

2022 India BioEconomy Report

INDIA BIOECONOMY REPORT 2025

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This report has been prepared for “**Make In India Facilitation Cell for Biotechnology**” of Biotechnology Industry Research Assistance Council (BIRAC) by Association of Biotechnology Led Enterprises (ABLE). The report is written by **Narayanan Suresh**, Chief Operating Officer of ABLE and **Srinivas Rao Chandan**, Editorial Consultant for ABLE under the able guidance of **Mr G S Krishnan**, Hon. President, ABLE

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FOREWORD



Dr. Jitendra Singh

Union Minister of State
(Independent Charge) for
Science and Technology,
Minister of State
(Independent Charge) for
Earth Sciences, Minister of
State PMO,
Department of Atomic
Energy, Department of
Space, Personnel, Public
Grievances and Pensions

India's BioEconomy Hits New Highs

The *India BioEconomy Report 2025* arrives at a pivotal moment, marking a period of unprecedented growth and transformative achievement within the nation's biotechnology landscape. As India strides toward its "Viksit Bharat" goal of becoming a developed nation by 2047, the BioEconomy's remarkable growth underscores its critical role in this journey.

The numbers speak for themselves: the Indian BioEconomy's value has nearly doubled, surging from \$86 billion in 2020 to an impressive \$165.7 billion in 2024. This exponential rise reflects the dynamism and burgeoning potential of this vital sector.

Equally significant is the milestone reached by India's biotech startup ecosystem, which crossed 10,075 startups in 2024—a tenfold increase in just nine years. This surge highlights the nation's entrepreneurial spirit and the enabling environment fostered by strategic government initiatives. This growing startup base is more than a numerical achievement; it represents a vibrant engine of innovation, driving advancements across diverse fields, from healthcare to agriculture.

A groundbreaking achievement that deserves special recognition is the successful completion of whole genome sequencing of 10,074 individuals from 99 communities, reflecting the vast linguistic and social diversity of India. The GenomeIndia Project, a pioneering initiative funded by the Department of Biotechnology (DBT), Ministry of Science and Technology, embarked on an ambitious quest to map the genetic variations of India's diverse communities. This achievement is more than a scientific milestone—it is a foundational step toward unlocking the potential of personalized medicine. The creation of a "Reference Genome for the Indian Population" will provide invaluable insights into the genetic underpinnings of diseases, enabling the development of targeted interventions tailored to specific ethnic groups.

The GenomeIndia Project positions India as a

global leader in genome research and serves as a vital resource for researchers worldwide, facilitating future large-scale human genetic studies. The success of this initiative, spearheaded by a consortium of 20 national institutes, exemplifies the power of collaborative, mission-oriented scientific partnerships. I extend my sincere congratulations to all contributors for their dedication and hard work.

The wealth of high-quality biological data generated by initiatives like GenomeIndia is crucial for addressing pressing global challenges, including infectious diseases, biodiversity loss, and climate change. However, the true potential of this data can only be realized through responsible and efficient sharing.

In this context, I commend DBT for the timely publication of the Framework for Exchange of Data (FeED) Protocols, developed under the Biotech-PRIDE (Promotion of Research and Innovation through Data Exchange) Guidelines, 2021. This document establishes a robust framework for data sharing, ensuring integrity, security, and reproducibility. By fostering responsible data sharing, the FeED Protocols will empower researchers to accelerate discoveries and drive innovation across the biological sciences.

Furthermore, the approval of the BioE3 (Biotechnology for Economy, Environment and Employment) Policy for Fostering High-Performance Biomanufacturing by the Union Cabinet, chaired by Prime Minister Shri Narendra Modi, in October 2024 marks a significant step towards realizing India's BioEconomy vision. This policy outlines a comprehensive strategy to drive innovation, entrepreneurship, and sustainable growth in the Biomanufacturing sector.

The BioE3 Policy emphasizes innovation-driven support for R&D, the establishment of Biomanufacturing and Bio-AI hubs

and Biofoundries, and the promotion of regenerative BioEconomy models. It aligns with the government's commitment to achieving a 'Net Zero' carbon economy and promoting 'Lifestyle for Environment,' paving the way for accelerated green growth through a circular BioEconomy. This policy will also create a surge in job creation and expand India's skilled workforce, contributing to the nation's journey towards Viksit Bharat.

To operationalize the BioE3 Policy, DBT has launched an implementation plan under the Bio-RIDE scheme. This initiative focuses on establishing "मूलांकुर" BioEnabler Hubs, including Biofoundries and Biomanufacturing Hubs, through Public-Private Partnerships (PPP). These hubs will target six key sectors: bio-based chemicals, functional foods, precision biotherapeutics, climate-resilient agriculture, biofuels, and marine/space research.

DBT will support academia, while BIRAC will aid startups and MSMEs, facilitating research, pilot production, and pre-commercial manufacturing. Biofoundries will focus on innovation and early-stage scaling, while Biomanufacturing Hubs will bridge the gap between lab research and commercial production. Funding mechanisms, including grants-in-aid, co-funding, equity financing, and royalty sharing, will be tailored to support diverse applicants. Sustainability remains a key focus, ensuring long-term viability.

The India BioEconomy Report 2025 provides a comprehensive overview of these advancements, highlighting the nation's progress toward becoming a global BioEconomy leader. It serves as a testament to the power of innovation, collaboration, and strategic government initiatives in driving sustainable and inclusive growth. I am confident that India's BioEconomy will continue to flourish, contributing to a healthier, more prosperous, and sustainable future for all.

From the DBT Secretary's Desk



Dr. Rajesh S. Gokhale

Secretary to the Government of India, Department of Biotechnology,
DG BRIC and Chairman, BIRAC

India's BioEconomy: A Defining Moment in Economic Transformation

India's BioEconomy has emerged as a powerful engine of economic growth, marking a remarkable rise over the past decade. In 2024, the sector reached a value of **\$165.7 billion**, reflecting strong growth across biopharma, bio-industrial production, research services, and agricultural biotechnology. The biotech startup ecosystem has expanded rapidly, with the total base of biotech startups reaching **10,075** in 2024 – up from 8,530 in 2023. The sector now contributes approximately **4.25% to India's GDP**, placing it alongside global leaders like the United States and China. However, this is just the beginning. With the right strategic investments and policy alignment, India's BioEconomy could grow to contribute **10%–12% of GDP** over the next decade – potentially elevating India into the ranks of the world's top bio-based economies.

The Bio-Revolution: India's Opportunity

History shows that industrial revolutions reshape the global economic order. The First Industrial Revolution was powered by steam and coal; the Second by steel, electricity, and heavy engineering; and the Third by information and communication technology. The next 25 years will be defined by the industrialization of biology – the **Bio-Revolution**.

Advances in synthetic biology, gene editing, bioinformatics, and biomanufacturing are already transforming healthcare, agriculture, and industrial processes. Countries that can harness these advances will secure strategic economic advantages. India stands well-positioned to lead this transformation, given the expanding biotech infrastructure, deep scientific expertise, and a vibrant startup ecosystem. The convergence of biology with digital technologies (DigiTech) and sustainable innovation (GreenTech) places India at the forefront of the Bio-Revolution.

Breaking the Middle-Income Trap

India's rise as a global BioEconomy leader could help it overcome the middle-income trap—a challenge that has stalled the progress of several emerging economies, including Brazil, Mexico, and South Africa.

A differentiated growth strategy is essential. India must leverage its bio-based economy alongside digital and green technologies to break through this economic barrier. The BioE3 Policy (Biotechnology for Economy, Environment, and Employment) provides a structured framework for this transition by focusing on three key pillars:

- **Economy** – Accelerating biomanufacturing and bio-innovation to drive economic growth and value creation in healthcare, agriculture, and industrial production.
- **Environment** – Promoting sustainable practices and reducing environmental impact through bio-based solutions.
- **Employment** – Generating high-value jobs and supporting inclusive growth by enabling startups and expanding industrial-scale biomanufacturing.

A Growth Model Tailored for India

India's demographic dividend, economic structure, and geographic diversity require a tailored approach to compress the timelines for growth that is seen in United States, Europe, or Japan. The rapid expansion of the biotech startup ecosystem reflects India's capacity to innovate and scale. Currently, India has approximately **one startup for every 10,000** citizens across all industries. To match global leaders like the **US and Israel**—where the ratio is one startup for every **2,000 to 4,000 people**—India would need to grow its total number of startups to over **1 million** in the coming decades.

The BioE3 Policy seeks to create an enabling

environment by offering targeted funding, infrastructure development, and technology transfer support. Strategic partnerships amongst the industry, private investors, global corporations, and academic institutions will be crucial in achieving this scale.

Sectoral Shifts and Employment Growth

Agriculture remains India's largest employer, accounting for over **40% of the workforce**. In developed economies, agriculture employs only single-digit percentages of the population. As India's economy matures, a significant shift toward industrial and services sectors is inevitable. The BioEconomy offers a pathway for this labor transition, particularly through biomanufacturing and biotechnology.

The BioPharma sector remains a global leader, with India producing over **3 billion vaccine doses** annually and conducting more than **5 billion diagnostic tests** each year. The bio-industrial segment spanning biofuels, enzymes, and bio-based materials, is experiencing rapid growth, driven by rising global demand for sustainable products. India's ethanol blending program, supported by expanding distillery capacities, reflects this momentum.

Over the past decade, the Department of Biotechnology (DBT) and the Biotechnology Industry Research Assistance Council (BIRAC) strategic funding, handholding and policy support have nurtured India's bio-innovation ecosystem. BioE3 marks the next step — strengthening India's biomanufacturing capabilities. The BioE3 Policy provides a clear strategic roadmap to harness this potential by aligning economic growth with environmental sustainability and social responsibility, paving the way for a resilient and inclusive BioEconomy.

India stands at a pivotal moment. The decisions and efforts made today will define the country's economic trajectory for the next half-century. The time to act is now!

From BIRAC MD's Desk



Dr. Jitendra Kumar

Managing Director, BIRAC

India BioEconomy Surge Continues in 2024

With biotechnology applications continuing its usefulness in agriculture, healthcare, manufacturing and services, India's BioEconomy maintained a healthy share of the national economy in 2024. One of the highlights of the **India BioEconomy Report 2025**, brought out by BIRAC in collaboration with ABLE, is that BioEconomy contributed 4.25% to the national GDP of \$3.89 trillion.

On the basis of a strong 9.75 % growth, India's BioEconomy has recorded \$165.7 billion in 2024, compared to previous year's \$151.1 billion. As innovators continue to pursue their entrepreneurial dreams, attracted by the potential of biotechnology, 1544 new biotech startups were incorporated across the country in 2024. With this, the number biotech startups in the country have crossed a major milestone to reach 10,075. I am happy to note that a large of schemes run by BIRAC since its inception in 2012 continues to play a significant role in sustaining the growth momentum of innovation in biotechnology.

As the nation grapples with many challenges on the environmental front, I am happy that biotechnological applications have come to the fore in providing sustainable solutions. A prime example is the increasing share of biofuels in petroleum products consumed in the country. With the blending percentage edging past 20%, at least five years ahead of schedule, the government will now be in a position to aim to increase this share to at least 25%. This will call for more support from the biotech industry to quicken the pace of next generation technological platforms that can use the vast amount of feedstock available in the country in the form of agricultural wastes.



Two key sectors, BioIndustrial that uses an array of enzymes to replace many of the conventional chemical based manufacturing processes, and BioPharma that provides a wide range of medicinal products to prevent and as well treat a variety of illnesses affecting humanity, dominate the country's BioEconomy. BioIndustrial segment with 47.2 % share at \$78.2 billion and BioPharma with 35.2% share at \$58.4 billion thrive with their products and services finding increased acceptance in the society. The recent examples of Indian companies getting approvals to provide very advanced cell and gene therapy solutions within the country itself to hundreds of critical patients at a fraction of the global costs is a good sign.

Another notable feature that a large number of states in the country are embarking on attractive policies to make sure biotechnology takes strong roots in their geographies. At the same time, the dominance of the Top 5 States, **Maharashtra, Karnataka, Telangana, Gujarat and Andhra Pradesh**, continued in 2024. A distinguishing feature of these top states is that they continue to interact closely with the biotech leaders and regularly fine tune their policies and incentive schemes to retain relevance to the needs of the technologically fast changing segments. I am sure other states are watching and learning from the success

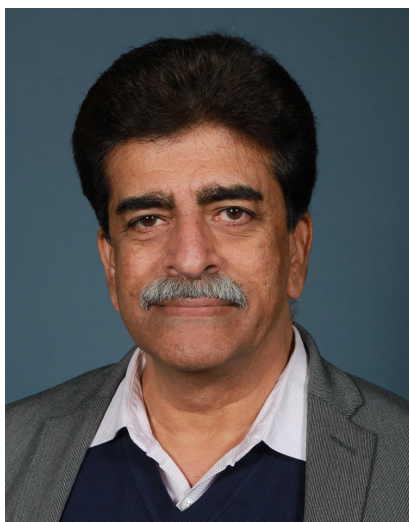
stories to tailor their offering to ensure that biotechnology embeds itself into the economies strongly in the coming years.

