Research Unit
Press Information Bureau
Government of India

The Rise of India's Bioeconomy

From $10bn to $165.75bn in a Decade

(Ministry of Science & Technology)

27th March 2025

Key takeaways

- India's bioeconomy has grown from **$10 billion** in **2014** to **$165.7 billion** in **2024**, with a target of **$300 billion** by 2030.
- The sector contributes **4.25%** to GDP with a compound annual growth rate (CAGR) of **17.9%** over the past four years.
- The government aims to make India a global bio-manufacturing hub driven by **innovation**, **sustainability**, and inclusive development.
- BioE3 promotes regenerative biomanufacturing and supports a **circular bioeconomy** aligned with **India's net-zero goals**.
- The National Biopharma Mission, co-funded with the **World Bank ($250 million)**, supports over **100 projects** and **30 MSMEs**.
- India is among the top producers of vaccines globally and developed the world's first DNA COVID-19 vaccine.
- Ethanol blending increased from **1.53%** in **2014** to **15%** in **2024**, with a target of **20% by 2025.**

Introduction

India's bioeconomy has undergone a remarkable transformation over the past decade, growing **sixteen-fold** from **$10 billion in 2014** to an impressive **$165.7 billion in 2024**. This exceptional expansion reflects the nation's focused efforts to position biotechnology as a cornerstone of sustainable economic growth and innovation. Contributing **4.25% to the national GDP**, the sector has demonstrated a robust **compound annual growth rate (CAGR) of 17.9%** over the past four years, reinforcing India's emergence as a rising global force in biotechnology. With an ambitious target of **$300 billion by 2030**, the bioeconomy is poised to play a pivotal role in shaping India's future as a knowledge-driven, bio-enabled economy.

The bioeconomy is the use of renewable biological resources to produce food, energy and industrial goods**,** which supports **sustainability** and **economic growth**. **Innovations** like gene editing and bioprinting are driving progress, while integration across sectors strengthens long-term impact. By

aligning **biotechnology** with **digital tools** and **circular economy principles**, the bioeconomy offers sustainable solutions to environmental challenges and promotes overall societal well-being.

India's Vision for a Thriving Bioeconomy

India's vision for the bioeconomy is rooted in **innovation-led growth**, sustainable development, and inclusive economic progress. The country aims to become a **global hub for bio-manufacturing**, backed by strong R&D infrastructure, cutting-edge technologies, and a skilled scientific workforce. The focus is on creating a **resilient industrial ecosystem** that promotes the development and commercialization of **new biotech products**, while unlocking opportunities in both **urban and rural** regions. With an ambitious target of achieving a **$300 billion bioeconomy by 2030**, India also seeks to lead globally in **bio-pharma**, including **vaccines, diagnostics, and therapeutics**. This strategy directly contributes to the broader goals of **India@2047**, emphasizing **sustainability, economic self-reliance**, and **green growth**.

