellectual Property  
**Source:** Organisational website, IP India
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<th>Organisation</th>
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| Hindustan Unilever Limited           | **Hindustan Unilever Limited**  
|                                      | • HUL is credited with innovations in product areas such as structured bar soap, fairness cream, zero alcohol soap, poly-coated scouring bar for dishwashing, fortified salt, instant tea, critical components for a water purifying device, and value-added (nature care) tea.  
|                                      | • Worldwide, HUL has over 20,000 registered patents and patent applications.                                                                                                                                                                                                                                                                                                                                               |
| Tata Steel Limited                   | **Tata Steel Limited**  
|                                      | • Tata Steel undertake research in areas such as raw materials and coke, iron and ferro alloys, steel making, coated products, materials characterisation and joining, materials modelling and product design and refractory technology.  
|                                      | • The total value of patents and trademarks stood at Rs. 46.5 million (US$ 0.72 million) in FY19.                                                                                                                                                                                                                                                                                                                     |
| Cipla Limited                        | **Cipla Limited**  
|                                      | • Cipla’s R&D division focuses on new product development and new drug delivery system across a range of therapies  
|                                      | • It is among the top companies domestically in R&D spending.                                                                                                                                                                                                                                                                                                                                                               |

*Note: R&D - Research and Development, ANDA - Abbreviated New Drug Application  
Source: Organisational website*
Strong policy framework to promote India as a R&D hub

Policy support

- Strengthening capacity for basic research
- Strengthening institutional capacity for research
- Strengthening human capacity for research

Resulting in

Increasing investment and growth in R&D

Note: R&D - Research and Development
Source: ICRA, Deloitte, PWC
### Project funding

- In December 2020, the Ambassadors of France and Germany, and the European Union announced to work out a detailed plan to fund more eco-friendly projects in Kerala in the coming years.
- On October 12, 2020, the Finance Minister, Mrs. Nirmala Sitharaman, announced a Rs. 12,000 crore (US$ 1.63 billion) interest-free, 50-year loan to states for spending on capital projects in a bid to boost economy.
- On September 23, 2020, a loan agreement was signed with Cocoslab Innovative Solutions Pvt. Ltd., Bangalore, for Rs. 27.5 million (US$ 375.13 thousand) against overall project expense of Rs. 59 million (US$ 806.11 thousand) for partial funding of the project—advanced video analytics for low-cost thermal cameras to recognise people in public places with irregular body temperatures.

### MSME development

- Modulus, a start-up in IIT Madras research park, signed an MoU with Sree Chitra Institute for Medical Sciences and Technology (SCTMIST) for a collaborative effort to develop deployable field hospital structures to combat COVID-19.
- In November 2020, the Engineering Exports Promotion Council India and the National Institute of Design collaborated to promote and upgrade designs and technology for the medical devices industry, enabling it to meet the emerging needs of the country’s health sector.
- In August 2020, CAWACH, was launched as Department Of Science & Technology (DST) programme to support start-ups, which have developed indigenous products/solutions across various domains such as ventilators & medical devices, disinfectants, PPE kits, diagnostic kits and informatics. Out of the 826 applications received, 51 start-ups have been extended for the first round of funding.

### Technology department

- In September 2020, the technology license agreement was signed on ‘Brucella abortus S19Δ per vaccine’ between ICAR- Indian Veterinary Research Institute (IVRI) and Hester Biosciences Limited to aid the National Control Programme on Brucellosis.

*Source: Department of Science and Technology, Government of India, and Other Government website*
Key government initiatives... (2/4)

4

Science Technology and Innovation Strategy, 2020

- Under the new Science Technology and Innovation Strategy, 2020, which seeks to make this arena more inclusive and diverse, science and technology institutes will be rated on the basis of the support they offer to female workers.