The BioE3 Policy announced by the Department of Biotechnology will be the harbinger of a new era in biotechnology for the country. DBT-BIRAC are working with the state governments with regular interactions and pitching for formation of BioE3 cells in all the states to facilitate further reach of biotechnology to all parts of the country.

As the nation continues its strides in biotechnology, the world too is looking at India for the talent in this sector. The increasing number of Global Capability Centers (GCCs) of life science companies opening technology centers is an example of this. The IBER 2025 report has captured the trends in this emerging area of activity that will further enhance the technological diffusion to our professional. There are now 105 GCCs in life sciences operating in the country. As biotechnology industry bolsters its roots in the country, it is estimated that venture capitalists and other investors committed more than \$ 700 million in 2024. This is three times the \$ 200 million invested by them in 2023.

I look forward to a bright future for biotechnology as we plan to achieve the next target of doubling the national BioEconomy to \$300 billion in the next five years.

From the ABLE President's Desk



G S Krishnan

Honorary President,
Association of
Biotechnology Led
Enterprises (ABLE)

BioEconomy Growth: India's Total Reaches \$165.7 Bn in 2024 at a CAGR of 17.9% (2020-24) and a growth of 9.7% over 2023

The *India BioEconomy Report 2025* reveals an interesting trend in the regional distribution and sectoral dominance of different BioEconomic activities in the country. It offers valuable insights into the strategic development of the Biotech sector across the nation.

A key takeaway is the pronounced **regional dominance**. **South Zone** emerges as the biotechnology powerhouse, contributing a substantial **45.40%** to the national BioEconomy. This dominance is attributed to an aggregation of sector specific industries, with established infrastructure, robust research institutions, and a thriving ecosystem for BioServices. The **West Zone** follows with **30.30%**, indicating a significant industrial presence, while the North and East Zones are slowly emerging at 18.50% and 5.80%, respectively. This stark regional variation opens opportunities for targeted interventions and follow tried and tested practices and policies, to foster balanced growth across the nation.

The **segment wise distribution** of BioEconomy shows **BioIndustrial @ 47.2%**, followed by **BioPharma @ 35.2%**, **Bio Services @ 9.4%** and **BioAgri @ 8.1%**

The analysis of **state-level contributions** reveals a complex landscape. **Maharashtra stands out as the leading state, followed by Karnataka and Telangana.** However, the study shows that states exhibit specialized strengths across different segments. **Andhra Pradesh leads in BioIndustrial** due to its focus on animal nutrition (Aqua & Poultry). Maharashtra's

vaccine industry drives its leadership in BioPharma, while **Karnataka's strong BioServices sector** propels its position. **Maharashtra and Gujarat dominate BioAgri.**

Further dissecting the sectoral contributions reveals intriguing patterns. The **BioIndustrial segment**, comprising **nearly half of the total BioEconomy**, is predominantly in **South Zone**. However, **the North Zone** maintains a strong presence, accounting for roughly a third of this segment. This indicates a growing industrial base in the North, potentially driven by advancements in areas like biomanufacturing and industrial biotechnology. **The West**, while **significant**, holds a smaller share, highlighting the sector's varied regional development.

The **BioPharma** segment, a crucial component of BioEconomy, is heavily **concentrated** in the **South and West**, collectively **accounting for 91.4%** of the national share. South Zone leads, demonstrating its strength in pharmaceutical research, development, and manufacturing. **The West**, driven by Maharashtra's vaccine industry, also contributes significantly. This concentration highlights the need for strategic investments to expand biopharma capabilities in other regions.

The **BioAgri segment** paints a different picture. The **West**, particularly **Maharashtra and Gujarat**, reigns supremely, contributing

over **60% of the national share**. This dominance is likely fueled by the region's strong agricultural base, Bt Cotton cultivation and advancements in areas like biopesticides, biofertilizers, and sustainable agriculture. South India, while significant, plays a supporting role in this sector.

The BioServices segment, encompassing a wide range of activities like **contract research, clinical trials, data analytics, and global capability centers** are predominantly **concentrated in South Zone**. This reinforces the region's position as a hub for biotechnology innovation and service provision.

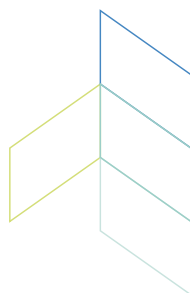
These trends highlight the need for a focused approach to BioEconomy development. While South India's dominance in BioServices and BioPharma is evident, the West's strength in BioAgri and the North's growing BioIndustrial presence offer distinct opportunities.

Future strategies could focus on leveraging regional strengths, fostering inter-regional collaboration, and addressing the specific challenges faced by each region. This includes investing in infrastructure, promoting research and development, and creating a conducive regulatory environment by the respective state governments too. By adopting a holistic and regionally strategic approach, India can unlock the full potential of its BioEconomy and drive sustainable growth across the country.

Note on Data Presentation

In this report, numerical figures have been rounded to improve clarity and ease of presentation. For example, \$150.97 billion may be rounded to \$151 billion in charts, tables, or the narrative text. These adjustments are made to enhance readability and should not be interpreted as errors or discrepancies. All data has been carefully sourced and rounded in a consistent manner to maintain accuracy across the report.

In cases where figures are presented without rounding, they reflect the precise values as reported and are accurate as provided. Please note that due to rounding, totals, averages, or shares may differ slightly from calculations using two decimal places. The rounding is intended to make the information more accessible and should not affect the overall analysis or conclusions drawn from the data.



INDIA BIOECONOMY REPORT 2025

By Narayanan Suresh &
Srinivas Rao Chandan, ABLE



FROM STRENGTH TO STRENGTH

INDIA'S BIOECONOMY HITS **\$165.7** **BILLION** IN 2024, PAVING THE WAY FOR FUTURE INNOVATIONS

India's BioEconomy continued to expand, reaching **\$165.7 billion** in 2024. Despite moderate decline in growth momentum, the sector's increasing significance accounts for **4.25%** of India's Gross Domestic Product (GDP) of **\$3.89 trillion** in **2024** calendar year





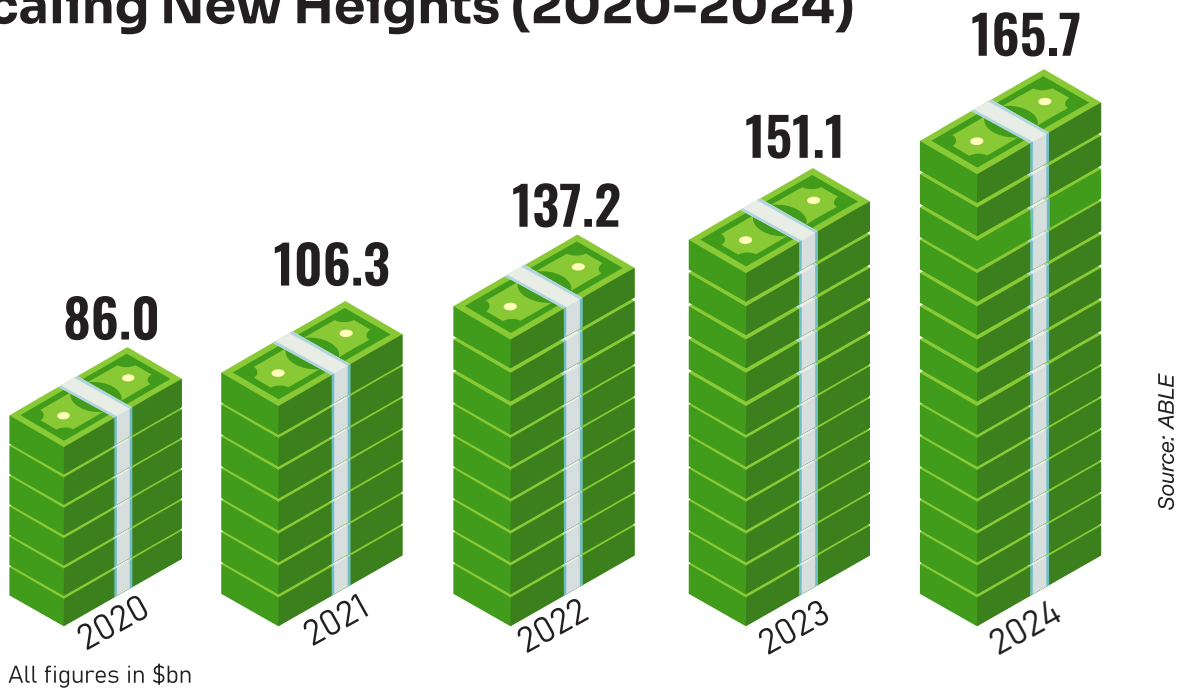
In 2023 the BioEconomy contributed 4.3% to the national GDP, and this share remained strong at 4.25% in 2024. This stability reflects a sustained commitment to integrating biotechnology across various industries, driving innovation and supporting economic growth.

In 2023, India's BioEconomy registered a 10% growth rate, while in 2024 it registered 9.7% growth. However, as the BioEconomy matures, maintaining such high growth will require further innovation, scaling of bio-based solutions, and overcoming infrastructure and policy bottlenecks. The national BioEconomy has expanded rapidly, nearly doubling in five years, growing from \$86 billion in 2020 to its current valuation of \$165.7 billion, driven by advancements in biotechnology, agricultural innovation, biomanufacturing, and healthcare.

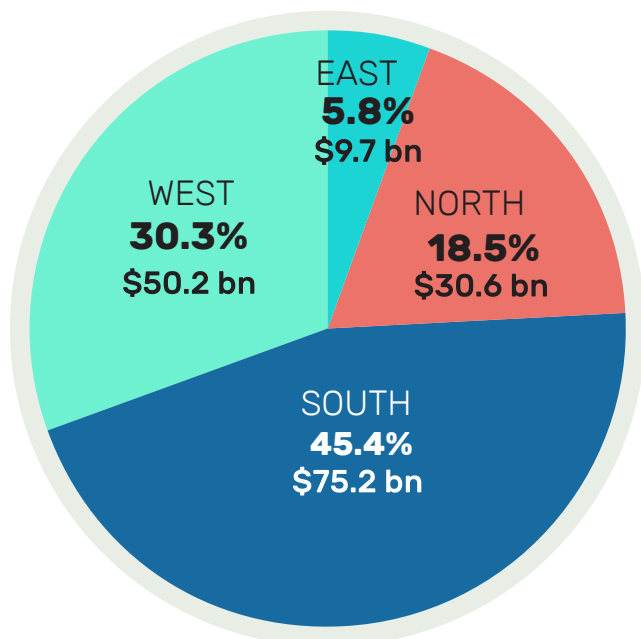
India's BioEconomy recorded a significant milestone in 2023, when it surpassed \$150 billion milestone. The country was hoping to achieve this target only in 2025 but this goal was achieved two years ahead of estimates. This number is significant because it positions the country among the Top 5 BioEconomies in the world. And as the country embarks on an ambitious new Biomanufacturing initiative with the new **BioE3 program**, the leap forward will send India further up on this ladder during the current decade.

The sector's progress underscores its vital role in promoting sustainable development and enhancing resilience in key areas like healthcare and agriculture. Moving forward, strategic investments, technological advancements, and supportive regulatory frameworks will be crucial for harnessing the full potential of this dynamic sector.

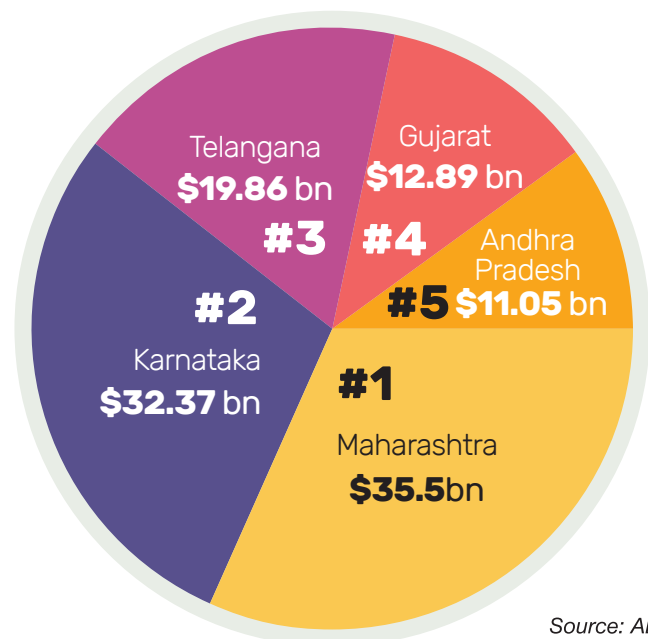
India's BioEconomy: Scaling New Heights (2020-2024)



Geographic Distribution of BioEconomy Across Regions and States



**REGIONAL BIOECONOMY
DISTRIBUTION**



TOP 5 STATES OVERALL
(Grand Total in \$Billion)

Source: ABL

\$165.7 billion

The national BioEconomy has expanded rapidly, nearly doubling in four years, growing from **\$86 billion** in **2020** to its current valuation, driven by advancements in biotechnology, agricultural innovation, biomanufacturing, and healthcare.