Government Initiatives and Key Programmes

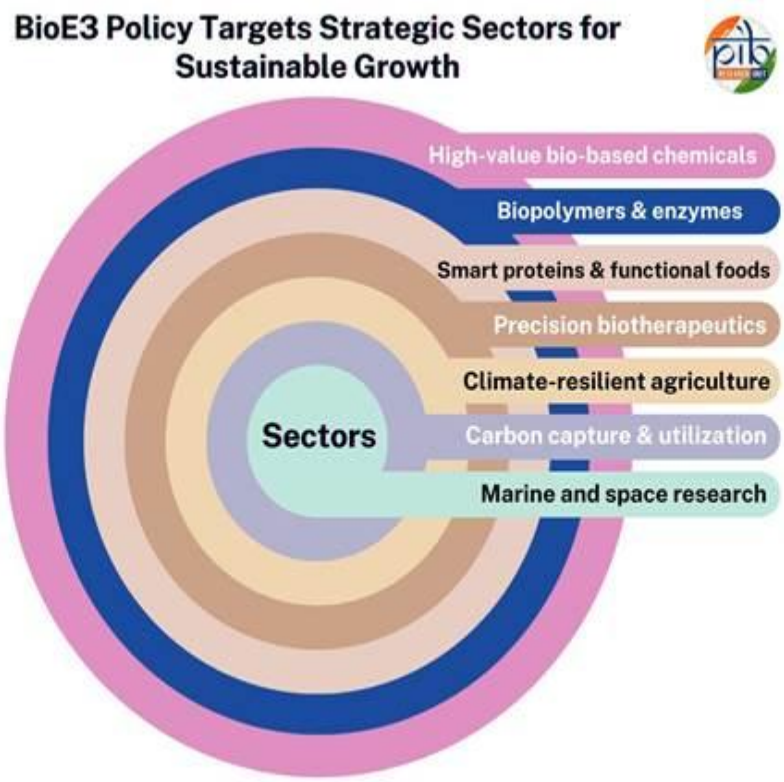
1. BioE3 Policy (Biotechnology for Economy, Environment, and Employment)

BioE3 (Biotechnology for Economy, Environment and Employment) Policy marks a significant leap in India's biotechnology sector. Approved by the Union Cabinet on 24th August 2024, the policy aims to transform India into a global **biotech powerhouse** by fostering high-performance **biomanufacturing** and addressing key pillars of the **economy, environment**, and **employment**.

It aligns with the vision of a cleaner, greener, and more prosperous future by promoting regenerative biomanufacturing and a shift from chemical-based industries to sustainable bio-based models. This supports a circular bioeconomy and aligns with the goal of net-zero carbon emissions. This approach supports environmental sustainability and contributes significantly to the '**Make in India**' initiative by fostering the development of biobased products with minimal carbon footprints**.**

Strategic Sectors and Key Initiatives

The BioE3 Policy introduces key initiatives such as advanced **biomanufacturing facilities**, **bio-foundry clusters**, and **bio-AI hubs** to support bio-based product development and commercialization. These centers will bridge lab-to-market gaps and foster collaboration across startups, SMEs, and industry. With a strong focus on employment, the policy aims to generate jobs in **tier-II and tier-III** cities by leveraging local biomass. It also emphasizes ethical biosafety and alignment with global regulatory standards to boost India's global biotech competitiveness.



Key Features

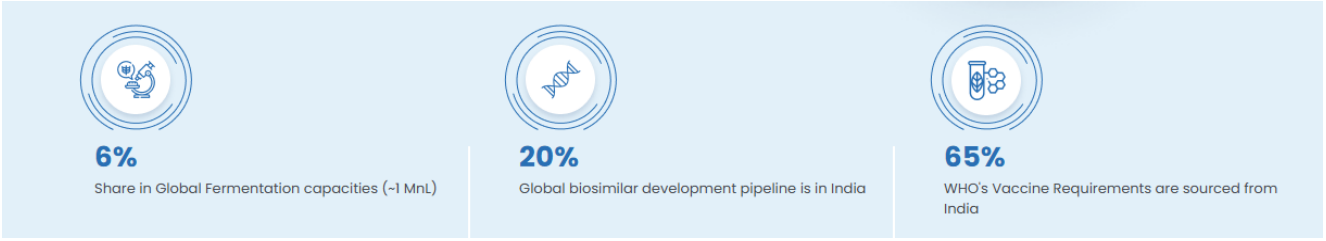
1. Innovation-driven support for R&D and entrepreneurship
2. Establishment of Biomanufacturing & Bio-AI hubs and Biofoundry
3. Focus on regenerative bioeconomy models for green growth
4. Expansion of India's skilled workforce
5. Alignment with 'Net Zero' carbon economy and 'Lifestyle for Environment' (LiFE) initiatives

