



India at 75: Part III

For Prelims: Five Year Plans, Green Revolution, 1991 economic reforms, GST, ISRO and initiatives, CSIR and related innovations, Integrated Guided Missile Programme, Giant Metrewave Radio Telescope, LAC Tejas, DRDO, Missions Shakti, PSLV, GSLV, Stockholm Conference, Environment and Biodiversity related Acts and Rules

For Mains: India's Economic Growth since Independence, India's Scientific Progress since Independence, India's initiatives to protect the Environment

What is the Context?

Over the last seven decades, the Indian economy has seen several ups and downs. The country has gone from having a GDP of just Rs 2.7 lakh crore at the time of Independence to now sitting close to Rs 150 lakh crore. Once branded a **“third world country”**, [India is now the fifth largest economy in the world.](#)

Not only this, but India has also made major strides in the field of science & technology as well. Independent India's tryst with science and technology began with **Pt. Jawaharlal Nehru's vision of social transformation through public investment in this sector.**

Let us understand how India has progressed economically, scientifically and environmentally since its independence.

How has India Progressed Economically?

- **India's Pre-Liberalisation Approach:** India's economic policy after independence was influenced by the colonial experience. The then Prime Minister; Pandit Jawaharlal Nehru, wanted India to flourish as an outcome of rapid development of heavy industries by both public and private sectors.
 - The **Industrial Policy Resolution of 1948** proposed a **mixed economy**.
 - The **Bombay Plan** proposed by influential industrialists envisaged a **substantial public sector with state interventions and regulations** to protect indigenous industries.
- **Planning Commission and FYPs:** The **Planning Commission** was set up in 1950 to oversee the entire range of planning, including resource allocation, implementation and appraisal of **five-year plans (FYPs)**. The five-year plans were centralised economic and social growth programmes.
 - The **first FYP (1951-55), focused on agriculture** and irrigation to boost farm output as India was losing foreign reserves on foodgrain imports.
 - The **second FYP (1956-60) laid the foundation for economic modernization** to better serve India's long-term growth imperatives.
 - It advocated rapid industrialization with a focus on heavy industries and capital goods.
- **Nationalisation of Companies/Industries:** From 1950s to 1991, several industries and companies were nationalised by the government.
 - Under the **Air Corporations Act 1953, Parliament voted to nationalise nine airlines** and replaced them with Indian Airlines and Air India International.

- The political success of this Act set the pace for the nationalisation of several other sectors; banking, life insurance, general insurance and mining.
 - In 1969, the Government of India announced **nationalisation of 14 leading banks.**
- **The Advent of the Green Revolution:** The quest to quickly industrialise the nation caused a large reallocation of funds away from the farm sector resulting in food shortages and inflation.
 - In 1964, amid the **persisting inflation, food shortages and the war with China**, the Government realised the need to move away from centralised planning and price controls and a renewed focus on agriculture.
 - This led to geneticist **MS Swaminathan** and other scientists, stepping in with high-yield variety seeds of wheat, setting off the **Green Revolution.**
- **Liberalisation:** With the **collapse of the Soviet Union in 1991** and the **Gulf war** resulting in a spike in oil prices, India found itself in a **major balance-of-payments crisis** and approached the IMF to seek a loan of \$1.8 billion.
 - In return, the **IMF demanded de-regulation** which led to the **1991 economic reforms.**
 - These reforms aimed to liberalise the economy by **doing away with the Licence Raj.**
 - They also **reduced tariffs and interest rates** and **ended many public monopolies**, allowing automatic approval of foreign direct investment in many sectors.
- **GST and Demonetisation:** **Demonetisation** and introduction of **Good & Services Tax (GST)** are probably the two most controversial economic events in 21st century India.
 - In November 2016, the Prime Minister of India declared all Rs 500 and Rs 1,000 high value notes invalid.
 - The move was aimed at flushing out black money hidden from the taxman.
 - This announcement **led to nearly 86% of the currency in circulation becoming invalid** by midnight.
 - The GST regime was introduced in 2017 after the GST Council approved the CGST Bill 2017, the IGST Bill 2017, the UTGST Bill 2017 and the Compensation Bill 2017.
 - Thereafter, State Legislatures of different states passed respective **State Goods and Services Tax Bills.**
 - After the enactment of various GST laws, GST was launched all over India with effect from 1 July 2017.
- **Progress in Industries:**
 - **Growth of Leather Industries:** The leather industry employed less than 25,000 people at the time of Independence, however, a major turning point came in the **1970s** when the **Government decided to ban the export of raw hides and skins and impose a 25% export duty on semi-finished leather products.**
 - In more than 50 years since then, the leather industry now has a workforce of more than 4.5 million, a large percentage of them being women, and a thriving market for Indian leather products around the world.
 - **Indian exports in this sector are close to \$6 billion.**
 - **Developments in Dairy Sector:** Under the guidance of leaders like **Sardar Patel, Morarji Desai and Tribhuvandas Patel**, the Kaira District Co-operative Milk Producers Union Ltd (KDCMPUL) was formed (which is now known as Amul) to prevent the exploitation of marginal milk producers by middlemen.
 - Incorporation of Amul is one the key milestones of the Indian economy as it made the nation the **world's largest producer of milk and milk products.**