BIOTECHNOLOGY



AGRICULTURAL
INNOVATION



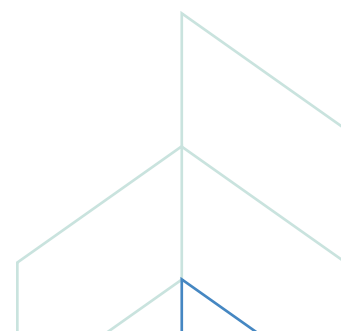
BIOMANUFACTURING



HEALTHCARE

India's BioEconomy showcases a comprehensive approach that integrates biotechnology across industries, driving innovation and sustainability. By capturing diverse value chains, it reflects the sector's dynamic growth and evolving role in shaping the country's economic landscape.

In 2024, India's BioEconomy was characterized by a strong industrial focus, with BioIndustrial and BioPharma collectively accounting for nearly **82.4%** of the sector's value. While BioAgri and BioIT/Research Services represent smaller shares, they remain vital for driving innovation and addressing key challenges in agriculture and health. The sector's overall growth emphasizes the increasing integration of biotechnology across various industries, positioning India as a key player in the global BioEconomy.

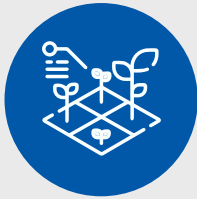


BIOECONOMY SUBSECTORS.



BioPharma and BioMedical

Sector includes the development of pharmaceuticals, medical devices, diagnostics, and lab-grown organoids. It focuses on areas like cancer immunotherapy, gene editing, precision medicine, and biologics, encompassing MedTech and diagnostics.



BioAgri

Focusing on agricultural biotechnology, this subsector covers genetically modified crops, precision agriculture, and bio-based products. Bt Cotton is a key example, highlighting biotech's role in boosting agricultural yields and sustainability.



BioIndustrial

This emerging sector deals with bio-based chemicals and products created using enzymes, biosynthetic processes, and recombinant DNA technology. It includes biofuels, bioplastics, biogas, and enzymatic applications across industries ranging from beverages to detergents.



BioResearch and BioIT (BioServices)

This segment involves contract research, clinical trials, biotech software and databases, specialized equipment, and bioscience education services.

Key Drivers of India's BioEconomy Success

BioIndustrial

47.2% Share
\$78.2 Bn

The BioIndustrial segment, representing nearly half of the total BioEconomy, is valued at **\$78.2 billion**. Its dominance reflects the growing adoption of bio-based solutions across sectors such as biofuels, chemicals, bioplastics, and enzymatic applications in various industries. The push toward sustainability and green technology has positioned this segment as a cornerstone of India's BioEconomy.

BioPharma

35.2% Share
\$58.4 Bn

With a significant 35.2% share, valued at **\$58.4 billion**, this segment is crucial to healthcare and medical innovation. BioPharma's focus on pharmaceuticals, medical devices, diagnostics, and biologics emphasizes India's growing role as a global leader in affordable biopharmaceuticals.

BioIT/ Research Services

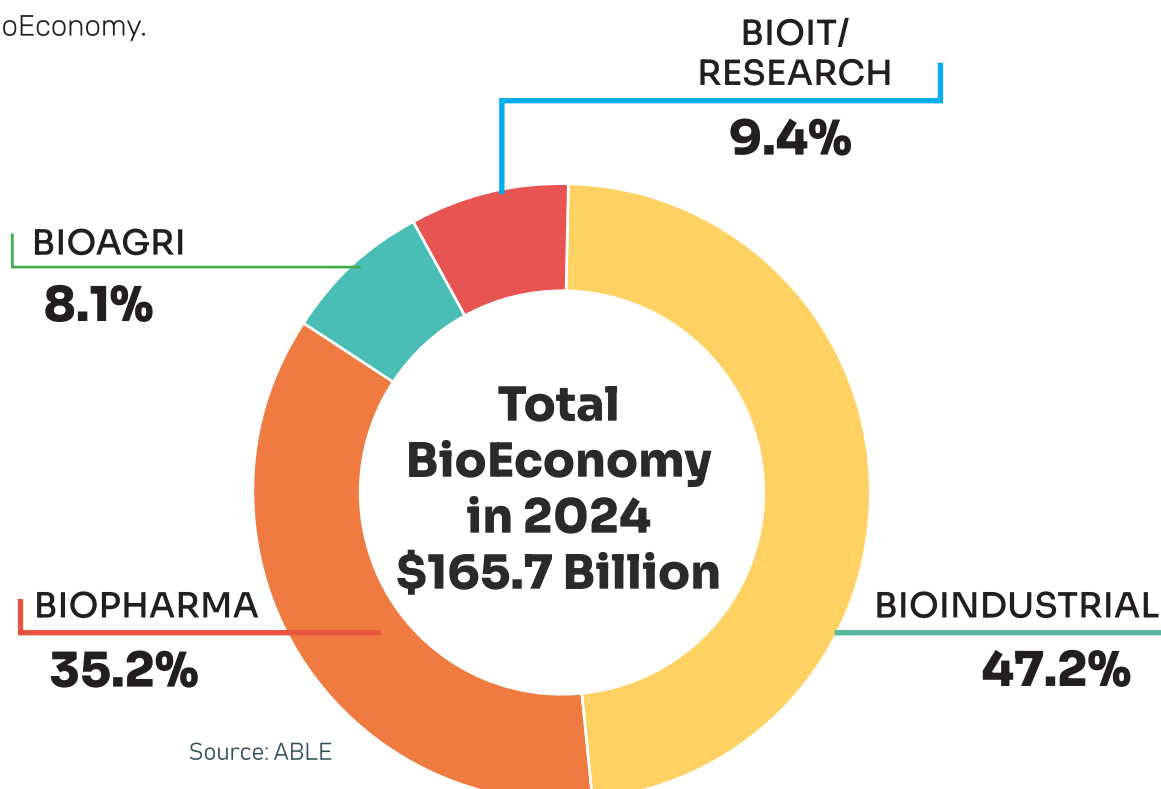
9.4% Share, \$15.6 Bn

This segment, valued at **\$15.6 billion**, includes contract research, clinical trials, bioinformatics, biotech software, and bioeducation. It reflects India's growing stature as a global hub for research and development services, offering cost-effective solutions in drug discovery and data management.

BioAgri

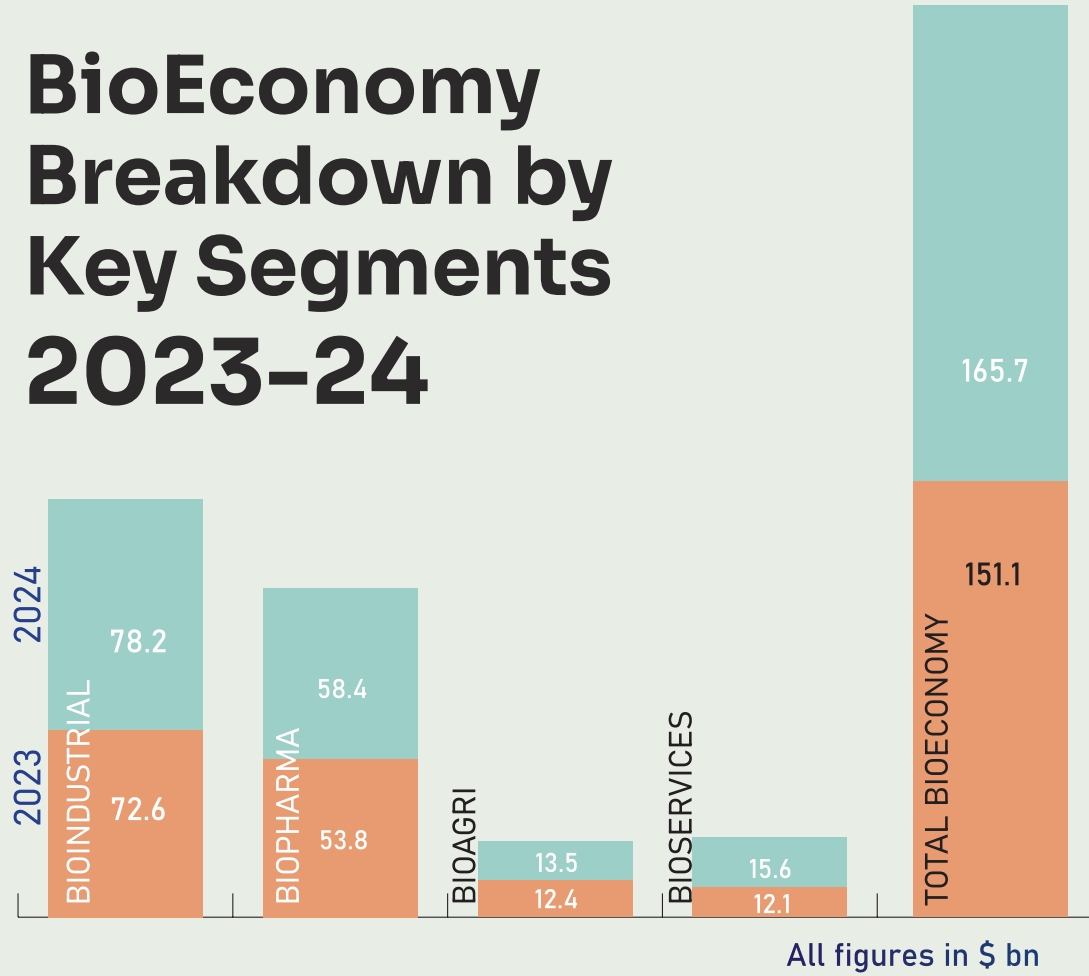
8.1% Share
\$13.5 Bn

Contributing 8.1% to the total BioEconomy, BioAgri centers on agricultural biotechnology. Valued at **\$13.5 billion**, this segment enhances agricultural productivity and resilience through genetically modified crops like Bt Cotton and precision agriculture technologies.



**Totals may not sum to 100% due to rounding to the nearest decimal*

BioEconomy Breakdown by Key Segments 2023-24



SEGMENT	2023 (\$ Bn)	2024 (\$ Bn)	% Change
BioIndustrial	72.6	78.2	7.7%
BioPharma	53.8	58.4	8.6%
BioAgri	12.4	13.5	8.9%
BioIT / Research Services / BioServices	12.1	15.6	28.9%
Total BioEconomy (\$Billion)*	151.1	165.7	9.7%

*Covid Economy of \$0.2 million

Contribution of Key States

In **2024**, Maharashtra leads India's BioEconomy with a value of **\$35.45 billion**, representing **21.4%** of the total BioEconomy value of **\$165.7 billion**. Karnataka follows closely with **\$32.4 billion** (19.5%), while Telangana contributes **\$19.9 billion** (12%). Gujarat adds **\$12.9 billion** (7.8%), Andhra Pradesh **\$11.1 billion** (6.7%), Tamil Nadu **\$9.9 billion** (6%) and Uttar Pradesh contributes **\$7.7 billion** (4.7%), respectively. The "Others" category, which includes various smaller states, totals **\$36.4 billion**, accounting for **21.9%** of the BioEconomy value. This distribution underscores the regional strengths within India's rapidly growing biotechnology sector, poised for significant expansion in the coming years.