5

Human capacity building

- Women Scientists Scheme: Four meetings have been conducted with Principal Investigators of Women Scientists Scheme-A (WOS-A), wherein ~120 women scientists from Physical and Mathematical Sciences, Engineering and Technology, Earth and Atmospheric Sciences and Chemical Sciences participated in these meetings. In September 2020, 45 sanctions were issued under WOS-A and WOS-B programmes.
- Special Online Classes: In September 2020, 99 online classes have been conducted for girls selected under ‘Vigyan Jyoti’ programme to build academic strength, help students clarify concepts and develop skills to participate in competitive examinations.

6

SERB-POWER (Promoting Opportunities for Women in Exploratory Research)

- In August 2020, SERB approved implementation of a Scheme - SERB-POWER (Promoting Opportunities for Women in Exploratory Research), to mitigate gender disparity in science and engineering, research funding in S&T programmes in Indian academic institutions and R&D laboratories.

7

India International Science Festival

- The Ministry of Science and Technology and Ministry of Earth Sciences, in association with Vijnana Bharati (VIBHA), created a unique platform, India International Science Festival, since 2015 to promote India’s vision in developing the spectrum of scientific temper in India and abroad.

Source: News articles, Government website, swissnex India
Interdisciplinary Cyber Physical Systems (ICPS)
- To promote R&D in this emerging field of research, Department of Science and Technology (DST) launched Interdisciplinary Cyber Physical Systems (ICPS) with an outlay of Rs. 3,660 crore (US$ 507.28 million) in 2019.
- Under the mission, 15 technology innovation hubs, six application innovation hubs and four technology translation research hubs are going to be established in the next five years.

Rural development
- On September 30, 2020, the Minister of Science & Technology, Earth Sciences and Health & Family Welfare, Dr. Harsh Vardhan, launched CSIR technologies for rural development under a joint initiative of Council of Scientific & Industrial Research (CSIR), Unnat Bharat Abhiyan (UBA), Indian Institute of Technology Delhi (IITD) and Vijnana Bharti (VIBHA). The technologies released included the following:
  - Improved beehive for quality and hygienic extraction of honey, CSIR-IHBT, Palampur;
  - Technology for manufacturing ‘Ginger’ paste, CSIR-CFTRI, Mysore;
  - Dehumidified drier for food and agri products, CSIR-NIIST, Thiruvananthapuram; and
  - Technology for agricultural waste based biodegradable plates, cups and cutleries, CSIR-NIIST, Thiruvananthapuram

Scientific Infrastructure Building September 2020
- Scientists from Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru and Indian Institute of Science (IISc), Bengaluru have devised a unique way to observe the devitrification process under a microscope in real time.
- A new sensor to detect biogenic thiols was developed by Indian Association for the Cultivation of Science (IACS), Kolkata.
- A new programme on ‘Technology Readiness Level Assessment’ was initiated by Technology Information, Forecasting & Assessment Council (TIFAC), New Delhi, to develop and manage the technology portfolio in select institutions such as research laboratories, academia, Atal innovation labs and TBIs.

Source: News articles, Government website
Other initiatives

- In September 2020, Remedial Action, Knowledge Skimming and Holistic Analysis of COVID-19 (RAKSHAK) became a part of Technology Innovation Hub (TIH) in IIT, Jodhpur. The various projects under RAKSHAK include developing a technology platform based on Artificial Intelligence (AI) to mitigate situations arising amid/due to the ongoing COVID-19 pandemic.

Source: News articles
3 Indian Institutes of Information Technology Laws (Amendment) Bill, 2020

- On September 22, 2020, Rajya Sabha passed the Indian Institutes of Information Technology Laws (Amendment) Bill, 2020 to provide knowledge in the field of Information Technology to offer solutions to challenges faced by the country.