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q1. Which of the following has/have occurred in India after its liberalization of economic policies in 1991? (2017)

1. Share of agriculture in GDP increased enormously.
2. Share of India's exports in world trade increased.
3. FDI inflows increased.

4. India's foreign exchange reserves increased enormously.

Select the correct answer using the codes given below:

- (a) 1 and 4 only
- (b) 2, 3 and 4 only
- (c) 2 and 3 only
- (d) 1, 2, 3 and 4

Ans: (b)

Q2. Which of the following is/are among the noticeable features of the recommendations of the Thirteenth Finance Commission? (2012)

1. A design for the Goods and Services Tax, and a compensation package linked to adherence to the proposed design.
2. A design for the creation of lakhs of jobs in the next ten years in consonance with India's demographic dividend.
3. Devolution of a specified share of central taxes to local bodies as grants

Select the correct answer using the codes given below:

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Ans: (c)

Q3. With reference to the Indian economy after the 1991 economic liberalization, consider the following statements: (2020)

1. Worker productivity (Rs. per worker at 2004-05 prices) increased in urban areas while it decreased in rural areas.
2. The percentage share of rural areas in the workforce steadily increased.
3. In rural areas, the growth in non-farm economy increased.
4. The growth rate in rural employment decreased.

Which of the statements given above is/are correct?

- (a) 1 and 2 only
- (b) 3 and 4 only
- (c) 3 only
- (d) 1, 2 and 4 only

Ans: (b)

Mains

Q1. Has the Indian governmental system responded adequately to the demands of Liberalization, Privatization and Globalization started in 1991? What can the government do to be responsive to this important change? **(2016)**

Q2. The public expenditure management is a challenge to the Government of India in the context of budget-making during the post-liberalization period. Clarify it. **(2019)**

Q3. Examine the impact of liberalization on companies owned by Indians. Are they competing with the MNCs satisfactorily? Discuss. **(2013)**

Q4. Explain the salient features of the Constitution (One Hundred and First Amendment) Act, 2016. Do you think it is efficacious enough “to remove cascading effect of taxes and provide for common national market for goods and services”? **(2017)**

Q5. Explain the rationale behind the Goods and Services Tax (Compensation to States) Act of 2017. How has COVID-19 impacted the GST compensation fund and created new federal tensions? **(2020)**

Q6. How are the principles followed by the NITI Aayog different from those followed by erstwhile Planning Commission in India? **(2018)**

How has been India’s Scientific Progress?