Maharashtra	\$35.45 billion
Karnataka	\$32.4 billion
Telangana	\$19.9 billion
Gujarat	\$12.9 billion
Andhra Pradesh	\$11.1 billion
Tamil Nadu	\$9.9 billion
Uttar Pradesh	\$7.7 billion
Others	\$36.4 billion



Maharashtra
21.4%



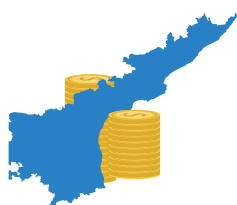
Karnataka
19.5%



Telangana
12%



Gujarat
7.8%



Andhra Pradesh
6.7%



Tamil Nadu
6%



Uttar Pradesh
4.7%

Others
21.9%

Total
BioEconomy Value
\$165.7 bn

Source: ABLE



Significant Biotech Milestones in 2025

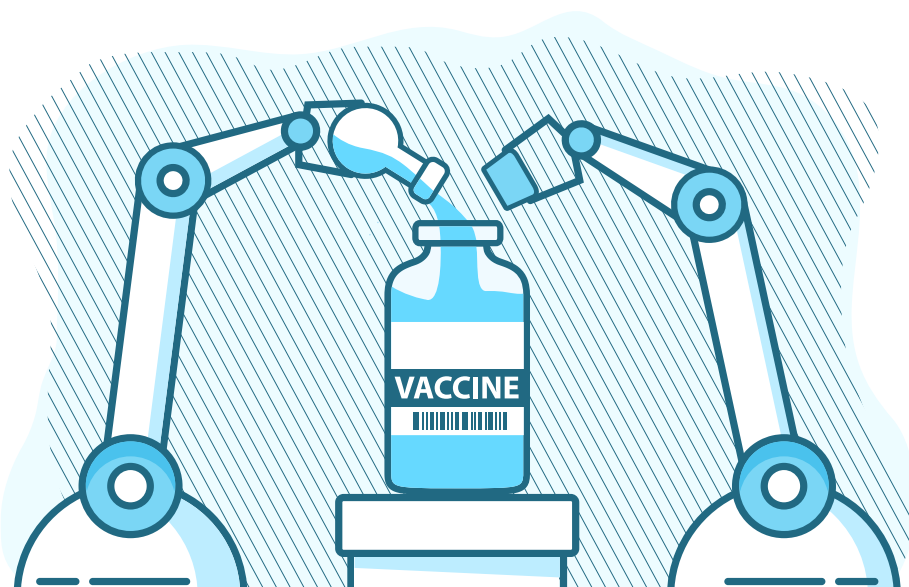
01 India increased its influence in Global Vaccine Access

India has consolidated its position as a top global vaccine manufacturer. According to the WHO Global Vaccine Market Report, the Serum Institute of India's share of the global vaccine market, excluding COVID-19 vaccines, increased from **19%** in **2021** to **24%** in **2024**. This growth was largely driven by a rise in the production of pneumococcal conjugate vaccine (PCV), measles-rubella (MR) vaccine, and tetanus-diphtheria (Td) vaccine. The adoption of new technology platforms also played a crucial role in scaling up COVID-19 vaccine production.

The global vaccine market remains highly concentrated, with 10 manufacturers

accounting for **over 80%** of the global supply, excluding COVID-19 vaccines. Notably, three of these manufacturers—**Serum Institute of India, Bharat Biotech International Ltd**, and **Biological E Ltd**—are based in India, underscoring the country's significant contribution to global vaccine production.

Indian manufacturers supplied **40%** of the total vaccine volumes purchased by the WHO, with a considerable portion consumed domestically. Moreover, India exported a substantial quantity of vaccines to the WHO African Region, making up approximately **20%** of its total exports.





02 Ethanol blended petrol program achieves significant progress towards 2025 target

India's ethanol blending program has seen substantial growth, reaching **18.2%** in December 2024, with an average of **14.6%** for ESY 2023-24, up from 1.5% in ESY 2013-14

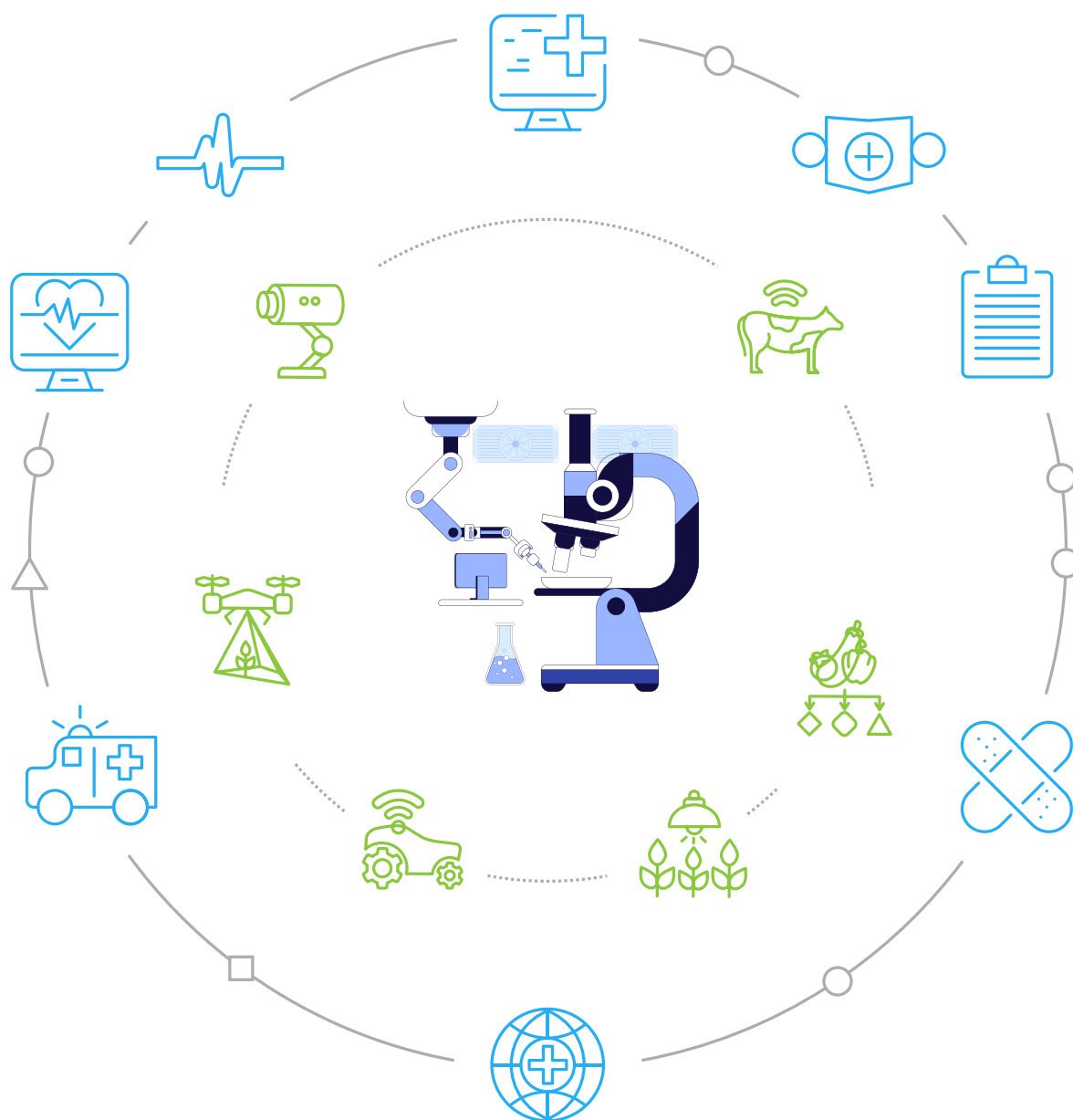
India's Ethanol Blended Petrol (EBP) program has been pivotal in reducing the nation's dependence on imported fuels while promoting domestic ethanol production. Government measures such as price regulation, expanded production routes, tax incentives, and the National Policy on Biofuels have significantly accelerated the growth of India's bioethanol industry.

The country's installed bioethanol capacity saw a remarkable surge, increasing from 13.8 billion liters in 2023, to 16.2 billion liters in 2024. Industry experts attribute this rapid growth to approximately \$5 billion in capacity expansion investments over recent years. As a result, India has become the world's third-largest producer and consumer of ethanol, with production nearly tripling over the past five years. As the nation progresses towards the **20%** blending ratio in petrol, from the current **14%**, the requirement for additional production capacities will only increase.

According to the International Energy Agency, this growth underscores India's emerging leadership in bioethanol. However, the sector's future growth depends on the continued implementation of favorable policies, effective cost control, and securing sustainable feedstocks. By prioritizing these factors, India can solidify its position as a global leader in biofuel production and further its energy independence.

The launch of the Global Biofuel Alliance (GBA) during the G20 Summit in New Delhi in 2023 marked a major milestone in the shift toward a sustainable energy future. Led by India, Brazil, and the United States, the alliance seeks to reshape the global biofuels landscape through international collaboration, technology exchange, and enhanced policy frameworks. For India, the GBA presents an opportunity to reduce costly oil imports, boost domestic biofuel production, and enhance economic stability.

03 Precision Medicine and Preventive Care lead Healthcare Advancements ahead of 2025





These innovations illustrate a broader trend toward integrating advanced technology, AI, and genomics into healthcare while addressing critical agricultural needs. India's sectors are steadily advancing toward a more sustainable and precision-focused future.

The healthcare and biopharmaceutical landscape is experiencing a transformative shift as we approach 2025, characterized by innovative technologies and a focus on personalized and preventative care.

Recent advancements include the launch of **Nafithromycin, indigenous antibiotic targeting antimicrobial resistance (AMR)**, which addresses Community-Acquired Bacterial Pneumonia caused by drug-resistant bacteria.

This development highlights the urgent need for effective treatments amid rising antibiotic resistance. Additionally, **vaccine innovations** such as a quadrivalent influenza vaccine and a 14-valent Pneumococcal Conjugate Vaccine enhance disease prevention efforts. The **integration of gene sequencing technologies** is paving the way for tailored treatments in oncology and immunology. Furthermore, **CAR T-cell therapies** offer new hope for blood cancer patients, while digital health solutions, including **AI-driven diagnostics and remote monitoring**, are reshaping healthcare delivery.

Overall, 2025 promises to usher in an era of **precision medicine, emphasizing proactive healthcare strategies** that empower individuals to manage their health effectively.

04 BioEconomy's Global Impact by 2050

The BioEconomy contributes significantly to various national economies, with Italy and Spain leading with **22% of GDP**. The U.S. and China, having larger BioEconomy sizes, see lower GDP shares at **5%** and **4%**, respectively. India's BioEconomy share aligns with China at **4.25%**. This data represents the most recent figures available, ranging from **2016 to 2023**.

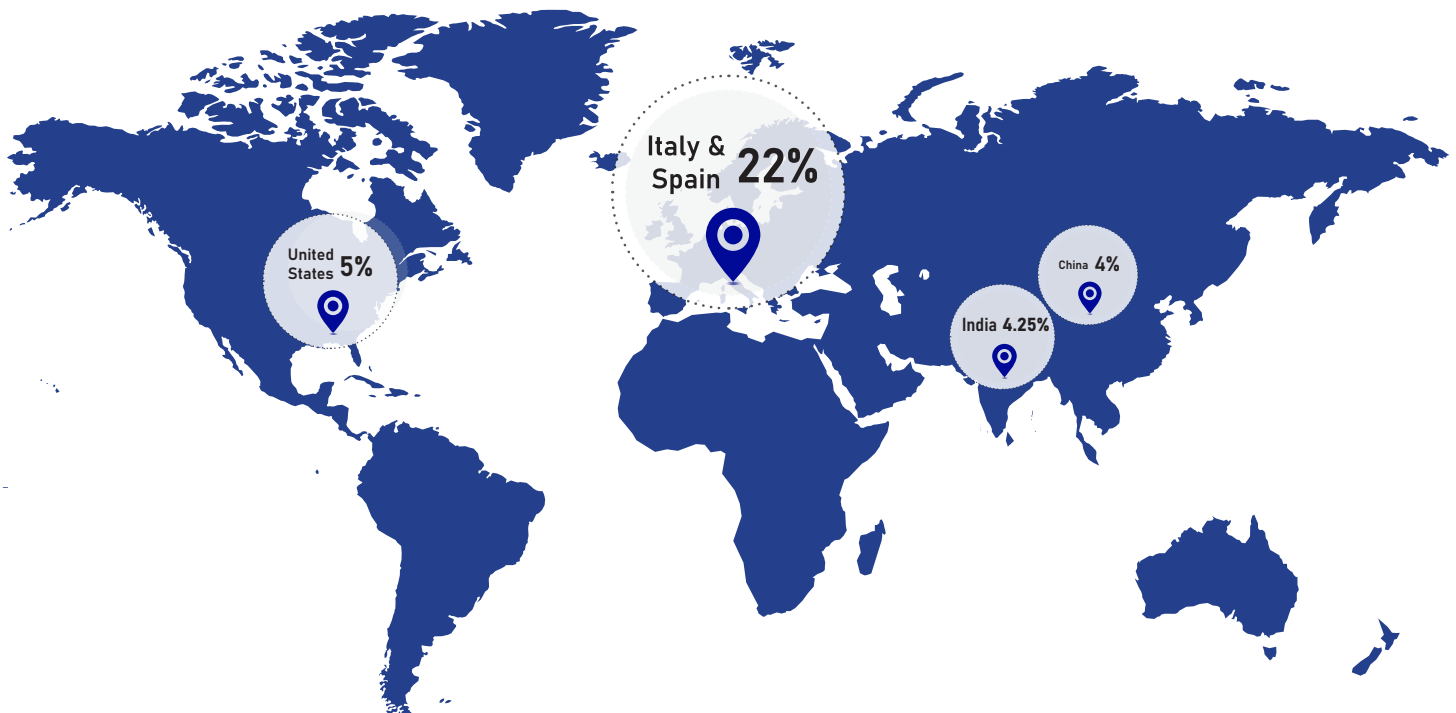
By 2050, the global BioEconomy is expected to expand significantly, with its contribution to the world economy growing from **\$4 trillion to \$30 trillion**, representing nearly **12%** of the projected global GDP of **\$228 trillion**. Emerging markets like India, China, and Indonesia are anticipated to be key drivers of this growth. According to PWC's **"The World in 2050"**

With an anticipated growth of 8 to 10 times its current value, India BioEconomy is set to expand significantly, reaching \$1.5 trillion by 2050 from \$165.7 billion in 2024.

report, emerging markets like India are set to drive global growth, with the **Emerging 7**, or **E7 economies** poised to increase their share of world GDP from around **35%** to nearly **50%**. In this context, the BioEconomy is expected to play a pivotal role.