2 O-SMART (Ocean Services, Modelling, Applications, Resources and Technology) scheme

- Ocean Services, Modelling, Applications, Resources and Technology (O-SMART) scheme of the Ministry of Earth Sciences is as follows:
  1. To generate and regularly update information on marine living resources and their relationship with the physical environment in the Indian Exclusive Economic Zones (EEZ).
  2. To periodically monitor levels of sea water pollutants for health assessment of coastal waters of India to develop shoreline change maps for assessment of coastal erosion due to natural and anthropogenic activities.
  3. To develop a range of state-of-the-art ocean observation systems to collect real-time data from seas around India.

1 Union Budget 2020-21

- The allocation to the Department of Science and Technology (DST) has been increased to Rs. 6,302 crore (US$ 901.70 million) against the previous budget.
- Under the Union Budget 2020-21, the Government of India announced the largest ever allocation of Rs. 14,473 crore (US$ 2.07 billion) to the Ministry of Science and Technology. The Department of Atomic Energy has been allocated Rs. 18,229 crore (US$ 2.61 billion).
- The Ministry of Earth Sciences was allocated Rs. 2,070 crore (US$ 296.18 million).

Note: PPP - Public Private Partnership
Source: Battelle, Electronics for You, Organisational website
The Ministry of Science & Technology has formulated following schemes to provide attractive avenues and opportunities to Indian researchers who are residing in foreign countries to work in Indian Institutes and Universities.

1 Visiting Advanced Joint Research (VAJRA) Faculty Scheme
- Visiting Advanced Joint Research (VAJRA) Faculty Scheme aims to encourage overseas scientists and academicians including Non-resident Indians (NRI) and Overseas Citizen of India (OCI) to work in public-funded institutions and universities in India.

2 Ramanujan Fellowship
- Ramanujan Fellowship provides attractive avenues and opportunities to Indian researchers of high calibre, who are residing abroad, to work in Indian institutes/universities in all areas of science, engineering and medicine.

3 Ramalingaswami Re-entry Fellowship
- Ramalingaswami Re-entry Fellowship programme aims to encourage scientists (Indian Nationals) working outside the country, who would like to return to their home country to pursue their research interests in life sciences, modern biology, biotechnology and other related areas.

4 Biomedical Research Career Programme (BRCP)
- Biomedical Research Career Programme (BRCP) provides opportunities to early, intermediate and senior-level researchers to establish their research & academic careers in basic biomedical or clinical & public health sectors in India.

5 Scientists/Technologists of Indian Origin (STIO) in Indian Research Laboratory
- There is a provision to appoint ‘Scientists/Technologists of Indian Origin (STIO)’ on a contractual basis at Council of Scientific and Industrial Research (CSIR) laboratories to nurture research in their area of expertise.

6 Senior Research Associateship (SRA) (Scientist's Pool Scheme)
- Senior Research Associateship (SRA) (Scientist's Pool Scheme) is primarily meant to provide temporary placement to highly qualified Indian scientists, engineers, technologists and medical personnel returning from abroad, who do not have any employment opportunities in India.

Source: Department of Science and Technology, Government of India, and Other Government website
In recent years, the Indian Government has implemented several fellowship schemes to nurture human capacity for advanced research in the country.

The number of students enrolled in the various constituent laboratories of Council of Scientific Research and Industrial Research (CSIR) increased to 1,967 in FY19 from 1,526 in FY16.

The period between 2010-20E has been declared as the ‘Decade of Innovation’ by the country and the need for the establishment of National Innovation Council has been emphasised. To fuel growth, innovation in science and technology STI (Science, Technology and Innovation) Policy 2013 was formed.

A total of 1,000 students were enrolled under Science Pursuit for Inspired Research (INSPIRE) scheme in FY19.

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**Note:** Pursuit for Inspired Research (INSPIRE),^ - Figures mentioned are as per latest data available, , SERB - Science and Engineering Research Board, DST - Department of Science & Technology

**Source:** NSTMIS, Department of Science and Technology
Local demand attracting investment from MNCs… (1/2)

- India presents a unique opportunity for companies manufacturing technologically advanced products, registering per capita income of Rs. 143,048 (US$ 1,982.65) in FY19SAE.

