

BIOECONOMY @ 2030 – ECONOMY

NEWS: Union Minister of Science & Technology called for a **wider public understanding and inclusive participation in India's biotechnology mission**, stating that every Indian is a stakeholder in the country's bioeconomy.

- The Minister reiterated the government's commitment to realizing a **\$300 billion bioeconomy by 2030**.

WHAT'S IN THE NEWS?

Understanding the Bioeconomy

- **Definition:** Bioeconomy refers to the production of **food, energy, and industrial goods** using **renewable biological resources**, such as plants, animals, microbes, and bio-waste.
- **Sustainability Focus:** It is designed to **reduce dependency on fossil fuels**, support **climate resilience**, and foster **green growth** through eco-friendly industrial transformation.
- **Technological Integration:** Advances in **gene editing (e.g., CRISPR)**, **3D bioprinting**, and **synthetic biology** are revolutionizing traditional sectors.
- **Digital Synergy:** Bioeconomy leverages **digital tools**, such as artificial intelligence (AI), IoT, and bioinformatics, along with **circular economy principles** to promote resource efficiency and waste valorization.

India's Bioeconomy – Scale and Global Standing

- **Global Ranking:** India is among the **Top 12 biotech destinations** globally and **3rd largest** in the Asia-Pacific region.
- **Sectoral Growth:** India's bioeconomy grew **16-fold**, from **\$10 billion in 2014 to \$165.7 billion in 2024**, showcasing strong momentum.
- **GDP Contribution:** The sector contributes **4.25% to India's national GDP**, signaling its central role in economic development.
- **Growth Rate:** It has achieved a **CAGR (Compound Annual Growth Rate) of 17.9%** over the past four years, reflecting dynamic expansion.
- **Sub-sectors:** It is classified into four main pillars:
 - **Biopharmaceuticals**
 - **Bio-agriculture**
 - **Bio-IT (Bioinformatics)**

- **Bio-services**



Future Aspirations and Vision

- **Bioeconomy Target for 2030:** India aims to achieve a \$300 billion bioeconomy by 2030.
- **Global Leadership Goals:** Plans to lead in:
 - Vaccine production and distribution
 - Diagnostic innovation
 - Advanced therapeutics and biopharma

Key Government Policies and Initiatives

a) BioE3 Policy (2024) – *Biotechnology for Economy, Environment, and Employment*

- **Approved by:** Union Cabinet in 2024.
- **Aim:** To position India as a **global biotech powerhouse** by enabling innovation-led growth.
- **Key Features:**
 - Promotes **biomanufacturing** and **Bio-AI hubs**.
 - Supports **Biofoundries** for rapid prototyping of biotech products.
 - Encourages **green and regenerative bioeconomy** for sustainable development.
 - Aligns with **Net Zero** targets and **LiFE (Lifestyle for Environment)** mission.
 - Focuses on **R&D, entrepreneurship, and workforce expansion**.

b) National Biopharma Mission

- **Led by:** Department of Biotechnology (DBT), implemented by **BIRAC**.
- **Co-funded:** 50% by the World Bank, with a total budget of **\$250 million**.
- **Objective:** Enhance India's capabilities in:
 - **Vaccines and biosimilars**
 - **Medical devices and diagnostics**
 - **Industry-academia partnerships**
- **Impact:** Supports **101 projects**, involving over **150 organisations and 30 MSMEs**.

Sectoral Highlights

a) Biopharmaceuticals

- **India's Role:**
 - **Ranks 3rd globally** in pharma production by volume.
 - **14th by value**, reflecting its cost-effectiveness and scale.
 - Manufactures **65% of the world's vaccines**, aiding global health equity.
- **Innovation Focus:**
 - Developing India's **first indigenous HPV vaccine** for cervical cancer.
 - Nearly **1 in 3 tablets globally** is manufactured in India.

b) Bio-agriculture

- **Led by:** DBT's Agricultural Biotechnology Programme.
- **Key Innovations:**
 - **Climate-smart crops:** Example – SAATVIK (NC 9) chickpea with high drought tolerance and yield.
 - **Genome-edited rice:** DEPI-edited MTU-1010 line improves rice productivity.
 - **SNP Arrays:** IndRA (rice) and IndCA (chickpea) aid crop improvement and DNA fingerprinting.
 - **Amaranth Resources:** Nutritional screening tools developed to combat malnutrition and obesity.
 - **Biocontrol Innovation:** Nano-formulation from *Myrothecium verrucaria* controls powdery mildew in tomato and grape.
 - **Farmer Safety:** Kisan-Kavach, an anti-pesticide suit, enhances health protection during field spraying.