According to projections from Goldman Sachs, visualized by Visual Capitalist, India's real GDP is estimated to reach **\$22 trillion**, while China's GDP could rise to **\$42 trillion** and the United States to **\$35 trillion** by **2050**. For India, with its GDP projected at **\$22 trillion**, the BioEconomy's contribution could range between **\$1.4 trillion** and **\$2.7 trillion**, accounting for

6.5% to 12% of the nation's GDP. This growth is poised to play a critical role as India and other nations work toward achieving net-zero carbon emissions, with sustainability initiative expected to drive economic growth and create millions of high-quality jobs.



05 India plans to develop its bioeconomy to reach \$300 billion by 2030

The future of India's BioEconomy looks exceptionally promising, with substantial growth anticipated across key sectors. By **2030**, the India BioEconomy is projected to double to **\$300 billion**, up from **\$151 billion** in **2023**, reflecting a robust compound annual growth rate (CAGR) of **12.3%**.

Sector Growth Projections



BioMedical

Expected to grow at a CAGR of **13.2%**, reaching **\$128 billion** by 2030.



BioAgriculture

Critical for sustainable food production, anticipated to expand at a CAGR of **17.6%**, reaching **\$39.3 billion**.



BioIndustrial

Projected to reach **\$121 billion** with a steady CAGR of **7.5%**.



BioServices

Set to experience rapid growth with a CAGR of **19%**, reaching **\$42.4 billion**.

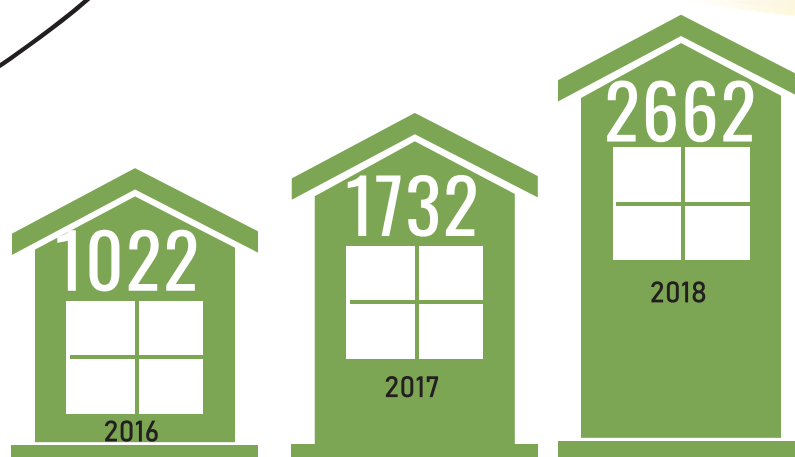
This expansion underscores the increasing contribution of the BioEconomy to India's GDP, emphasizing its role as a key driver of sustainable growth and innovation within the country's economic landscape.

06 India's Biotech Startup Ecosystem Surpasses 10,000 Milestone in 2024

India's biotech startup sector continues its rapid ascent, with the last three years showcasing exponential growth. Between **2021** and **2024**, the cumulative number of biotech startups surged from **5,365** to **10,075**—a **88%** increase. This rise reflects a consistent upward trajectory since 2016, with a noticeable surge post-2020.

The biotechnology and life sciences sector added **1,390 startups** in 2021, followed by **1,776** in 2023, and **1,554** in 2024. This expansion is driven by increased investments, favorable policy shifts, and rising demand for biotech innovations in healthcare and sustainability. The moving average trend line further highlights this consistent growth. BIRAC's entrepreneurship development and strategy support programs have played a pivotal role.

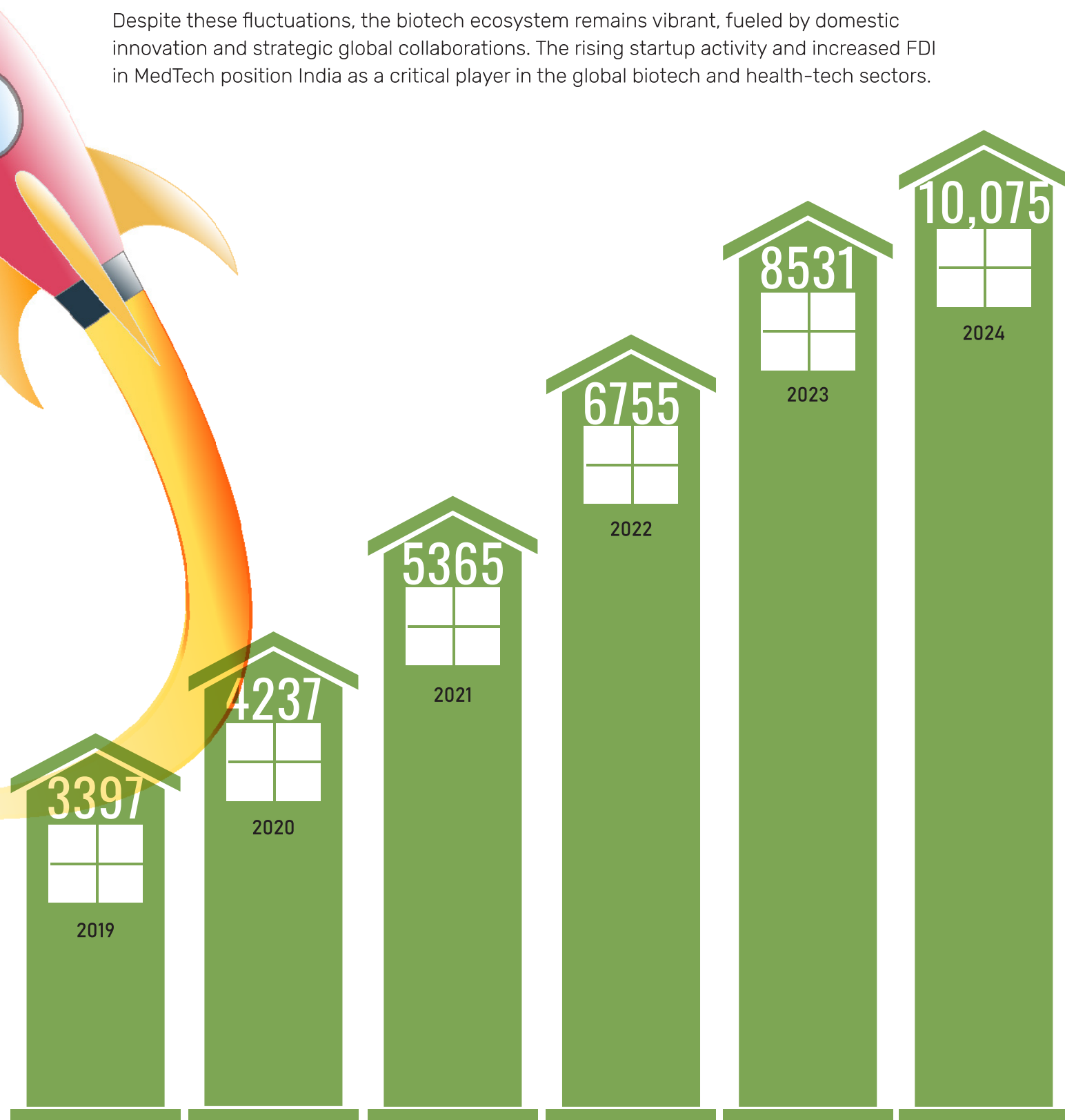
The COVID-19 pandemic acted as a catalyst, turning attention to biopharma, health-tech, and diagnostics. Investors increasingly recognized biotech as a high-impact sector. Government initiatives and global partnerships have also played pivotal roles in sustaining this momentum.



Source: ABLE

Indian startups have developed over **800 products** and raised more than **\$600 million** in follow-on funding. However, while **2022** saw **31 deals** totaling **\$938.8 million**, **2023** saw a dip, with only **16 deals** worth **\$199.6 million**. The year **2024** witnessed recovery and is estimated to close at **\$700 million** with over two dozen deals. On a positive note, the MedTech sector witnessed robust Foreign Direct Investment (FDI) growth, rising from **\$370 million** in **2022** to **\$618 million** in **2024**. In contrast, FDI in pharmaceuticals dropped from **\$2 billion** to **\$1 billion** in the same period, signaling shifting investment priorities.

Despite these fluctuations, the biotech ecosystem remains vibrant, fueled by domestic innovation and strategic global collaborations. The rising startup activity and increased FDI in MedTech position India as a critical player in the global biotech and health-tech sectors.





Startups and Employment Growth

Complementing this expansion, the number of biotech startups in India is expected to surge from **10,075** in **2024** to an impressive **22,500** by **2030**. This growth will significantly boost employment, with the BioEconomy projected to create **35 million** jobs.

The sector's development highlights its increasing contribution to India's GDP and its pivotal role in driving sustainable growth, innovation, and large-scale employment across the nation.

22,500
STARTUPS
BY 2030

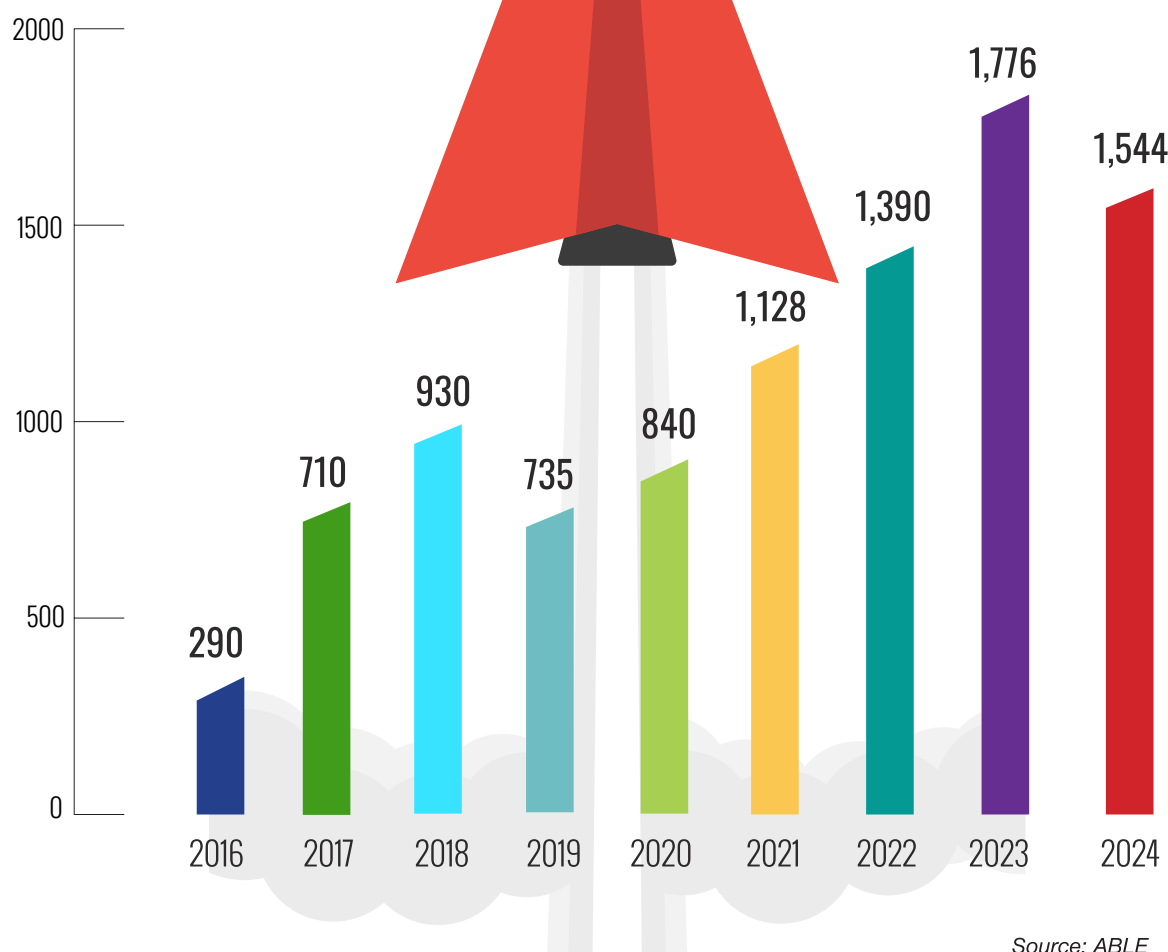
35 MILLION
JOBS TO BE
CREATED



New Startup Registrations

Starting with **290** new startups in **2016**, there was a remarkable increase in the following years, peaking at **1,776** in **2023**. The growth trajectory was particularly strong from **2020** to **2022**, with registrations rising significantly each year, culminating in **1,390** startups in **2022**. In **2024**, the number of new startups reached **1,544**, reflecting a period of consolidation and adaptation within the entrepreneurial landscape as businesses navigate evolving market dynamics and opportunities.