Some of the milestones in India’s scientific journey include:

▪ 1950s:

- In 1951, the first FYP had a dedicated chapter on “**Scientific and Industrial Research**”.
- 1953-54 **India’s first indigenous electronic analogue computer** was built at the Indian Statistical Institute, Calcutta.
- In 1954, the **first particle accelerator cyclotron** became operational.
 - In the same year, Homi J. Bhabha set up the Atomic Energy Establishment which was named the [Bhabha Atomic Research Centre](#) after his death.
- In 1959, Tata Institute of Fundamental Research, Bombay, built **India’s first digital computer called TIFRAC (TIFR Automatic Computer)**.

▪ 1960s:

- In 1962, Jawaharlal Nehru established the Indian National Committee for Space Research (**INCOSPAR**) which was renamed as [Indian Space Research Organisation \(ISRO\) in 1969](#).
- In 1963, G.N. Ramachandran (and team) developed the “**Ramachandran plot**” which is used universally in the field of **protein conformation**.
- Same year, Vikram Sarabhai established **India’s first rocket launching station** at Thumba near Thiruvananthapuram.
- In 1964, cosmic ray experiments began at **Kolar Gold Fields** which is **credited with the discovery of atmospheric neutrinos**.

▪ 1970s:

- In 1974, **Pokhran-1**, [India’s first nuclear test](#), was conducted.
- The year 1975 witnessed the launch of ‘**Aryabhata**’ - **India’s first indigenously designed and built satellite**.

▪ 1980s:

- In 1983, under the leadership of [Dr. A.P.J. Abdul Kalam](#), the [Integrated Guided Missile Programme](#) began.
 - The missiles - **Prithvi, Trishul, Akash, Nag and Agni** - are developed under this programme.
 - The same year, India established its scientific base station - [Dakshin Gangotri](#), in **Antarctica** which was later abandoned in 1988 and [Maitri - India’s first permanent station](#) replaced it.
- In 1986, India’s **first parallel computing supercomputer, Flosolver** became operational.
- The Centre for Cellular and Molecular Biology **developed DNA fingerprinting technology in 1988** with which **India became the third country to do so**.

▪ 1990s:

- In 1994, the making of the [Giant Metrewave Radio Telescope](#) was completed.
- It pioneered new techniques in antenna design and is **one of the largest and most sensitive low frequency range radio telescopes** in the world.

▪ 2000s:

- Maiden flight of the indigenously designed and built [light combat aircraft - Tejas](#) in 2001.
 - It was designed by the Defence [Research and Development Organisation](#)

(**DRDO**) and has now been inducted into the Air Force and the Navy.

- The year 2008 marked **ISRO's first mission to the Moon.**
- 2009 marked the **launch of the first of the Arihant-class nuclear-powered ballistic missile submarines.**
 - It was developed under the **Advanced Technology Vessel project.**
 - Arihant is the **first ballistic missile submarine to have been built by a country other than the P5 of the UNSC.**

▪ **2010s:**

- In 2013, ISRO launched its **Mangalyaan (Mars Orbiter Mission)** and became the fourth space agency to send a spacecraft into a Martian orbit and the **first one to do so on its maiden attempt.**
- In 2015-16, ISRO developed **India's first indigenous cryogenic engine.**
- Mission Shakti
- In 2019, in a first-of-its-kind attempt, the DRDO managed to successfully neutralise a satellite in space with its **anti-satellite (ASAT) missile.**
 - This was one of the most important and complex missions that was undertaken by the DRDO, and it was named - **Mission Shakti.**
 - It demonstrated the **DRDO's ability to defend Indian assets in space.**

