GOVERNMENT OF INDIA
MINISTRY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF SCIENCE AND TECHNOLOGY
LOK SABHA
STARRED QUESTION NO.208
TO BE ANSWERED ON 1/8/2018

RESEARCH AND DEVELOPMENT

†*208. SHRI RAJU SHETTY:

Will the Minister of SCIENCE AND TECHNOLOGY विज्ञान और प्रौद्योगिकी मंत्री **be pleased to state:**

(a) whether the Research and Development (R&D) establishments in the country have achieved their desired objectives;

(b) if so, the details thereof during the 11th and 12th Plan periods and the funds spent for this purpose;

(c) whether R&D as well as innovation capacity in India is lower as compared to other BRICS countries despite better research institutes in the country, if so, the details thereof and the reasons therefor;

(d) whether the country lacks innovative research and the research carried out by the public and private institutions is not getting converted into commercial ventures significantly; and

(e) if so, the details thereof and the corrective steps taken/proposed to be taken in this regard?

ANSWER

MINISTER OF SCIENCE AND TECHNOLOGY, MINISTER OF EARTH SCIENCES AND MINISTER OF ENVIRONMENT, FOREST AND CLIMATE CHANGE
(DR. HARSH VARDHAN)
विज्ञान और प्रौद्योगिकी मंत्री, पृथ्वी विज्ञान मंत्री और पर्यावरण, वन एवं जलवायु परिवर्तन मंत्री

(डा. हर्ष वर्धन)

(a) to (e): A statement is laid on the Table of the House.

STATEMENT AS REFERRED IN REPLY TO PARTS (a) TO (e) OF LOK SABHA STARRED QUESTION NO.208 FOR 1/8/2018 REGARDING RESEARCH AND DEVELOPMENT

(a) Yes, Madam. The Research and Development (R&D) establishments under the Ministry of Science and Technology have actively pursued R&D to meet their objectives of basic research, technology development, human resource development and establishment of advanced research infrastructure and recorded impressive achievements.

(b) 14 of the 16 R&D institutions under the Department of Science and Technology (DST) pursue cutting-edge basic research. The remaining two pursue applied and technology-oriented research in advanced materials technology and bio-medical device technology. Some of the notable achievements of these institutions during the 11th and 12th Plan periods were: successful launch of an Ultraviolet Imaging Telescope (UVIT) aboard the Indian Astronomy Satellite ASTROSAT which is giving the sharpest images in the Ultraviolet region; establishment of a 3.6 m optical telescope at Devasthal in Uttarakhand, the largest telescope in Asia of its kind; establishment of 1.3 m optical telescopes at Devasthal, Uttarakhand and Kavalur, Tamilnadu; participation in the construction of the international Thirty Meter Telescope (TMT); participation in a leading experiment at the Large Hadron Collider (LHC) at Geneva; accelerator and detector building for construction of the upcoming Facility for Antiproton and Ion Research (FAIR) at Darmstadt and subsequent experiments at the facility; development of better variety of wheat and soybean; molecular understanding of cell cycle regulation in normal and cancer cells; development of an effective antifungal agent; preparation of new gelator molecules for sustained pheromone release for live insect control in open fruit orchard; nanosilver-based antimicrobial textiles; nanotitania-based self-cleaning textiles; nanotechnology-based drug delivery; bio-remediation of oil pollution in fields; and a large body of cutting-edge fundamental research work on variety of topics in physical, chemical, and life sciences, earth and atmospheric sciences, materials and nano science and technology and astronomy and astrophysics. These institutions published 8846 and 10249 research papers in leading research journals and produced 199 and 359 patents in the 11th and 12th Plan Periods respectively.

The 16 R&D institutions under the Department of Biotechnology (DBT) carry out frontline research in life sciences like structural biology, stem cell biology, role of RNA in biological control processes, cellular and molecular basis of memory, DNA fingerprinting, brain mapping, manipulation of plant genes to breed improved variety of food, disease biology, sustainable exploitation of bio-resources, infectious diseases of animals; drug development and so on. DBT's work on biotechnology have led to major inventions in the field of rapid diagnostics, biodesign, agriculture biotechnology, vaccines and food and nutrition during the 11th and 12th Plan Periods. A few important examples are rotavirus vaccine, malaria vaccine, dengue diagnostic and vaccine, an innovative newborn hearing screening device "Sohum", neonatal resuscitation device, food formulations for severe acute malnutrition in children and iron fortification in rice. The National Biotechnology Development Strategy was announced in 2015 and the main focus has been on generation of biotech products, processes and technology to enhance efficiency, productivity, safety and cost-effectiveness of agriculture, food and nutritional security, affordable health and wellness, environmental safety, clean energy and biofuel and bio-manufacturing.