While there was a slight decrease in new startup registrations in **2024**, the overall trend from **2016** to **2024** reflects a remarkable **431%** growth in startup activity, underscoring the strength of India's entrepreneurial ecosystem. This growth demonstrates a sustained interest in launching new businesses, even as external factors may impact registration rates. The fluctuations observed highlight the resilience and adaptability of entrepreneurs, who continue to thrive in a dynamic market landscape.



Source: ABL

Overall Size & Structure

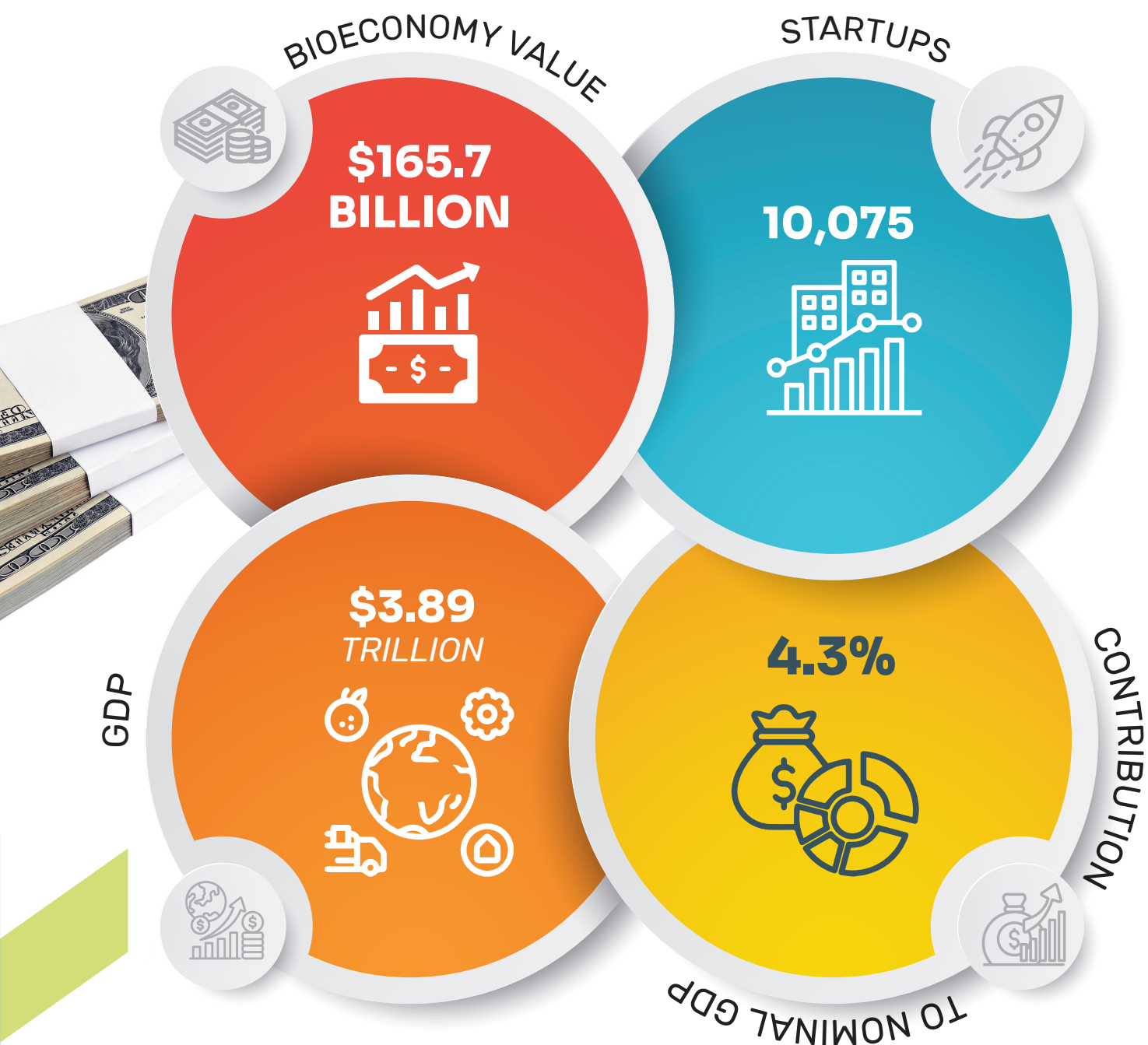
BIOECONOMY 2024

India's BioEconomy has witnessed a phenomenal rise over the past decade, transforming from a fledgling sector to a powerhouse contributing significantly to the nation's economic growth. In **2003**, India's bioeconomy stood at a modest **\$2 billion**. The initial phase witnessed steady growth, reaching **\$5 billion** by **2008**, with the bioeconomy tripling to **\$11 billion** by **2013**. This period marked the beginning of a remarkable upsurge.

From **2013** to **2018**, the bioeconomy experienced an exponential surge, reaching a staggering **\$55 billion** – a phenomenal **400% growth**. The momentum continued between **2018** and **2024**, with the bioeconomy reaching a colossal **\$165.7 billion**.

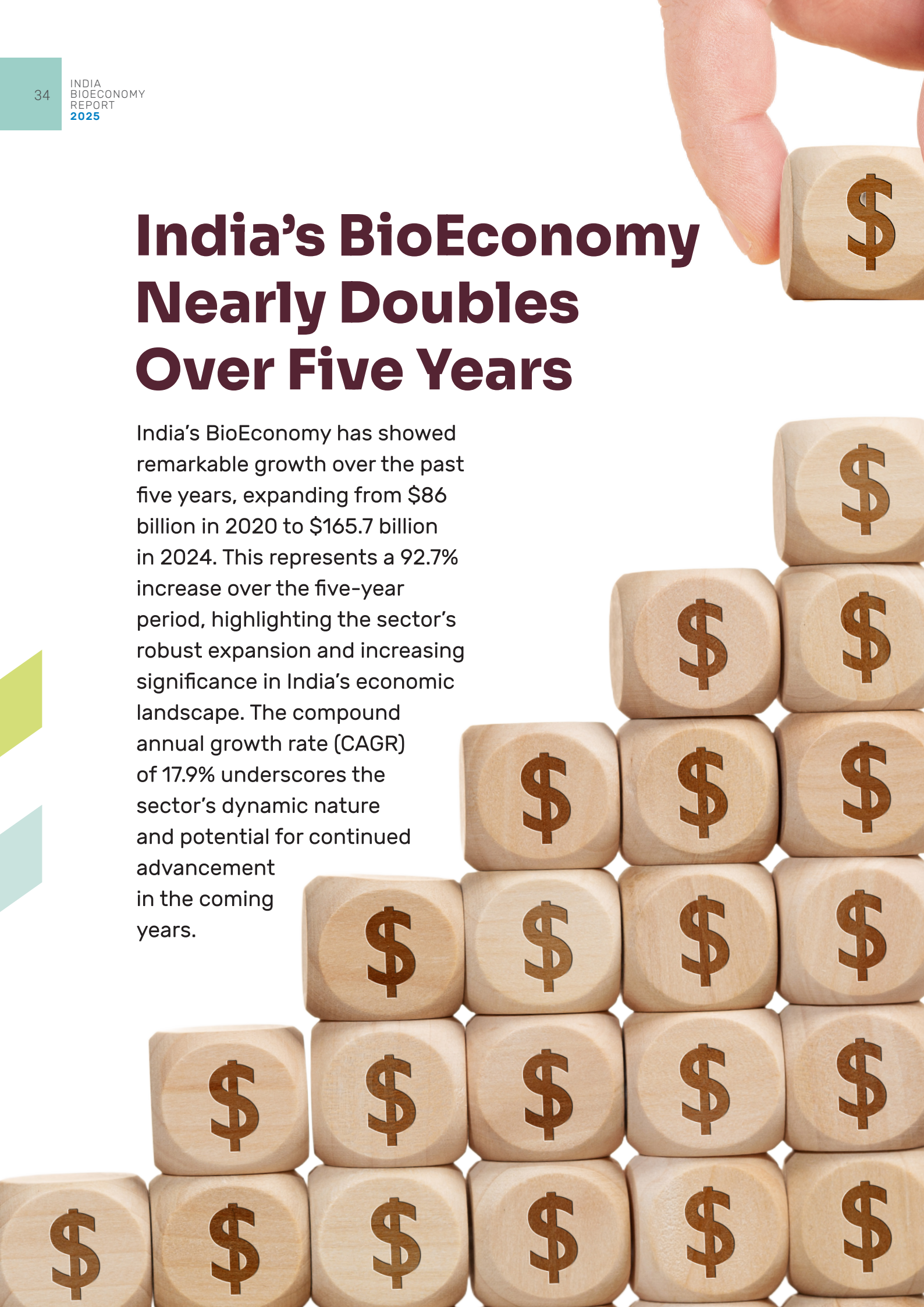
The state governments are setting targets as a factor of national BioEconomy Values and as part of the Gross State Domestic Product (GSDP) considerations. More about such examples will be shared in subsequent sections.

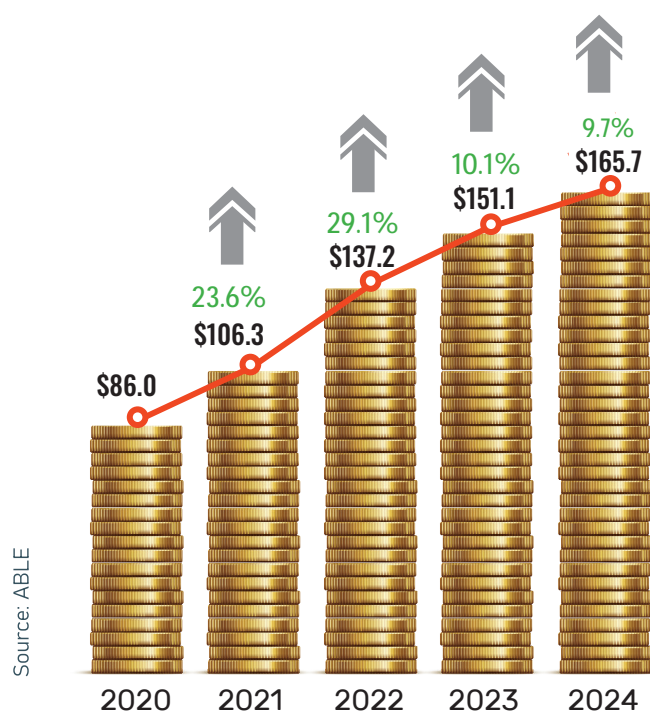




India's BioEconomy Nearly Doubles Over Five Years

India's BioEconomy has showed remarkable growth over the past five years, expanding from \$86 billion in 2020 to \$165.7 billion in 2024. This represents a 92.7% increase over the five-year period, highlighting the sector's robust expansion and increasing significance in India's economic landscape. The compound annual growth rate (CAGR) of 17.9% underscores the sector's dynamic nature and potential for continued advancement in the coming years.





Overall BioEconomy Growth Trajectory

The most substantial growth occurred between **2021** and **2022**, with a **29.1%** increase, while the growth rate has moderated in recent years. This pattern suggests an initial rapid expansion phase followed by a more sustainable growth trajectory as the sector matures.

Four key segments contribute to the India BioEconomy.

BioIndustrial: The BioIndustrial sector in India is a significant contributor to the country's BioEconomy. This sector leverages biotechnology to produce a wide range of products using enzymes and microbes which are essential biocatalysts that speed up biochemical reactions. Multiple industries, including Textiles, Alcoholic Beverages, Detergents, Paper & Pulp, Leather, Aquaculture and Poultry, Baking, Starches, and Vegetable Oil, use enzymes in key processes that are now intrinsic to the end products from these sectors. The applications highlight the versatility and importance of enzymes and microbes in the BioIndustrial sector, contributing to sustainable and efficient production processes across various industries.