- An expanding middle-class and rise in purchasing power of rural residents have boosted demand for innovation and development of cheap and durable products that could meet the local requirements.

- Rising per capita income in India will bring boom in R&D investment in the country with more and more of foreign players shifting R&D bases to India.

- Qualcomm plans to invest US$ 8.5 million on design initiatives in India, which would include funding its innovation labs at Hyderabad and Bangalore, for R&D.

- In FY20, the country's per capita monthly income rose by 6.8% to Rs. 11,254 (US$ 159.29).

- In March 2020, Agnikul Cosmos Pvt Ltd., an IIT Madras incubated space tech start-up developing low-cost satellite launch vehicles, raised Rs. 23.4 crore (US$ 3.35 million) in a pre-series A funding round led by pi Ventures.

- As per the Nasscom and ANSR report, >25 Over 25 new Global Capability Centres (GCCs) in the retail/consumer packaged goods industry are looking to set up their tech centres in 2021.

**Note:** SAE - Second Advance Estimates

**Source:** IMF, World Bank, India Budget, Government of India Press Information Bureau Government of India, Ministry of Statistics and Programme Implementation
Lower development cost, rising technology intensity and growing local demand for top-of-the-line unique technology products have attracted R&D investment from foreign companies in India, making it one of the largest outsourcing provider in R&D segment.

- India ranks second on scientific publications among BRICS nations
- India ranks 6th for scientific publications and 10th for only resident patent applications.
- The total number of patent applications filed by scientists and inventors in India increased to 61,768 in FY19 from 47,854 in FY18.

Source: Loksabha
Opportunities and Developments
R&D opportunities in various sub sectors in India

1 ICT and wireless technology
- Establishment of Software Technology Parks of India (STPI).
- National Policy of IT aims at bringing the power of ICT within the reach of all its citizens to enable India to emerge as a global hub for IT by 2020.
- Cloud computing presents endless opportunities in wireless technologies

2 Pharmaceuticals and Health Care
- Third-largest pharmaceuticals market by 2020.
- A new Health Policy 2015-2025 to focus on healthcare for all holistically

3 Manufacturing technologies
- Automation and environmental sustainability are the key focus areas for manufacturing companies.
- The National Manufacturing Policy targets at creating 100 million additional jobs in the sector by 2025.

4 Material energy
- Multi-disciplinary research to combine emerging concepts in nanotechnology with fundamental metallurgical chemistry is the way forward.

5 Bio-energy
- Bio-energy is emerging as a promising alternative to meet rural energy needs in India.
- Target set by Bio-energy Programme: By 2020, 20% blending of fossil fuels will be done through a cost effective production system for algal biofuel and next generation biofuels from agricultural waste.

6 Water technologies
- The water demand of industry will account for 8.5% and 10.1% of the total fresh water abstraction in 2025 and 2050, respectively.
- R&D efforts should concentrate on developing technologies for treatment, recycling, recovery, reuse and efficient use of water.

Source: Make In India, FICCI
The Indian pharmaceuticals industry is now seeking to move up the global pharmaceutical value chain by investing in R&D for drug development, drug repurposing, process improvements and digital manufacturing.

In FY20, the highest expenditure on R&D done by Lupin, followed by Dr. Reddy’s. Sun Pharma’s R&D plan includes developing more products through expanded R&D team for global markets, focusing on more complex products across multiple dosage forms and investments in specialty pipeline.

Domestic pharma retail market, bounced back for the first-time since the coronavirus pandemic, registering a growth of >4% in September 2020, due to increasing sales of chronic medication and anti-virals to treat the virus. In March 2020, the industry was estimated at ~Rs. 1.5 lakh crore (US$ 20.44 billion).

Medicine spending in India is projected to grow 9-12% over the next five years, leading India to become one of the top 10 countries in terms of medicine spending.