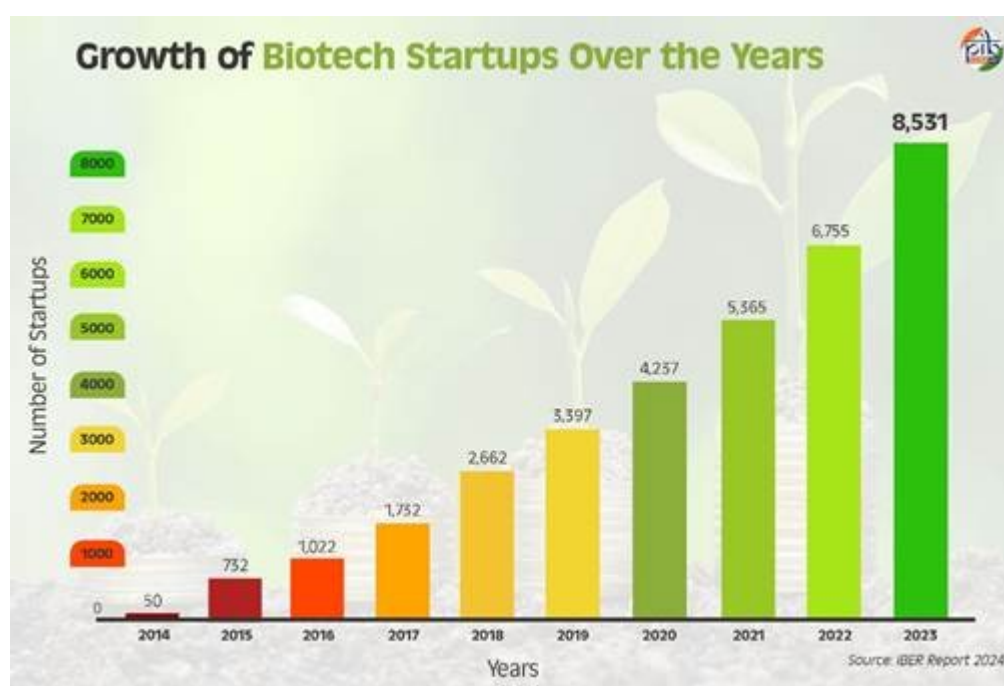
c) Biotech-KISAN Programme

- **Launched by:** Department of Biotechnology.
- **Model:** Hub-and-spoke approach.

- **Coverage:** Operational in **115 Aspirational Districts**.
- **Goal:** Strengthen **scientist–farmer partnerships** by integrating **agri-biotech solutions** directly at the farm level.

d) Bioenergy Sector

- **Bioenergy Definition:** Renewable energy derived from **biomass**, such as crop waste, dung, algae, and organic residues.
- **Ethanol Blending Programme:**
 - Blending rose from **1.53% in 2014** to **15% in 2024**.
 - Target: Achieve **20% blending by 2025**.
 - **Impact:** Reduced crude oil imports by **173 lakh metric tons**, saving **₹99,014 crore** and cutting **519 lakh metric tons of CO₂ emissions**.



Innovation Ecosystem – BIRAC’s Role

- **Established in 2012** by the Department of Biotechnology.
- **Mission:** To **empower biotech startups** through financial and infrastructural support.
- **Impact:**
 - Set up **95 bio-incubation centres** across India.
 - Promotes **mentorship, seed funding, and industry linkages** for early-stage biotech ventures.

Way Forward – Strategic Roadmap

- **Holistic Approach:** India’s bioeconomy strategy merges **innovation, sustainability, and inclusivity**.

- **Global Leadership Aspiration:** Through bio-manufacturing, bio-agriculture, and bioenergy, India aims to emerge as a **trusted partner in the global bio-based transition**.
- **Resilience Building:** Strengthening national capabilities in biotech reduces external dependencies and enhances **climate, health, and food security resilience**.
- **Collaborative Growth:** Strong interlinkages between **public policy, scientific research, and private sector investment** ensure long-term scalability and impact.

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