Contributions of Indian Space Research Organisation

- **Coming into Being:** Dr. **Vikram Sarabhai** formed the Indian National Committee for Space Research (INCOSPAR) in 1962. Dr. A. P. J. Abdul Kalam was also among the initial team of rocket engineers who formed the INCOSPAR.
 - As INCOSPAR gradually grew, it became the Indian Space Research Organisation (ISRO) on August 15th, 1969, which is now **one of the six largest space agencies in the world.**
- **Early Innovations of ISRO:**
 - **Aryabhata:** It was India's first satellite. It was **built by the ISRO and launched by the Soviet Union as a part of the Soviet Interkosmos programme.**
 - **SLV-3:** The **Satellite Launch Vehicle-3 (SLV-3)** was India's first experimental satellite launch vehicle, which was a four-stage vehicle.
 - SLV-3 put **Rohini** (a series of satellites) in orbit, **and hence made India the sixth member of an exclusive club** of space-faring nations.
 - The successful culmination of the SLV-3 project paved the way for advanced launch vehicle projects - **ASLV, PSLV and GSLV.**
 - **PSLV:** The **Polar Satellite Launch Vehicle (PSLV)** is India's third generation launch vehicle.
 - It was the first launch vehicle by India equipped with liquid stages.
 - Since its launch in 1994, PSLV has launched 39 consecutively successful missions till June 2017.
 - It successfully launched two spacecrafts - **Chandrayaan-1** in 2008 and Mars Orbiter Spacecraft in 2013.
 - **GSLV:** The **Geosynchronous Satellite Launch Vehicle (GSLV)** too is a space launch vehicle designed to launch satellites and other space objects into **Geosynchronous Transfer Orbits.**
 - A three-stage launcher with strap-on motors, GSLV has the capability to put a heavier payload in orbit than the PSLV.
 - **GSLV-D5** was the first successful flight of the GSLV using the indigenous cryogenic engine.
 - **Chandrayaan-I:** It was India's first moon mission and the **first unmanned lunar probe under the Chandrayaan** programme.
 - The spacecraft consisted of a lunar orbiter and an impactor.
 - Although the mission was concluded after communication was lost with the spacecraft, it still managed to give India's space program a major boost.
 - **Mars Orbiter Mission:** It was **India's first interplanetary mission.**
 - ISRO became the fourth space agency in the world to reach Mars orbit, after Roscosmos, NASA, and the ESA.
- **Recent Developments in ISRO:**
 - **IN-SPACE:** **IN-SPACE** was launched to provide a level playing field for private companies

to use Indian space infrastructure.

- It acts as a single-point interface between Indian Space Research Organisation (ISRO), and everyone who wants to participate in space-related activities or use India's space resources.
- **NewSpace India Limited (NSIL):** [NSIL](#) is the **commercial arm of ISRO** with the primary responsibility of enabling Indian industries to take up high technology space related activities.
- **Indian Space Association (ISpA):** [ISpA](#) aspires to be the collective voice of the Indian Space industry.
- **Amazonia-1:** [Amazonia-1](#) is an optical [earth observation satellite](#) which would provide remote sensing data to users for monitoring deforestation in the Amazon region.
 - **Brazil's Amazonia -1 was launched in the 53rd flight of PSLV-C51.**
- **Gaganyaan:** It is a mission by ISRO scheduled to be launched in 2023.
 - Under this mission:
 - Three flights will be sent into orbit.
 - There will be two unmanned flights and **one human spaceflight.**
 - ISRO will also conduct two [unmanned 'Abort Mission' in 2022](#) to ensure crew safety during the Gaganyaan mission.
- **Other Upcoming Missions:**
 - **Chandrayaan-3**
 - [Shukrayaan Mission](#) - mission to Venus
 - India's [Own Space Station](#)
 - XpoSat - Space observatory to study cosmic x-rays
 - [Aditya L1 mission](#)

Contributions of Council of Scientific and Industrial Research (CSIR):