2. National Biopharma Mission

The **National Biopharma Mission (NBM)**-Innovate in India (i3), is a government-approved initiative led by the **Department of Biotechnology (DBT)** and implemented by **BIRAC**. It aims to boost India's capabilities in **biopharmaceuticals, vaccines, biosimilars, medical devices, and diagnostics** by fostering collaboration between **industry and academia**. With a budget of **$250 million**, co-funded 50% by the **World Bank**, the mission supports **101 projects**, involving over **150 organisations** and **30 MSMEs**. It has helped set up **11 shared facilities** for testing, validation, and manufacturing—benefiting start-ups and MSMEs. These include **GCLP labs** for vaccine testing, **GLP labs** for biosimilar analysis, and **cGMP facilities** for manufacturing. The mission has also generated **over 1,000 jobs**, including **304 scientists and researchers**. Additionally, the **Genome India Programme**, which involves sequencing **10,000 genomes**, is expected to shape future global healthcare strategies, both in treatment and prevention.

Key Achievements in India's Pharma Sector:

- India has emerged as a global hub for **affordable,** high-quality medicines, ranking **3rd** in pharmaceutical production by volume and 14th by value.
- Developed the **world's first DNA vaccine** for COVID-19, showcasing innovation in global health.
- Produces **65% of the world's vaccines**, significantly benefiting low- and middle-income countries.
- The **"Make in India"** initiative is reducing dependency on imported Active Pharmaceutical Ingredients (APIs) through strengthened domestic manufacturing.
- Pharma industry has transitioned from a **generic-focused model** to developing **biopharmaceuticals and biosimilars**.
- India is working on the **first indigenous HPV vaccine** to prevent **cervical cancer** in adolescent girls.
- **Every third tablet** consumed globally is manufactured in India, demonstrating global trust in Indian pharma.



