India into Scientific Research based on UNESCO Science Report

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Science, Technology and Innovation (STI) plays a significant role in fostering socio-economic and political development globally and benefitting all the sectors through scientific and technological advances. STI acts as a key determinant in addressing socio-economic challenges related to critical sectors such as health, environment, education, food, energy, climate change, water etc. In this context, while India has made 'solid progress' towards the Sustainable Development Goal (SDG) targets concerning industry, infrastructure and innovation, the country's investment in research remains unsatisfactory, the UNESCO Science Report has observed.

In news: India's investment in research unsatisfactory: UNESCO report
Placing it in syllabus: Economy
Dimensions

- Evolution of India's Science, Research and Innovation Policy
- India's spending on Science Research
- Startups in India
- Research papers on AI and Robotics

Content:

Evolution of India's Science, Research and Innovation Policy:

- Indian Science and Technology policies post-independent India were predominantly rooted in the ideas of self-

reliance and indigenous development across the sectors.

There have been four major policies implemented since independence namely:

Scientific Policy Resolution, 1958 (SPR1958):

- SPR 1958 laid the foundation of **scientific enterprise and scientific temper** in India.
- S&T were seen as vehicles for the onward journey towards socio-economic transformation and nation-building.
- Creating a pool of high-quality scientists on a large scale was necessary to fulfil the country's needs, especially in areas such as agriculture and defence.
- SPR 1958 highlighted that it was important to create a culture and mechanism where creative talents of citizens are recognised and opportunities are found in scientific activity, acquisition, dissemination, and discovery of new knowledge.
- SPR 1958 was primarily a science policy document. Technology development was given secondary importance as it was assumed then that technological development could only stem through the study of science and its applications.
- By 1980, India had developed advanced scientific and technological infrastructure in the areas of space, industrial research, nuclear energy, defence research, biotechnology, agriculture, and health.

Technology Policy Statement (TPS 1983)

- It was launched with a focus to **achieve technological competence and self-reliance** through the promotion and development of indigenous technologies
- The primary feature of TPS 1983 was technological self-reliance through promotion and development of indigenous technologies.
- Adoption of indigenous technology would reduce

vulnerabilities in critical areas and would help maximise the utilisation of local (human and material) resources.

- TPS 1983 stressed on strengthening the technology base especially in new sectors at that time – information, electronics, and biotechnology through an increase in R&D investments and collaboration amongst governmental organisations, educational institutions and industries.
- It resulted in the establishment of the Technology Development Fund and the formation of Technology, Information Forecasting, and Assessment Council (TIFAC).
- These S&T policies took recourse to mass education and cultivation of science and scientific research in HEIs for attaining technological competence

Science and Technology Policy 2003

- Post-1991, **economic liberalisation** paved the way for **large foreign investment** in several sectors.
- Economic liberalization and globalization brought new challenges and opportunities in Science and Technology.
- From 2000 onwards, India focused on the conversion of knowledge into wealth and value, addressing socio-economic needs of the country and amalgamating science, technology, and innovation (STI).
- Science and Technology Policy 2003 brought together the areas of S&T with the aim of increasing the investment required for R&D and innovation in the areas impacting the economy and society.
- This led to the emergence of a strong institutional mechanism through the creation of **Scientific and Engineering Research Board (SERB)** under the ambit of DST to promote scientific and engineering research in the country.
- The period following the S&T Policy 2003 is marked by a significant increase in R&D Investment, a rise in

publication ranking, and a steady increase in institutional and human capacity.

- As a result, the decade of 2010 to 2020 was declared as the **'Decade of Innovation'** with the agenda to create a 21st Century National Innovation Ecosystem, to build innovative institutions and mindsets for national progress.

Science, Technology, and Innovation Policy 2013 (STIP 2013)

- It was acknowledged that in order to stay globally competitive, it was necessary to make a transition into a knowledge-based economy.
- There was a need to synergise science, technology and innovation to position India amongst the top five global scientific powers. With this objective, the fourth policy, the STIP 2013 was implemented.
- A critical new element in this policy document was the term **"innovation"**. Promoting a science and technology-led innovation ecosystem in the country and broadly linking science, technology and innovation to socio-economic priorities were some of the key aspects of STIP 2013.
- This policy document was a step in the right direction towards building a robust national innovation ecosystem attracting private sectors into R&D and linking STI to socio-economic priorities
- This policy also resulted in India's increased participation in global mega-science initiatives such as the Laser Interferometer Gravitational-Wave Observatory (LIGO), the Large Hadron Collider (LHC – CERN), the International Thermonuclear Experimental Reactor (ITER) and the Square Kilometre Array (SKA), among others.