During the 11th and 12th Plan Periods, the 38 laboratories of Council of Scientific and Industrial Research (CSIR) implemented 105 and 159 projects, respectively, covering diverse areas ranging from radio and space physics, oceanography, earth sciences, geophysics, chemicals, drugs, genomics, biotechnology and nanotechnology to mining, aeronautics, instrumentation, environmental engineering and information technology. Some notable developments were: Drishti transmissometer, a visibility measuring system providing information to pilots on visibility for safe landing and take-off operations; wax deoiling technology that has generated livelihood for 2500 Micro, Small and Medium Enterprises (MSMEs) and reducing imports of wax by over Rs. 300 crores per annum; high density glass for radiation protection in nuclear reactors developed by the Department of Atomic Energy; four generations of streptokinase thrombolytics that have realized a direct value of Rs. 580 crores for the patients; BGR-34, a herbal formulation for diabetes; and low-cost portable system for detection of adulteration in milk. CSIR published 21,381 and

27,241research papers in leading journals of international repute and filed 2782 and 3476 patents during the 11th and 12th Plan Periods respectively.

The funds exclusively spent by the R&D institutions of the Ministry of Science and Technology during the 11th and 12th Plan periods were as follows:

(Figures in Rs. crores)

	CSIR	DST	DBT
11th Plan Period	12950.59	2463.80	1220.63
12th Plan Period	17344.71	3148.32	2566.48

In addition, DST and DBT spend the major component of their budget for funding R&D, building research infrastructure and human resource, promoting innovation, technology development and commercialization etc. to universities, other higher educational institutions, R&D establishments of other Ministries/Departments, industry, etc. on competitive basis.

(c) Two important parameters for measuring Research and Development (R&D) and innovation capacity are scientific publications and patents. In scientific publications, India ranks 2nd after China among BRICS nations. India's scientific publications are also growing at a rate of approximately 14% as compared to the world average growth rate of around 4%. In terms of patent filings by Residents, India is 3rd after China and Russia. But, the good news is that the share of patents filed in India by Indian Residents has grown from 28% to 33% between 2015-16 to 2017-18. These data indicate that R&D as well as innovation capacity of Indian researchers are rapidly growing. This is also consistent with the latest Global Innovation Index 2018 that shows that India, at 57th position, ranks after China (17th position) and Russia (46th position) among BRICS countries. While comparing with China and Russia, however, we have to keep in mind that the number of researchers in China and Russia are 15.24 lakhs and 4.45 lakhs respectively as compared to 2.83 lakhs in India. Whether India has better research institutions than other BRICS countries is a matter of debate as different ranking systems assign different weights to different attributes of institutions. A reasonable statement to make will be that our leading research institutions carry out internationally competitive R&D.

(d) & (e): It is true that the R&D enterprise in our country is relatively stronger in basic research and knowledge generation, which is evident from our publication record and its impressive growth rate. Innovative and applied research, leading to commercialization of products or commercial ventures, are, however, also showing an upward trend. The Ministry of Science and Technology has taken a number of steps to accelerate applied and innovative research leading to commercialization of products and processes. Some of the prominent ones are: (i) DST's National Innovation Foundation (NIF) has widened the base of innovation and recorded grassroots technological innovations and outstanding traditional knowledge, has created a pool of over 2,95,000 technological ideas, innovations and traditional knowledge practices, has helped get around 1500 grassroots technologies validated and/or value added, has filed over 980 patents and applications for 68 plant varieties developed by farmers and has succeeded in commercializing 108 such cases; (ii) DST's NIDHI (National Initiative for Developing and Harnessing Innovations), an umbrella programme for nurturing ideas and innovations into successful start-ups, has added 50 new Technology Business Incubators (TBIs) in the last four years taking the total number to 120 TBIs supported by DST; (iii) Technology Development Board (TDB), a unique organization under DST for providing financial assistance, by way of Loan, Equity or Grant, to industrial concerns for attempting development and commercialization of

indigenous technology, has led to commercialization of 343 technologies and about 150 socially relevant technologies based on innovations so far; (iv) DBT's public sector undertaking, Biotechnology Industry Research Assistance Council (BIRAC), has provided funds to 200 companies and 150 entrepreneurs bridging the gaps in the biotechnology innovation pipeline from ideation to commercialization which has led to commercialization of high quality and affordable products towards commercialization; (v) The Technology Development and Demonstration Programme (TDDP) of Department of Scientific and Industrial Research (DSIR)provides financial support to industry for innovative technology development and demonstration in major sectors of industry; (vi) The Fast Track Translation Projects (FTTs) of CSIR that provide implementation of close to market, business-drive projects, in any area of technology or application without thematic restrictions; (vii) Mission Mode Projects (MMPs) of CSIR which synergize the best competencies in CSIR labs and outside institutions which will also lead to innovative research; (viii) CSIR's focused efforts at enabling commercial exploitation of intellectual property, knowledge base and/or technologies/products developed in its constituent laboratories; often handholding the industry partner even after licensing of the technologies/products for further development of the technology to facilitate market acceptance and thereby its commercial success; and (ix) a large number of other programmes under DST, DBT and DSIR aiming at innovative and technology-oriented research; one such programme is India Innovation Growth Programme which has helped about 500 start-ups which have created a market value of 800 million dollars. And, to instil the culture of innovation in young minds, DST's MANAK (Million Minds Augmenting National Aspiration and Knowledge) is a gigantic programme aimed at school children of class VI to class X which encourages them to visualize and analyse the needs of society and devise innovative ideas to address them.

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