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DAILY EDITORIAL ANALYSIS

TOPIC

INDIA'S BIOECONOMIC OPPORTUNITY & FUTURE POTENTIAL

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Context

- **India's bioeconomy** needs capital-market innovation, regulatory modernisation and strategic blend of innovation to achieve **$1.2 trillion by 2047.**

About Bioeconomy

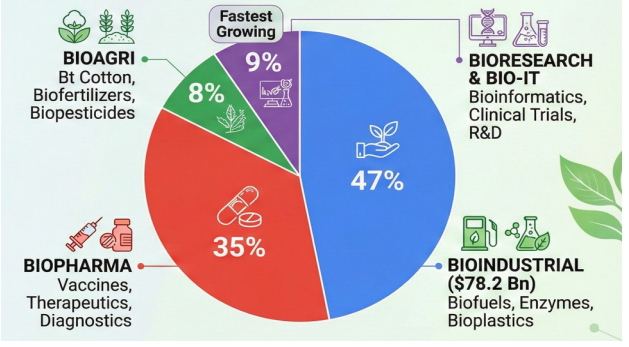
- As per **Food and Agriculture Organization (FAO**), the **bioeconomy is the production, utilization and conservation of biological resources**, including related knowledge, science, technology, and innovation, to provide information, products, processes and services across all economic sectors aiming **toward a sustainable economy.**

Status of India's Bioeconomy

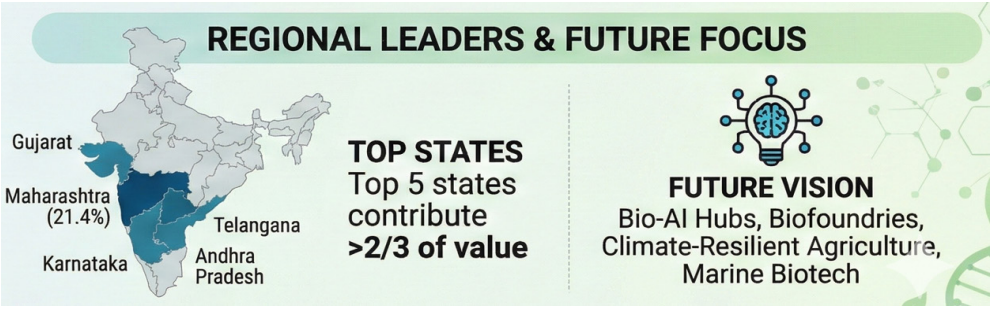
- India's bioeconomy has witnessed exponential growth, expanding **16-fold in a decade**, from **$10 billion in 2014** to **over $165 billion in 2024**, and it aims to contribute about **$1.2 trillion by 2047.**
- As per the **India BioEconomy Report 2024**, the sector c**ontributes 4.25% to India's GDP**, signalling its rising centrality in national development.
  - It has been fueled by **advances in biotechnology, pharmaceuticals, agriculture, and bioenergy**, supported by a growing startup ecosystem and government support.
- In Ethanol, India is now the **third-largest producer of blended ethanol,** with production almost tripling in five years, supporting both energy security and decarbonization efforts.

Key Sectors Driving the India's Bioeconomy

- **Biopharma:** India is already a **global leader in generics and vaccines**, and it is focusing on **biologics, biosimilars, and personalized medicine.**



- **Agricultural Biotechnology:** Innovations in crop genetics, biofertilizers, and precision farming can enhance food security and sustainability.
- **Bioenergy & Biofuels:** Bioethanol and biogas offer scalable alternatives to fossil fuels, with a push for clean energy
- **Industrial biotechnology: Enzymes, bioplastics, and green chemicals** are gaining traction as eco-friendly industrial inputs.



- India can build **thousands of deep-tech start-ups**, lead globally in **mRNA, RNAi, gene therapy, biosimilars, and biologics**, emerge as a **preferred global hub** for clinical research and bio-manufacturing, generate **millions of high-value jobs** under the BioE^3 **framework,** and realise a **$1.2 trillion bioeconomy by 2047**.

India's Push For Expanding Bioeconomic Architecture

- **BioE3 Policy:** The BioE3 policy (Biotechnology for Economy, Environment, Employment) acts as a unifying strategy to propel biomanufacturing, focusing on six domains—ranging from bio-based chemicals to functional foods, carbon capture, precision biotherapeutics, climate-smart agriculture, and even marine/space bio-research.
- **Other Key Measures:** National Mission on Bioeconomy (2016), National Biopharma Mission, Bio-RIDE, BioNEST incubators, Global Biofuels Alliance & National Biological Data Centre (NBDC).