BioPharma: The BioPharma sector is another major driver of India's BioEconomy, encompassing the development and production of pharmaceuticals, vaccines, diagnostics, and medical devices. It has been a leading segment, with diagnostics and therapeutics playing crucial

roles. The sector benefits from India's strong generics market and growing capabilities in biologics and personalized medicine.

BioIT/Research Services/BioServices: This segment includes contract research organizations (CROs), contract development and manufacturing organizations (CDMOs), and BioIT services. It supports the broader BioEconomy by providing essential research and development services, leveraging India's IT capabilities to enhance biotech innovation and efficiency.

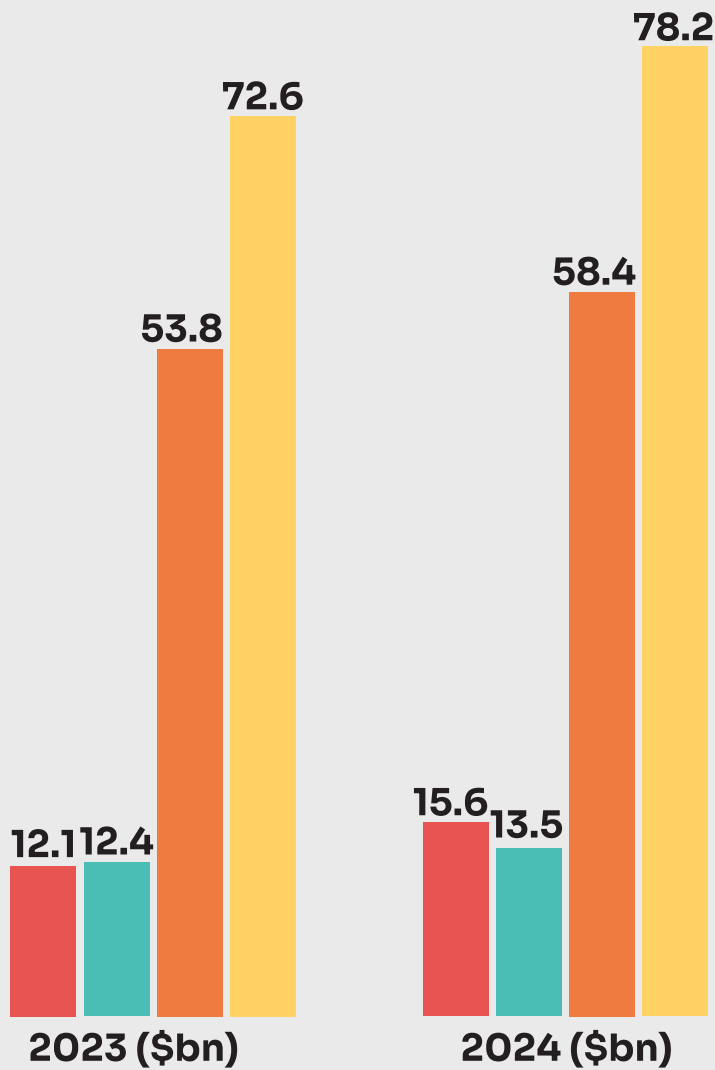
BioAgri: The BioAgri sector focuses on genetically modified crops, precision agriculture technologies, and bio-based products. It includes notable contributions from Bt Cotton, biopesticides, biofertilisers and biostimulant. This sector plays a vital role in enhancing food security and sustainability in India's agricultural landscape.

These segments collectively contribute to the robust growth and diversification of India's BioEconomy, each playing a unique role in driving innovation and economic development.

Segment Performance (2023–2024)

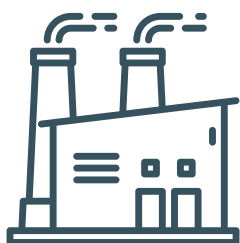
Segment	2023 (\$bn)	2024 (\$bn)	Growth (\$bn)	Growth (%)
BioIndustrial	72.6	78.2	5.6	7.7%
BioPharma	53.8	58.4	4.6	8.6%
BioAgri	12.4	13.5	1.1	8.9%
BioIT/Research Services/BioServices	12.1	15.6	3.5	28.9%
Total	151.1	165.7	14.6	9.7%

Source: ABLE



*Totals may not sum to 100% due to rounding to the nearest decimal

All figures in \$bn



BIOINDUSTRIAL SECTOR

As the largest component of India's BioEconomy, the BioIndustrial sector accounts for **47.2%** of the total BioEconomy value in **2024**. With a value of **\$78.2 billion**, this segment has grown by **7.7%** from 2023 to 2024. While its growth rate is slightly below the average for the overall BioEconomy, its substantial size means it contributed **47.2%** of the total BioEconomy in absolute terms (Or **\$5.6 billion** of the total **\$14.6 billion** increase in value).

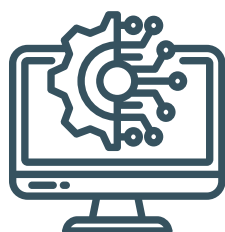
The dominance of this sector reflects India's strong industrial biotechnology foundation, including biofuels, bio-based chemicals, enzymes, and industrial bioprocesses. The moderate but steady growth rate suggests a maturing sector with established applications and technologies.



BIOPHARMA SECTOR

The BioPharma sector is the second-largest contributor to India's BioEconomy, accounting for **35.2%** of the total value in 2024. At **\$58.4 billion**, this segment has grown by **8.6%** (which is 4.6 bn, accounting for 31.5% share of the growth) from 2023, accounting for **31.5%** of the overall growth of the BioEconomy.

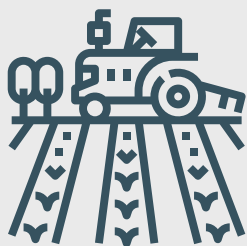
The substantial share of the BioPharma sector highlights India's position as a significant global player in pharmaceuticals, vaccines, and therapeutic biologics. The sector's growth rate, slightly below the overall average, may reflect the impact of post-pandemic normalization in healthcare spending.



BIOIT/RESEARCH SERVICES/ BIOSERVICES

Although representing a smaller portion of the BioEconomy at **9.4% (\$15.6 billion)**, the BioIT/Research Services/BioServices sector demonstrated the highest growth rate of all segments at **28.9%** between 2023 and 2024. This exceptional growth contributed **24.0%** to the overall BioEconomy expansion, despite the sector's relatively smaller size.

This impressive performance indicates a rapid expansion in bioinformatics, computational biology, contract research services, and other biotechnology support services. The sector's accelerated growth suggests increasing digitalization in biotechnology and growing demand for specialized biotechnology services and research capabilities.



BIOAGRI SECTOR

The BioAgri sector accounts for **8.1%** of India's BioEconomy in 2024, valued at **\$13.5 billion**. The sector grew by **8.9%** from 2023 to 2024. It contributed **8.1%** to the total growth of the BioEconomy.

The performance of this sector reflects ongoing innovations in agricultural biotechnology, including biofertilizers, biopesticides, genetically modified crops, and molecular breeding techniques. The growth rate suggests steady adoption of biotechnological solutions in agriculture, which remains a critical sector for India's economy.



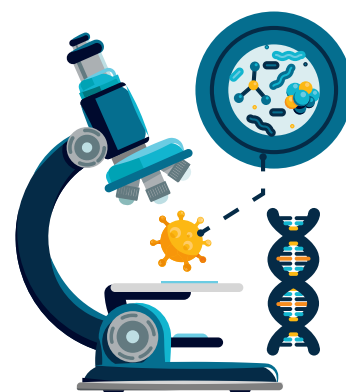
India's BioEconomy has demonstrated remarkable resilience and growth, nearly doubling in size from 2020 to 2024. The sector's expansion has been driven primarily by the BioIndustrial and BioPharma segments, which together account for almost **82.4%** of the total BioEconomy value.

The standout performer in terms of growth rate is the BioIT/Research Services/BioServices sector, which grew by **28.9%** between 2023 and 2024, indicating a significant shift towards digitalization and specialized services in biotechnology.

The continued expansion of India's BioEconomy, even as growth rates moderate, suggests a maturing sector that is becoming increasingly integrated into the broader economy. With a CAGR of **17.9%** over the past five years, the BioEconomy represents one of the most dynamic sectors in India's economic landscape, with significant potential for continued innovation and growth in the coming years.

Biotech Spread

across various towns and cities



Source: ABLE

Places having presence of either Biotech companies, Biotech startups, Biorefineries, Biocubators, Bioresearch centers, Bioprocessing centers, BioMedical manufacturers or BioAgri zones.

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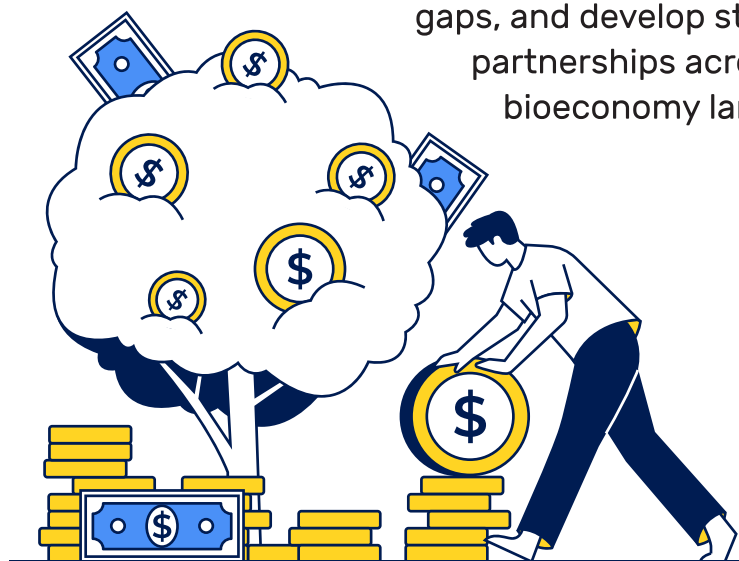
Regional Analysis of the BioEconomy Distribution

India's BioEconomy landscape, valued at approximately **\$165.7 billion**, exhibits distinct regional patterns that reflect historical investments, policy priorities, and natural resource advantages. These four major regions—South, West, North, and East—house India's BioEconomy activities; each region possesses a unique sectoral composition that defines its market.

The Bioeconomy's four key sectors—BioIndustrial, BioPharma, BioServices, and BioAgri—show significant variation in regional concentration,

revealing specialized ecosystems that have grown through a combination of deliberate strategic focus and organic development. The South leads in business, having a diverse range of companies, while other regions concentrate on specific areas.

The regional distributions provide critical insights for policymakers, investors, and industry leaders seeking to identify growth opportunities, address market gaps, and develop strategic partnerships across the bioeconomy landscape.



SOUTH REGION

(\$75.2 bn, 45.4% share)

- ✓ **Dominant player** in the BioEconomy market
- ✓ Strong leadership in **BioIndustrial (\$30.0 bn)** and **BioPharma (\$28.7 bn)**
- ✓ Exceptional performance in **BioServices (\$12.5 bn)**, controlling 80% of this sector
- ✓ Moderate presence in **BioAgri (\$4.0 bn)**
- ✓ Overall balanced portfolio across all segments

WEST REGION

(\$50.2 billion, 30.3% share)

- ✓ **Second largest** regional market
- ✓ Strong in **BioPharma (\$25.1 bn)** accounting for **43%** of this sector
- ✓ Significant presence in **BioIndustrial (\$14.2 bn)**
- ✓ Leading position in **BioAgri (\$8.2 bn)**, controlling **61%** of this sector
- ✓ Relatively weak in **BioServices (\$2.7 bn)**

NORTH REGION

(\$30.6 bn, 18.5% share)

- ✓ **Third largest** regional market
- ✓ Significant presence in **BioIndustrial (\$25.0 bn)**
- ✓ Modest presence in **BioPharma (\$4.1 bn)**
- ✓ Very limited activity in **BioAgri (\$1.2 bn)** & **BioServices (\$0.3 bn)**
- ✓ Overall portfolio heavily weighted towards BioIndustrial

EAST REGION

(\$9.7 bn, 5.8% share)

- ✓ **Smallest** regional player
- ✓ Primarily focused on **BioIndustrial (\$9.0 bn)**
- ✓ Minimal presence in other sectors
- ✓ Represents an emerging or under developed bioeconomy region



