India’s Bioeconomy to Reach Trillion by 2047, Initiatives, Challenges

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India’s bio-economy is projected to expand to Rs. 92.44 lakh crore (US$ 1 trillion) by 2047, according to Union Minister of State (Independent Charge) for Science and Technology, Dr. Jitendra Singh. He highlighted that the 21st century will be driven by a biology-led economy, India’s bio-economy is projected to reach $1 trillion by 2047, placing it among the top three globally, as stated by Union Minister Jitendra Singh.

What is Bioeconomy?

The bioeconomy refers to an economic system that uses biological resources, processes, and principles to produce goods, services, and energy. It includes sectors such as:

- **Biotechnology** and pharmaceuticals
- Agriculture and food systems
- Bio-energy and biofuels
- Environmental and industrial biotechnology

It emphasizes sustainability, circular resource use, and reduced dependence on fossil fuels.

India’s Bio-Economy Growth

India’s bioeconomy has witnessed exponential growth over the last decade:

- India’s bio-economy has expanded from $10 billion in 2014 to over $165 billion today, growing at nearly 18% annually, with a target of $300 billion by 2030.
- The number of biotech startups has increased from around 50 to more than 11,000.
- By 2047, India aims to emerge among the top three global bio-economies.

This growth reflects India’s transition from a nascent biotech player to a global bio-innovation hub.

Drivers of India’s Bio-Economy Growth

India’s bioeconomy growth is being driven by a combination of policy support, innovation, and rising demand across sectors.

- **Policy-Led Expansion**: Targeted interventions such as the BioE3 Policy, RDI Fund, and Anusandhan National Research Foundation have created a supportive ecosystem for bio-innovation and manufacturing.
- **Startup-Led Innovation**: Rapid rise of biotech startups has strengthened the lab-to-market pipeline, attracting private capital and solving real-world challenges.
- **Rising R&D and Global Integration**: Increasing investment in research and deeper global collaborations have enhanced India’s technological capabilities and competitiveness.
- **Institutional Backbone**: Strong support from research institutions, universities, and incubators has enabled knowledge creation and talent development.
- **Demand-Side Push**: Growing needs in healthcare, clean energy, and food security are driving expansion of bio-based industries.

Government Initiatives

The government has introduced several targeted measures to accelerate the growth of the bioeconomy sector.

- **BioE3 Policy (Biotechnology for Economy, Environment and Employment)**: Approved by the Union Cabinet in 2024, it aims to position India as a global bio-manufacturing hub. It promotes high-performance biomanufacturing across sectors. It’s focus areas include bio-based chemicals, smart proteins, precision biotherapeutics, climate-resilient agriculture, carbon capture, and space/defence applications. It aims to position India as a global bio-manufacturing hub.
- **Anusandhan National Research Foundation**: A research funding body with a corpus of fifty thousand crore rupees to strengthen long-term scientific research.
- **Research Development and Innovation Fund**: A one lakh crore rupees fund aimed at supporting deep technology and high-risk innovation.
- **Startup and infrastructure support**: Expansion of biotechnology parks, incubators, and programs supported by Biotechnology Industry Research Assistance Council to promote entrepreneurship.
- **Biofuel policies**: Promotion of ethanol blending and other bio-energy initiatives to support energy security and sustainability.

Challenges in India’s Bioeconomy

Despite strong growth, several structural challenges continue to limit the full potential of India’s bioeconomy.

- **Low investment in research and development**: India’s Gross Expenditure on Research and Development remains around zero point six to zero point seven percent of Gross Domestic Product, which is lower than the global average.
- **Regulatory uncertainty**: Delays and policy ambiguity, especially in genetically modified crops, slow down innovation and investment.
- **Import dependence**: Heavy reliance on imported Active Pharmaceutical Ingredients and medical devices creates supply chain risks.
- **Funding gap**: Biotechnology startups face difficulty in securing late-stage funding, often referred to as the “Valley of Death,” which limits commercialization.
- **Infrastructure gaps**: Limited bio-manufacturing capacity and lack of pilot-scale facilities restrict scaling of innovations.
- **Weak commercialization**: High research output is not adequately converted into patents or market-ready products.
- **Skill gap**: There is a mismatch between academic training and industry requirements in areas such as bioinformatics and synthetic biology.

Way Forward

To achieve the target of a one trillion dollar bioeconomy by 2047, India needs to adopt a comprehensive and forward-looking strategy.

- **Develop bio-manufacturing infrastructure**: Establish shared bio-foundries and pilot facilities to support large-scale production.
- **Reform regulatory system**s: Introduce regulatory sandboxes and faster approval processes to promote innovation.
- **Enhance financing mechanisms:** Create dedicated platforms to attract long-term investment in biotechnology.
- **Strengthen industry academia linkages**: Set up Technology Transfer Offices to improve commercialization of research.
- **Promote domestic manufacturing**: Encourage production of critical inputs and key starting materials to reduce import dependence.
- Focus on skill development: Integrate biotechnology with **artificial intelligence** and data science to build a future-ready workforce.
- Leverage genomic data: Use India’s genetic diversity for precision medicine and global research collaborations.