Hindrances to Reach $1.2 Trillion by 2047

- **India's Structural Bottleneck:** India does **not permit pre-revenue or research-stage biotech companies** to list publicly. Consequently:
  - Innovators rely heavily on **private, risk-averse capital**.
  - **Valuations remain suppressed**.
  - **High-potential start-ups relocate abroad**, seeking more supportive ecosystems.
- **Regulatory Inefficiencies:** Cumbersome approval processes for biotech products delay innovation and commercialization.
  - Lack of a single-window clearance system for biotech startups and research trials creates uncertainty.
  - **First-in-Human (FIH)** trial approvals take months. Each trial phase requires **fresh Subject Expert Committee (SEC)** review.
  - CDSCO lacks **scientific capacity** to assess emerging modalities like **mRNA, CRISPR, CAR-T, and gene therapies**.
- **Limited Capital Market Access:** Biotech startups struggle to raise early-stage and scale-up funding due to high R&D risks and long gestation periods.
  - India lacks a robust biotech IPO pipeline, unlike the US and China, where public markets actively support biotech innovation.
- **Fragmented Innovation Ecosystem:** Weak industry-academia linkages hinder translational research and product development.
  - Many innovations remain trapped in labs due to poor commercialization pathways and limited tech transfer infrastructure.
- **Inadequate Infrastructure:** Shortage of biomanufacturing facilities, especially for biologics, diagnostics, and advanced therapeutics.
- **Policy and Coordination Gaps:** Multiple ministries (Science & Tech, Health, Agriculture, Environment) operate in silos, leading to policy fragmentation.
  - Absence of a centralized bioeconomy mission or roadmap with measurable milestones hampers strategic alignment.

Key Suggestions For Achieving Bioeconomy $1.2 Trillion by 2047

- **Regulatory Reform:** India's current drug-regulation system — led by **CDSCO** — remains **slow, fragmented, and bureaucratic**.
  - Even with capital access, innovation will stagnate without **regulatory speed and scientific clarity**.
- **Need of Innovation & Biotech Board:** India urgently needs a **dedicated listing board** on the **NSE and BSE**, modelled on **NASDAQ**, **STAR**, and **Hong Kong's Biotech Chapter**.
  - It could **unlock domestic capital**, draw **global institutional investors**, and become the **financial engine of India's bioeconomy**.

- Such a platform should:
  - Allow **pre-revenue and research-stage biotech listings**.
  - Enable **IP-led companies** to access patient capital.
  - Attract **global investors** to India's science story.
  - Encourage **domestic scaling** instead of foreign migration.
- **Focus on Innovation:** Both capital-market reform and regulatory reform together can drive innovation that powers **global biotech leadership**. It needs:
  - A **dedicated Innovation & Biotech Board**;
  - A **science-led dual-agency regulatory system**; and
  - Strong **institutional support**.

Two-Pillar Model for India

- **Empower ICMR for Scientific Review:** ICMR's research depth and ethical infrastructure make it ideal for evaluating early-stage drugs, vaccines, diagnostics, and advanced biologics.
- **Position CDSCO as Licensing Authority:** CDSCO should focus on final approvals, GMP compliance, site inspections, and pharmacovigilance.
  - **Separation of scientific assessment (ICMR)** and **administrative licensing (CDSCO)** could reduce approval timelines, improve scientific rigour, and reinforce investor confidence.

Case Study of China

- **Capital Innovation Fuels Scientific Innovation:**
  - **STAR Market (Shanghai, 2019):** Enabled pre-revenue deep-tech firms to list without profitability requirements, mobilising **$130+ billion**.
  - **Hong Kong Biotech Chapter (2018):** Allowed non-revenue biotech IPOs; over **70 companies listed**, raising **$25 billion**.
  - **Venture Capital Inflows (2018–2022): $45 billion** in life sciences — nearly **10 times India's inflows**.
  - **Pharma R&D Investment:** Surpassed **$20 billion**, compared to India's **$3 billion**.
- China faced **regulatory hurdles, similar to India**, a decade ago but acted decisively:
  - Reformed **NMPA** into a **science-led regulator**.
  - Introduced **time-bound review pathways**, cutting trial approval times by **40–60%**.
  - Allowed **parallel review of trial phases**.
  - **Aligned with ICH** global standards.
  - **Fast-tracked advanced modalities**, approving multiple CAR-T and gene therapies before Western counterparts.
- This **regulatory agility** created **predictability**, which built **investor confidence**, fueling China's biotech surge.

Conclusion

- India stands at a decisive juncture. We have **the science, the talent, and the market**. What remains is the **courage to reform**.
- **Capital-market innovation** and **regulatory modernisation** must be treated as **national priorities**.
  - India can evolve **from the pharmacy of the world to the lab of the world** — leading global biotech innovation, not just supplying it with bold action.

Source: BL

Daily Mains Practice Question

[Q] Discuss the opportunities and challenges India faces in realizing its bioeconomic potential by 2047. What strategic initiatives and sectoral transformations are necessary to achieve this goal?