- **Coming into Being:** The newly independent India had the challenges of educating the people, feeding the population, implementing democracy, promoting industry & trade, and ensuring the country's security.
 - Against this backdrop, the responsibility of developing the science, technology and innovation ecosystem fell upon the [Council of Scientific and Industrial Research \(CSIR\)](#), which had been founded in 1942.
- **Early Roles of CSIR:**
 - The immediate priority of the CSIR was to **establish a number of national laboratories** under its umbrella, and also **promote similar organisations** independently.
 - In the early years of Independence, to conduct fair democratic elections — to prevent frauds of double voting - the **CSIR's National Physical Laboratory developed the indelible ink** made up of silver nitrate which is used even today and exported to many countries.
 - Independent India did not have well-established industries in many sectors and the informal work sector was also highly unorganised.
 - **A key mandate of the CSIR was to help develop local industries** by making contemporary technologies available and training requisite manpower.
 - A prominent example of the CSIR's contributions in this context has been in **developing the leather industry.**
- **Success in Technologies:**
 - The Green Revolution has been one of the crowning glories of science, technology and innovation.
 - During the Revolution, the CSIR's footprint could be seen in the **development of agrochemicals and the mechanisation of agriculture.**
 - The mechanisation of agriculture was achieved through the **indigenous development of the Swaraj tractor** at the CSIR-Central Mechanical Engineering Research Institute (CMERI).
 - Similarly, **production of anti-HIV drugs** by processes developed in CSIR laboratories provided the necessary impetus to the growth of generic pharmaceutical companies.
 - A significant impact of the CSIR can also be seen in the food and nutrition industry, in the aerospace sector, in the health and biotechnology industry, in protecting India's traditional knowledge systems, and in promoting crops for enhancing farmers' incomes.

- The CSIR **developed technologies to convert buffalo milk into powder** which **assisted in solving the infant food problem** in the 1950s.
- **Recent Innovations of CSIR:**
 - **Aroma Mission:**
 - The **Aroma Mission of the CSIR** has transformed the lives of thousands of farmers across the country. The cultivation of lavender in the Union Territory of Jammu and Kashmir has been attracting attention worldwide as India's '**Purple Revolution**'.
 - **Strategic:**
 - CSIR developed indigenous **Head-Up- display (HUD)** for Indian LAC - Tejas which aids the pilot in flying the aircraft and in critical flight maneuvers including weapon aiming.
 - **Energy & Environment:**
 - **Solar Tree:** It occupies the minimum space to produce clean power.
 - **Lithium Ion Battery:** India's first lithium-ion battery fabrication facility based on indigenous novel materials for making 4.0 V/14 h standard cells.
 - **Agriculture:**
 - **Samba Blight Resistant Mahsuri Rice Variety:** It developed a Bacterial Rice.
 - **Rice Cultivar (Muktashree):** A rice variety has been developed which restricts assimilation of Arsenic within permissible limits.
 - **White-fly resistant Cotton Variety:** Developed a transgenic cotton line which is resistant to whiteflies.
 - **Food & Nutrition:**
 - **Ksheer-scanner:** It detects the level of milk adulteration and adulterants in 45 seconds at the cost of 10 paise.
 - **Double-Fortified Salt:** Salt fortified with iodine and iron having improved properties developed and tested for addressing anaemia in people.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q1. Consider the following statements: (2016)

The Mangalyaan launched by ISRO

1. is also called the Mars Orbiter Mission
2. made India the second country to have a spacecraft orbit the Mars after USA
3. made India the only country to be successful in making its spacecraft orbit the Mars in its very first attempt

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Ans: (c)

Q2. With reference to India's satellite launch vehicles, consider the following statements: (2018)

1. PSLVs launch satellites useful for Earth resources monitoring whereas GSLVs are designed mainly to launch communication satellites.

- Satellites launched by PSLV appear to remain permanently fixed in the same position in the sky, as viewed from a particular location on Earth.
- GSLV Mk III is a four-staged launch vehicle with the first and third stages using solid rocket motors; and the second and fourth stages using liquid rocket engines.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 and 3
- (c) 1 and 2
- (d) 3 only

Ans: (a)

Mains

Q1. India has achieved remarkable successes in unmanned space missions including the Chandrayaan and Mars Orbiter Mission but has not ventured into manned space mission. What are the main obstacles to launching a manned space mission, both in terms of technology and logistics? Examine critically. **(2017)**

Q2. Discuss India's achievements in the field of Space Science and Technology. How has the application of this technology helped India in its socio-economic development? **(2016)**

Q3. What is India's plan to have its own space station and how will it benefit our space programme? **(2019)**

How has the Status of Environment Changed in India in last 75 Years?