The Ayurveda sector in India reached US$ 4.4 billion by 2018 end and is estimated to grow at 16% CAGR till 2025.

In December 2020, India’s first indigenous mRNA vaccine candidate received approval from the Indian Drug regulators to initiate Phase I/II human clinical trials. The novel mRNA vaccine candidate, HGCO19 has been developed by Gennova, Pune, and supported with seed grant under the Ind-CEPI mission of Department of Biotechnology of Ministry of Science & Technology.

Source: Make in India, FICCI, Ministry of Chemicals and Fertilizers- Department of Pharmaceuticals, PWC report
The way forward… (1/2)

1 Biotechnology sector
- The biotechnology sector is recognised as the primary driver in contributing to the US$ 5 trillion Indian economic target by 2024.
- The biotechnology industry has the ability to provide a variety of solutions to problems in areas of health, agriculture, the environment, energy and industrial processes because of its multidisciplinary approach.
- This entails imaginative solutions to different social problems, use of biosimilars to help millions of people worldwide fight against life-threatening medical problems.

2 Human capital development
- Special incentive mechanisms are being developed to stimulate research in universities and develop young leaders in science and engineering.
- The policy framework is being devised to enable school science education reforms by improving teaching methods and science curricula.

3 Investment to promote research
- Government is promoting investment in basic research to improve research quality to meet global standards and to address national challenges.
- Leveraging international S&T co-operation, the Government has planned co-investment of resources for joint initiatives with Australia, Canada, and Germany among others.
- The Government has its focus on investing in R&D for technologies that address the need of rural India.

4 Attracting investment from private sector
- Through Science, Technology and Innovation Policy, the Government is promoting the establishment of large R&D facilities in PPP model with provisions for benefits sharing.

Source: Science, Technology and Innovation Policy 2013; Department of Science and Technology
5 Promoting innovation

- In August 2020, Raman Research Institute, an autonomous institute under the Department of Science & Technology, Govt. of India, found a new way for quantum state estimation, ‘Quantum State Interferography’, to make crucial quantum operations simpler.
- In January 2021, the Ministry of Electronics and Information Technology (MeitY) announced that it will establish a quantum computing applications lab in the country, in collaboration with AWS, to accelerate quantum computing-led R&D and enable new scientific discoveries.

6 Attracting investment from private sector

- The Indian Institute of Science Education and Research (IISER) has proposed to set up a LIGO (Laser Interferometer Gravitational Wave Observatory) detector in India. LIGO will help in detection and observation of gravitational waves.
- GridRaster Inc, working in the virtual and augmented reality space, has raised US$ 2 million in seed funding to be used for marketing and product development.
- As of March 2020, Agnikul Cosmos Pvt Ltd., an IIT-Madras incubated space tech start-up developing low-cost satellite launch vehicles, raised Rs. 23.4 crore (US$ 3.35 million) in a pre-series A funding round led by pi Ventures.

7 Artificial Intelligence (AI)

- India’s National Artificial Intelligence Strategy prepared by NITI Aayog outlined a way forward to harness the potential of AI in different fields. Accenture offers a framework for assessing the economic effect of AI for selected G20 countries in its latest AI research studies and forecast that AI will raise India’s annual growth rate by 1.3% by 2035.
- To address several challenges related to COVID-19, businesses and organisations in India have adopted various artificial intelligence (AI) tools; the rise in AI adoption was the highest among key economies such as the US, Japan and the UK.

Source: Science, Technology and Innovation Policy 2013, News Aricles, PwC
New developments in the science and technology industry

1 Collaboration

• In January 2021, the Council of Scientific and Industrial Research (CSIR) signed an MoU with the Russian centre for collaboration on marine sciences and technology.
• In January 2021, Wipro signed an MoU with Israel’s Tel Aviv University for research and analysis in quantum science and technology.
• In October 2020, the Department of Science & Technology (DST) and IBM India announced collaborations to scale two DST initiatives—Vigyan Jyoti and Engage with Science (Vigyan Prasar)—that are aimed to increase the number of women working in technology fields.