India's spending on Science Research:

- India has one of the lowest GERD/GDP ratios among the BRICS nations, according to the report

- In absolute terms, research expenditure has increased due to economic growth. However, The gross domestic expenditure on research (GERD) has been stagnant at 0.7% of the GDP for years.
- India’s Science and Technology Policy of 2003 has thus failed to realize its objective of carrying GERD to 2.0% of GDP by 2007.
- This has forced the government to set back its target date to 2018 in the latest Science, Technology and Innovation Policy (2013).
- China, on the other hand, is on track to meet its own target of raising GERD from 1.39% of GDP in 2006 to 2.50% by 2020. By 2013, China’s GERD/GDP ratio stood at 2.08%.
- The Science and Technology Policies of both 2003 and 20138 have emphasized the importance of private investment to develop India’s technological capability.
- The government has used tax incentives to encourage domestic enterprises to commit more resources to R&D.
- Public and private enterprises are certainly playing a greater role than before; they performed nearly 36% of all R&D in 2011, compared to 29% in 2005.
- Approximately 80% of all foreign and domestic patents granted to Indian inventors (excluding individuals) went to private enterprises in 2013.
- As a corollary of this trend, research councils are playing a smaller role than before in industrial R&D.
- R&D in the government sector has been in steady decline since 2015, whereas the share of private business enterprises in it has shot up to 42%.
- While in theory this is a positive trend, the R&D is focused primarily in sectors such as pharmaceuticals, automotive, and information technology. Even in these industries, it is **concentrated in a small number of firms.**
- Investment in R&D by foreign multinationals is on the rise, accounting for as much as 16% of private-sector

investment in R&D in 2019.

UNESCO Science Report:

- The **UNESCO Science Report** is a **global monitoring report** published **every 5 years** by the **United Nations Educational, Scientific and Cultural Organization**.
- This report **maps the latest trends and developments in national and regional policy landscapes**, against the backdrop of shifting socio-economic, geopolitical and environmental realities.

Each edition is released on 10 November, which is **World Science Day for Peace and Development.**

Startups in India:

- More than half of business R&D expenditure is distributed across just three industries: pharmaceuticals, automotive and IT.
- Six industries concentrate about 85% R&D. Pharmaceuticals continue to dominate, followed by the automotive industry and IT (read computer software).
- This implies that the subsidies have not really helped to spread an innovation culture across a wider spectrum of manufacturing industries.
- Meanwhile, India has become a hub for what is known as **frugal innovation**. These products and processes have more or less the same features and capabilities as any other original product but cost significantly less to produce. They are most common in the health sector, particularly in the form of medical devices
- Despite the overwhelming popularity of frugal innovation, innovation policies in India do not explicitly encourage frugal innovation. This oversight needs addressing
- The government needs to support the emergence of technology-based start-ups to broaden the innovation

culture in India.
- Technological progress has brought down traditional barriers which prevented SMEs from accessing technology. What SMEs need is access to venture capital.

Research papers on AI and Robotics:

- On the bright side is the encouraging increase in scientific publications by Indian researchers on cutting-edge technologies.
- Total publications have risen from 80,458 in 2011 to 1.61 lakh in 2019.
- Indian researchers are publishing between 1.5 and 1.8 times the global average on smart-grid technologies, photovoltaics, biofuels and biomass and wind turbine technologies, complementing the government's push to expand green energy sources
- But then again, patenting by domestic corporations, research institutes, universities and individuals remains low in India.
- The report noted that the majority of the software-related patents were being bagged by MNCs operating from Indian soil, while pharma patents were obtained mostly by domestic firms.

KEY TARGETS FOR INDIA

- ***spread responsibility for attaining a GERD/GDP ratio of 2%*** between the government and business enterprise sectors: the government should use this opportunity to raise its own share of GERD to about 1% of GDP by investing more heavily in university research
- ***improve the training and density*** of scientists and engineers engaged in R&D: more needs to be done to adapt curricula to market needs and to create a research culture at universities
- ***assessment of the effectiveness of tax incentives for R&D***: despite India having one of the

- most generous tax regimes for R&D in the world, this has not resulted in the spread of an innovation culture across firms and industries
- ***Give greater share of government research grants towards the business sector:*** Currently there are no large research grants which target the business enterprise sector to develop specific technologies
- ***support the emergence of technology-based enterprises:*** by giving this type of SME greater access to venture capital and catalyse private equity, quasi equity, soft loans and other risk capital for start-ups

Timely completion of Policy targets: The biggest challenge of all for Indian policy-makers will be to tackle each of the aforementioned imperatives within a reasonable period of time.

Mould your thought: How has the Science and Technology Policy evolved in India over the years? What are the current imperatives regarding Science technology and Innovations in India?

Approach to the answer:

- Introduction
- Discuss the 4 policies since independence in brief
- Discuss the current situation of Indian science and technology
- Mention the key targets for the policymakers in India
- Conclusion