Colonial era environment laws were oriented towards revenue gain or protecting upper-class interests. The **first change came in 1972** when the [Stockholm Conference](#) shifted the global approach towards **conservation and protection of the environment**.

India created the administrative and legal structures to ensure the protection of forests and wildlife. India's initiatives to protect the environment include:

▪ **1970s:**

- In 1972, the [Wildlife \(Protection\) Act](#) was enacted under which four statutory bodies were established.
 - National Board for Wildlife and State Wildlife Advisory boards
 - Central Zoo Authority
 - Wildlife Crime Control Bureau
 - [National Tiger Conservation Authority](#)
- In 1973, [Chipko Movement](#) was launched against the cutting down of forests in Chamoli and Tehri-Garhwal districts of Uttarakhand.
- The [Water \(Prevention and Control of Pollution\) Act](#) was introduced in 1974.
- In 1978, the **Silent Valley movement** was launched in Kerala against the proposal of a hydroelectric dam across River Kunthipuzha in Silent Valley, an evergreen tropical forest.

▪ **1980s:**

- [Forest \(Conservation\) Act 1980](#) was introduced which prohibits and regulates the de-reservation of forests and prevents the use of forest land for non-forest uses.
- In 1981, the [Air \(Prevention and Control of Pollution\) Act](#) was introduced.
- In 1985, **Narmada Bachao Andolan** was led against the construction of large dams on [River Narmada](#).
- In 1986, the [Environment \(Protection\) Act](#) was introduced following the Stockholm Conference and the [1984 Bhopal gas tragedy](#).
- In 1988, the [National Forest Policy](#) was introduced which recommended 33% forest

cover for the plains and 67% for the hills.

▪ **1990s:**

- 1991: [Coastal Regulation Zone \(CRZ\) notification](#) was issued under the EPA.
- 1995: The **National Environmental Tribunal Act** was enacted as an outcome of the [1992 Rio Summit](#).
- 1998: [Biomedical Waste \(Management and Handling\) Rules](#) notified.

▪ **2000s:**

- 2000: **Municipal Solid Wastes (Management and Handling) Rules** notified.
 - The same year [Noise Pollution \(Regulation and Control\) Rules](#) were also notified.
- 2001: [Energy Conservation Act](#) introduced under which the Bureau of Energy Efficiency was established.
- 2002: [Biological Diversity Act](#) enacted.
- [Scheduled Tribes and Other Traditional Forest Dwellers \(Recognition of Forest Rights\) Act 2006](#) was enacted with an aim to balance conservation with human rights.
- 2010: [National Green Tribunal Act](#) introduced as an amendment to the 1995 Act.
 - The National Green tribunal was set up.

▪ **2010s:**

- 2011: [E-waste \(Management\) Rules](#) notified which was amended in 2016 to enable only authorised dismantlers to operate in the dismantling of e-waste.
- [Plastic Waste \(Management\) Rules](#) were notified in 2016 to mandate increasing the minimum thickness of plastic carry bags from 40 to 50 microns and a minimum thickness of 50 micron for plastic sheets.
 - In 2021, the rules were amended to [prohibit single-use plastic items](#), having low utility and high littering potential by 2022.
- In 2016, the [Solid Waste \(Management\) Rules](#) replaced the Municipal Solid Wastes Rules of 2000.
- In 2017, the [Wetlands \(Conservation and Management\) Rules](#) were notified to decentralise the management of wetlands, giving States the power to identify and monitor them.
- 2022: [Forest \(Conservation\) Rules](#) were notified as an amendment to the 1980 rules.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q1. The Genetic Engineering Appraisal Committee is constituted under the (2015)