2 Technology Business Incubator (TBI)

• On October 8, 2020, the Union Minister of Education, Mr. Ramesh Pokhriyal ‘Nishank’, inaugurated the Gyan Circle Ventures, a MeitY funded Technology Business Incubator (TBI) of Indian Institute of Information Technology, Sri City (Chittoor), Andhra Pradesh, to foster innovation and entrepreneurial spirit in institutions.

3 National Supercomputing Mission

• In October 2020, in line with Atmanirbhar Bharat to achieve complete self-reliance, C-DAC signed an MoU with National Supercomputing Mission Host Institutes to establish supercomputing infrastructure in various premier institutions across India and accelerate the pace of research and innovation using computational science techniques.

4 Artificial Intelligence

• In October 2020, Prime Minister, Mr. Narendra Modi, inaugurated RAISE 2020, a mega virtual summit on Artificial Intelligence (AI), to exchange ideas on using AI for social transformation, inclusion and empowerment in areas such as healthcare, agriculture, education and smart mobility and others.
• In October 2020, the Ministry of MSME implemented artificial intelligence (AI) and machine learning (ML) on its robust single window system, ‘Champions’, to provide assistance and solutions to issues.

5 Hydrogen Fuel Cell fitted car

• On October 10, 2020, Council of Scientific and Industrial Research (CSIR) and KPIT successfully ran trials of India’s first hydrogen fuel cell (HFC) prototype car running on an indigenously developed fuel cell stack at CSIR-National Chemical Laboratory, Pune.

Source: Science, Technology and Innovation News Articles
Key Industry Contacts
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<tr>
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<th>Contact Information</th>
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<tbody>
<tr>
<td>National Academy of Sciences</td>
<td>Address: 5, Lajpatrai Road, New Katra Allahabad - 211 002, India Tel: 91- 532- 2640224 Fax: 91- 532- 2641183 Website: <a href="http://www.nasonline.org/">http://www.nasonline.org/</a></td>
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<tr>
<td>Indian National Science Academy</td>
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<td>Indian Academy of Sciences</td>
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<td>Indian Science Congress Association</td>
<td>Address: 14, Dr Biresh Guha Street Kolkata - 700017, India Tel: 033 - 2287 4530 / 2281 5323 Fax: 91- 33- 2402551 Email: <a href="mailto:es.sciencecongress@nic.in">es.sciencecongress@nic.in</a>/ <a href="mailto:isciscal_2004@yahoo.com">isciscal_2004@yahoo.com</a> Website: <a href="http://www.sciencecongress.nic.in/">http://www.sciencecongress.nic.in/</a></td>
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<tr>
<td>Department of Science and Technology</td>
<td>Address: Technology Bhavan, New Mehrauli Road  New Delhi - 110016, India  Tel: 91- 11- 26567373  Fax: 91- 11- 26864570  Email: <a href="mailto:dstinfo@nic.in">dstinfo@nic.in</a></td>
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Glossary

- CAGR: Compound Annual Growth Rate
- GDP: Gross Domestic Product
- FDI: Foreign Direct Investment
- FY: Indian Financial Year (April to March)
  - So FY12 implies April 2011 to March 2012
- GOI: Government of India
- MNC: Multinational Company
- GERD: Gross Expenditure on Research and Development
- STI: Science Technology and Innovation
- Y-o-Y: Year on Year
- Rs: Indian Rupee
- US$: US Dollar
- LCV: Light Commercial Vehicle
- PPP: Public Private Partnership
- Wherever applicable, numbers have been rounded off to the nearest whole number
## Exchange rates

### Exchange Rates (Fiscal Year)

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### Exchange Rates (Calendar Year)

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**Note:** As of January 2021  
**Source:** Reserve Bank of India, Average for the year
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