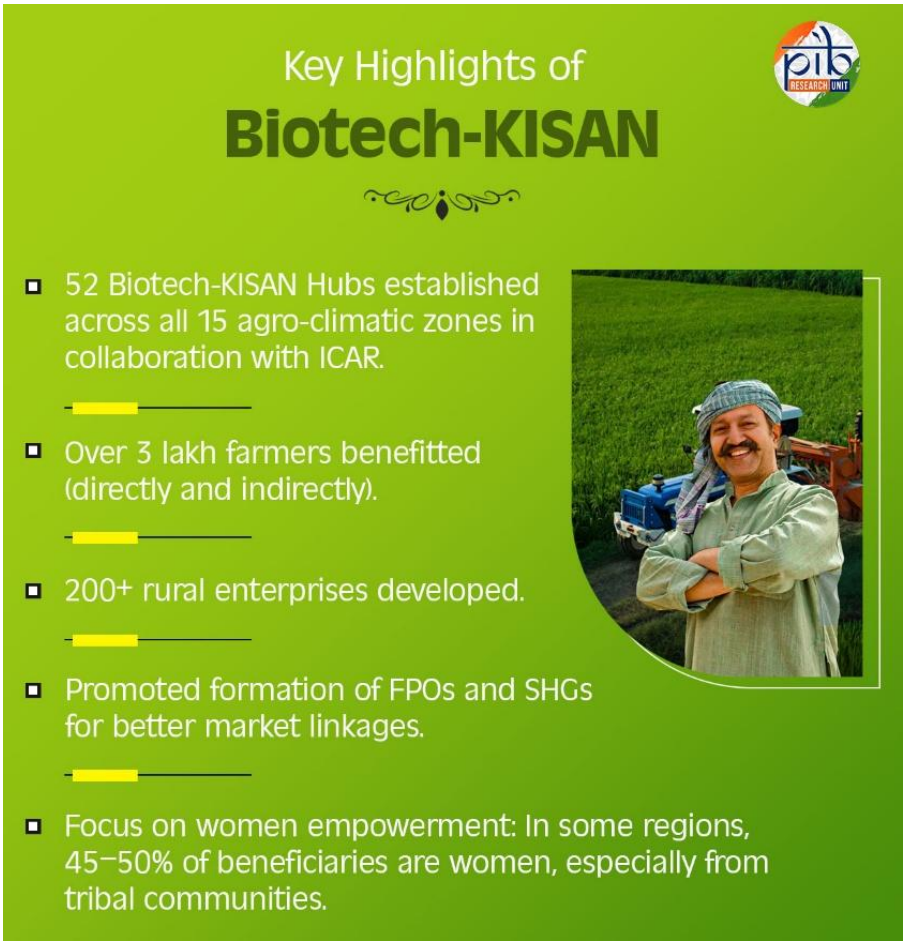
3. Bio-agriculture

Agricultural biotechnology in India is advancing rapidly through innovations in genomics, transgenics, and gene editing under the Department of Biotechnology's Agriculture Biotechnology programme.

- **Climate-Smart Crops**: A drought-tolerant, high-yielding chickpea variety *SAATVIK (NC 9)* has been approved for cultivation.
- **Genome-Edited Rice**: Loss-of-function mutations in yield-limiting genes have led to improved rice lines like DEP1-edited MTU-1010, showing higher yields.
- **Genotyping Arrays**: India's first 90K SNP arrays—*IndRA* for rice and *IndCA* for chickpea—enable DNA fingerprinting and variety identification.
- **Amaranth Resources**: A genomic database, NIRS techniques, and a 64K SNP chip aid nutritional screening and development of anti-obesity amaranth varieties.
- **Biocontrol**: A nano-formulation from *Myrothecium verrucaria* offers eco-friendly control of powdery mildew in tomato and grape.
- **Kisan-Kavach**: An anti-pesticide protective suit enhances farmer safety from toxic exposure.

4. Biotech-KISAN (Biotech-Krishi Innovation Science Application Network)

Biotech-KISAN is a **scientist-farmer partnership programme** launched to empower farmers, especially **women and those in rural and tribal areas**, through **agricultural innovation and scientific interventions**. It follows a **hub-and-spoke model** and is active across **115 Aspirational Districts** in India.



State-wise Impact:

- **Chhattisgarh (Bastar region):** Income rose by **40–50%** through improved **bio-fortified rice**; **2173 farmers** benefitted.
- **West Bengal: 37,552 farmers** (including **28,756 women**) trained with **14 scientific farming practices**; **14 FPOs** and **134 FIGs** formed.
- **Madhya Pradesh: 67,630 farmers** benefitted via technology adoption across **8 Aspirational Districts**.
- **Jharkhand (Deoghar): 69–100% increase** in cocoon and compost production; **2100 families** covered.
- **Meghalaya & Sikkim: 18–20% yield increase** in maize, turmeric, tomato; pest reduction by **50%**.

Bioenergy

India's bioenergy sector is playing a transformative role in strengthening the country's bioeconomy. Ethanol blending has seen a significant rise—from **1.53% in 2014 to 15% in 2024**, with a target of **20% blending by 2025**. This shift has not only reduced crude oil imports by **173 lakh metric tons** but also saved **Rs. 99,014 crores in foreign exchange** and cut **519 lakh metric tons of CO_2 emissions**.

The economic ripple effect is substantial, with **Rs. 1,45,930 crores disbursed to distillers** and **Rs. 87,558 crores to farmers**, reinforcing rural incomes and agro-industry linkages. Fuel diversification is gaining momentum through the launch of **E100 fuel at over 400 outlets** and the availability of **E20 fuel at over 15,600 retail stations**.

Bioenergy is a form of renewable energy that is derived from recently living organic materials known as biomass, which can be used to produce transportation fuels, heat, electricity, and products.