- (a) Food Safety and Standards Act, 2006
- (b) Geographical Indications of Goods (Registration and Protection) Act, 1999
- (c) Environment (Protection) Act, 1986
- (d) Wildlife (Protection) Act, 1972

Ans: (c)

Q2. Consider the following statements: (2019)

The Environment Protection Act, 1986 empowers the Government of India to

1. state the requirement of public participation in the process of environmental protection, and the procedure and manner in which it is sought
2. lay down the standards for emission or discharge of environmental pollutants from various sources

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Ans: (b)

Q3. If a particular plant species is placed under Schedule VI of the Wildlife Protection Act, 1972, what is the implication? (2020)

- (a) A licence is required to cultivate that plant.
- (b) Such a plant cannot be cultivated under any circumstances.
- (c) It is a Genetically Modified crop plant.
- (d) Such a plant is invasive and harmful to the ecosystem.

Ans: (a)

Mains

Q1. Describe the major outcomes of the 26th session of the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC). What are the commitments made by India in this conference? (2021)

Q2. How does the draft Environment Impact Assessment (EIA) Notification, 2020 differ from the existing EIA Notification, 2006? (2020)

Q3. What are the key features of the National Clean Air Programme (NCAP) initiated by the government of India? (2020)

What More can be Done to Provide Impetus to this Growth Story?

- **Environment Friendly Progress:** Even as we attribute the growing affluence of Indian society to science, technology and innovation-led developments, the challenges for the future remain intimidating.
 - **Reducing dependence on natural resources, making all industrial processes circular** so that no footprint of human activity is left, **making technologies environmentally friendly**, providing **sufficient opportunities to all** for living either in cities or in villages will remain priorities of science and technology.
 - Moreover, the ancient wisdom of **integrating science and spirituality by enhancing our understanding of nature in** association with that of the human mind and spirit will be the fond hope of the science and technology community of India.
- **Increasing Budget for R&D:** India shall aspire to make the next 75 years an enviable era with a **higher standard of living for every citizen**. Achieving this goal is possible provided there is a shift in focus to science and technology.
 - However, this is not possible given a **meagre expenditure of 0.7% of India's GDP on research and development (R&D)**. The Government needs to make some fundamental policy changes to facilitate the transition.
 - These include **increasing the R&D budget to 4% of the nation's GDP**, ensuring that **individual institutions implement processes** to accommodate the large budget, **encouraging individual entrepreneurs** and linking science with society.
 - **Israel and South Korea are prime examples** that drive their respective economies by **spending nearly 5% of their GDP on R&D**.
- **Strengthening Infrastructure:** An increase in the science budget to innovate must **precede appropriate macro-level policy changes** on how and where the money needs to be spent.
 - A part of this increase needs to be earmarked for **building physical and intellectual infrastructure** across the country, especially in the universities.
 - A first-class infrastructure must be accompanied by **well-trained, globally competitive institutional administrators** and processes.
 - India cannot compete on a global stage unless the dwindling infrastructure of its universities is upgraded.
- **Role of Institutions:** Before any policy changes take effect, individual institutions must

implement processes to accommodate the large budget.

- For example, each grant-receiving institution must have **internal procedures to handle their scientists' requests** to facilitate effective academia-industry collaboration.
 - Inadequate **staffing** at funding agencies, lack of **transparency in fund** disbursal, lack of a rigorous **international standard review** and **feedback process**, excessive delay in **fund disbursal**, and an outdated **appraisal system** are holding our scientists back.
- **Promoting Entrepreneurship in Science:** To bring the fruits of science and technology closer to the masses, there is no better way to do this than by **promoting and facilitating individual entrepreneurs**.
 - There are no better cradles for creative ideas than our university labs.
 - A robust system to **link the labs with the entrepreneurs to funnel innovative ideas**, products, and solutions to our society needs to be in place.
 - Entrepreneurship will only succeed in India if it is backed by a funnel of ideas and a **liberal process of taking those ideas out of the university labs**.

[India at 75: Part I](#)

[India at 75: Part II](#)

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