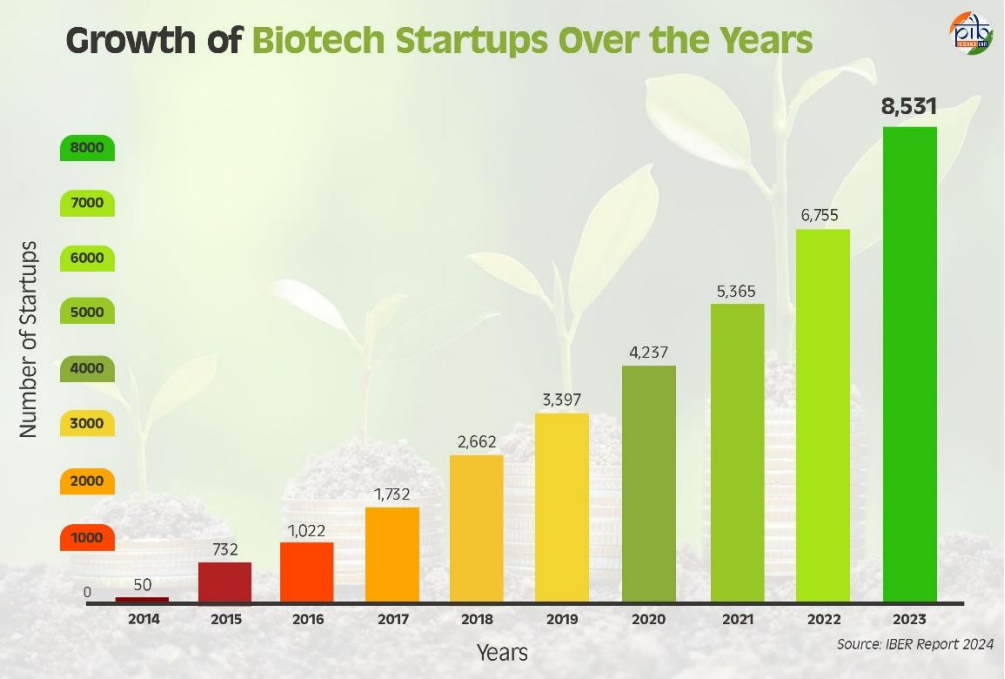
Supportive policies have encouraged the use of varied feedstocks, including maize, damaged rice, and sugarcane byproducts, backed by structured incentives. **Second-generation ethanol refineries** are converting agricultural residues like Parali and bamboo into fuel, strengthening the circular economy and reducing pollution. These developments highlight how bioenergy contributes to energy security, sustainability, and rural development—key pillars of India's expanding **bioeconomy**.

Boosting Biotech Innovation Through BIRAC Initiatives

The Biotechnology Industry Research Assistance Council (BIRAC), established by the Department of Biotechnology in 2012, plays a pivotal role in nurturing India's biotech startup ecosystem. With 95 bio-incubation centres set up nationwide, BIRAC supports startups through funding, infrastructure, and mentorship.

Key schemes include:

- **Biotechnology Ignition Grant (BIG):** Up to ₹50 lakh for 18 months to support early-stage startups; nearly 1,000 innovators supported.
- **SEED Fund:** ₹30 lakh equity support for proof-of-concept stage startups.
- **LEAP Fund:** ₹100 lakh equity support for commercialisation-ready innovations.
- **जनCARE – Amrit Grand Challenge:** Supported 89 digital health tech innovations in AI, ML, telemedicine, and blockchain, with a focus on tier-II, tier-III cities and rural areas.



Towards a Bio-Enabled Future

India's bioeconomy stands at a defining moment, with its integrated approach to **innovation**, **sustainability**, and **inclusive development** setting a global benchmark. Through robust policy frameworks, cutting-edge research, and a strong emphasis on collaboration across sectors, the nation is well on track to redefine its industrial and environmental landscape. The convergence of **bio-manufacturing**, **bio-agriculture**, and **bioenergy** not only strengthens national resilience but also signals India's strategic intent to lead in the emerging global bioeconomy. As India moves forward, this cohesive and future-oriented vision lays the foundation for a **more sustainable**, **self-reliant**, **and bio-enabled economy**, firmly aligned with the aspirations of **India@2047**.

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