Quarterly Performance and Trends

Analyzing the Fluctuations

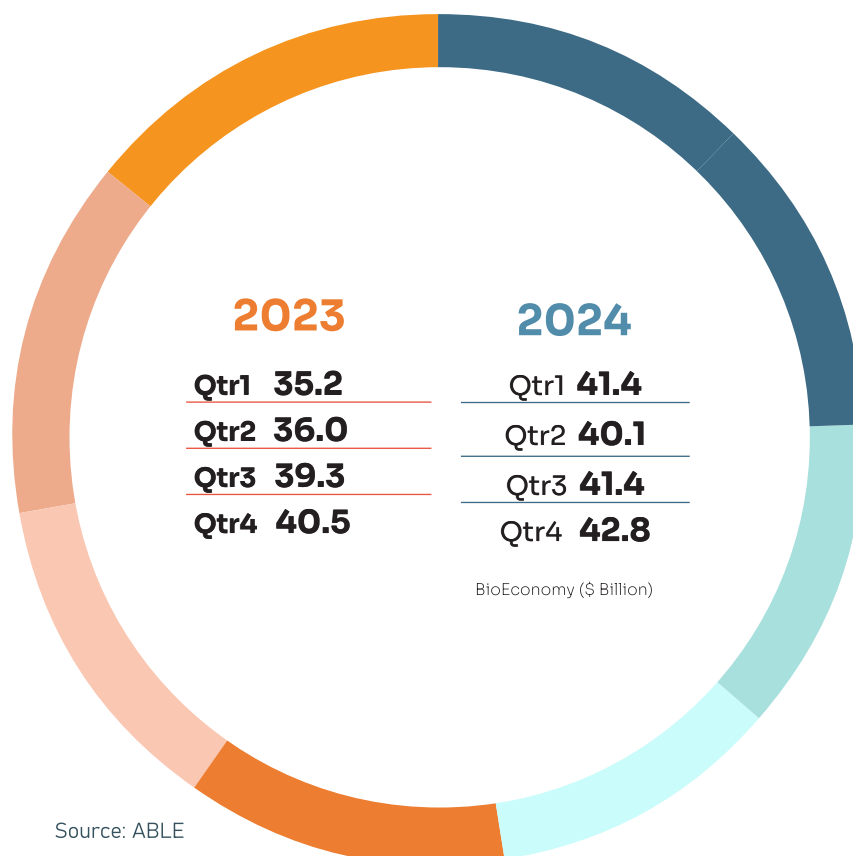
In 2024, the quarterly performance of India's BioEconomy exhibited stability and resilience. In Q1, the sector generated **\$41.4 billion**, setting a strong foundation for the year. This was followed by a slight dip in Q2, where the value decreased to **\$40.1 billion**. However, the sector rebounded in Q3, returning to **\$41.4 billion**, demonstrating its capacity for recovery.

The year concluded on a positive note in Q4, with a marginal increase to **\$42.8 billion**. Overall, the consistent quarterly figures reflect a robust performance and a promising outlook for continued growth in the BioEconomy. Comparing this per-

formance to 2023, there is a noticeable improvement across all quarters. In Q1 2023, the BioEconomy was valued at **\$35.2 billion**, which shows an increase of **\$6.2 billion** in **Q1 2024**. Similarly, **Q2 2023** recorded **\$36.0 billion**, indicating a rise of **\$4.1 billion** year-over-year.

Q3 2023 saw a value of **\$39.3 billion**, which means **Q3 2024** matched this figure with significant growth momentum.

Finally, **Q4 2023** ended at **\$40.5 billion**, while **Q4 2024** slightly surpassed this with **\$42.8 billion**.



Half-Yearly Trends

Comparing H1 and H2 Performance

In the first half of 2023, the BioEconomy was valued at **\$71.2 billion**, reflecting a steady growth trend. The second half of **2023** saw a notable increase to **\$79.8 billion**, marking a growth of approximately **12.8%**. This upward trajectory continued into **2024**, with H1 reaching **\$81.5 billion**, representing an increase of about **2.1%** from **H2 2023**.

H1 2024: The first half of 2024 exhibited strong performance,

with the BioEconomy totaling **\$81.5**

billion. H2 2024: The second half of 2024 further solidified this growth, achieving a value of **\$84.2 billion**, which is an increase of approximately **3%** from **H1 2024**. Overall, the BioEconomy demonstrated a robust growth rate of about **18.3%** when comparing **H1 2023** to **H2 2024**.

Year	Period	BioEconomy (\$ Billion)
2023	H1	71.2
2023	H2	79.8
2023	Yearly Total	151.0
2024	H1	81.5
2024	H2	84.2
2024	Yearly Total	165.7

Source: ABLE



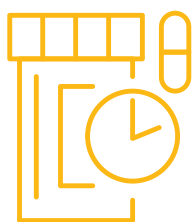
OVERVIEW OF BIOECONOMY SEGMENT PERFORMANCE

The BioEconomy continues to exhibit robust growth across its various segments, reflecting the increasing demand for sustainable and innovative solutions. Below is an analysis of the key segments for 2023 and 2024.



BioIndustrial: The Cornerstone of Growth

The BioIndustrial segment remains the largest contributor to the BioEconomy, showcasing a strong growth trajectory. In 2023, this segment contributed **\$72.6 billion**, representing **48%** of the overall BioEconomy. By 2024, contributions rose to **\$78.2 billion**, marking a notable increase of **7.7%**. This growth is attributed to heightened investments in bio-manufacturing and the development of eco-friendly alternatives to conventional industrial products.



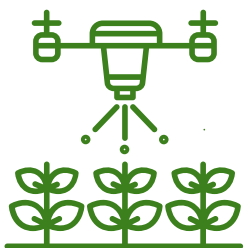
BioPharma: A Sector of Resilience

BioPharma stands as the second-largest segment within the BioEconomy. In 2023, it recorded a contribution of **\$53.8 billion**, accounting for **35%** of the total. This upward trend continued into 2024, with contributions reaching **\$58.4 billion**, reflecting a growth rate of **8.6%**. The sector's expansion is driven by advancements in biotechnology and personalized medicine, alongside a growing market for biosimilars.



BioIT / BioResearch / BioServices: Innovation Drives BioServices

With a **\$15.6 billion** valuation and **9.4%** share of the BioEconomy, BioServices is a key driver of biological science innovation. Its **24%** growth, the highest in the sector, highlights the essential role of research across all regions.



BioAgri: Steady Progress Amidst Challenges

The BioAgri segment has demonstrated consistent growth despite its smaller scale compared to other segments. It grew from **\$12.4 billion** in 2023 to **\$13.5 billion** in 2024, achieving an increase of **8.9%**. This steady progress is fueled by rising demand for sustainable agricultural practices and innovations in bio-based fertilizers and pest control solutions.

Key Pillars Driving India's BioEconomy Success

Investments in human capital & infrastructure are critical for meeting the demands of emerging biotech technologies, ensuring a skilled workforce and advanced facilities.

Capacity Building

Developing a robust research environment that integrates institutions, startups, large industries, and regional centers is key to fostering biotech advancements.

Innovation Ecosystem

Promoting public-private partnerships & collaborative models is vital for translating research into commercial products, from lab discoveries to market-ready technologies.

Product Commercialization

A strategic balance between basic and translational research is necessary to create a continuous pipeline of innovation and commercialization.

Balanced Research

By prioritizing these pillars, India has not only exceeded its BioEconomy goals but has also solidified its position as a global leader in the biotech industry.



India's BioIndustrial Sector Emerging Powerhouse of National BioEconomy

India's BioIndustrial segment has firmly established itself as the cornerstone of the nation's BioEconomy, contributing a remarkable **47.2%** to the total BioEconomy value with a market worth of **\$78.20 billion**. The segment shows a diverse portfolio across multiple subsegments, with significant regional variations that create distinctive competitive advantages throughout the country.



KEY SUBSEGMENTS

The analysis reveals three dominant subsegments driving growth: Potable Alcohol (**21.9%**), BioEthanol (**12%**), and Textiles (**11.1%**). These sectors, along with Poultry Feed (**8.8%**) and Beer (**8.5%**), collectively represent over half of the total BioIndustrial economy.

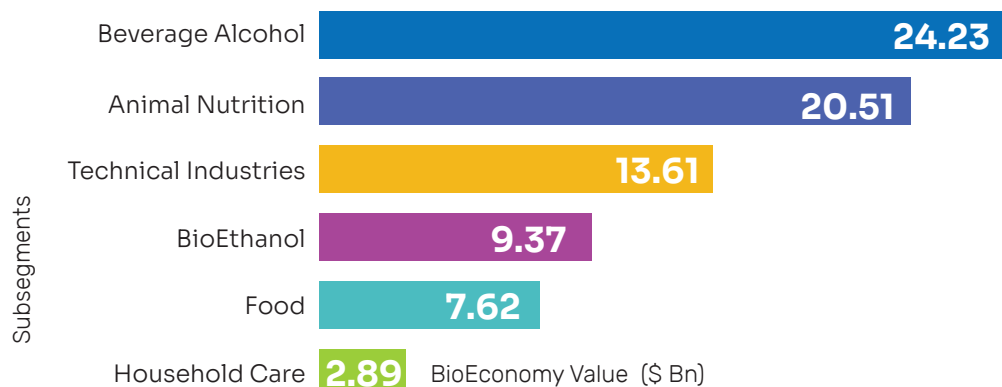


MAJOR BIOINDUSTRIAL SEGMENTS

The BioIndustrial segment can be organized into several key segments based on the products and industries they serve:

- ✓ **Animal Nutrition:** This includes products like **poultry feed and aqua feed**, which are essential for the health and growth of livestock and aquatic animals.
- ✓ **Beverage Alcohol:** This category encompasses the production of **beer, wine, and potable alcohol** derived from grains or molasses, highlighting the role of biotechnology in the beverage industry.
- ✓ **BioEthanol:** This involves the production of **ethanol** from molasses, grain, and biomass.
- ✓ **Food:** This segment covers various food-related applications such as **baking, cheese production, ice cream manufacturing, oil degumming, and starch processing**, showcasing how biotechnology enhances food quality and production efficiency.
- ✓ **Household Care:** Products in this category include **detergents**, which utilize biotechnology to improve cleaning efficiency and sustainability.
- ✓ **Technical Industries:** This segment encompasses a broad range of industrial applications including **leather processing, paper and pulp production, and textiles manufacturing**, where biotechnology is used to enhance product quality and manufacturing processes.

Subsegment Performance & Value



Source: ABLE

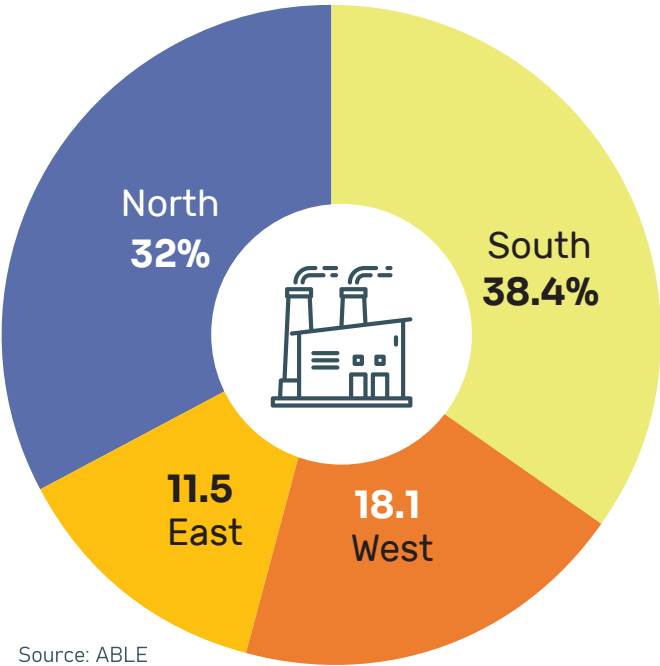


BioIndustrial segment encompasses various sub-segments that contribute significantly to the overall bioeconomy. Here is a breakdown of the top BioIndustrial sub-segments:

1. **Beverage Alcohol:** With a share of **31.0%**, this segment is the largest contributor, valued at **\$24.23 billion**. The North region dominates this sub-segment, reflecting a strong presence of potable alcohol production facilities.
2. **Animal Nutrition:** This segment accounts for **26.2%** of the total share, with a total value of **\$20.51 billion**. It is the second largest contributor to the BioIndustrial BioEconomy, particularly in regions like South, where it holds substantial value.
3. **Technical Industries:** With a share of **17.4%**, this segment is valued at **\$13.61 billion**. It includes diverse industries, showing significant economic impact across various regions.
4. **BioEthanol:** With a share of **12.0%** to the total market, BioEthanol is valued at **\$9.37 billion**. It is an important part of renewable energy efforts, with notable contributions from the North and East regions.
5. **Food:** The food segment accounts for **9.7%** of the market share, valued at **\$7.62 billion**. It is a crucial sector for consumer goods but has a relatively smaller share compared to other segments.
6. **Household Care:** This segment contributes **3.7%** to the total BioIndustrial Segment, with a value of **\$2.89 billion**. It is a niche but essential sector, focusing on sustainable household products.

Regional Analysis of BioIndustrial Segment

Regional specializations are emerging as competitive advantages across the country. South India leads this booming sector with a commanding **38.4%** market share valued at **\$30.01 billion**, followed by North India at **32.0%** (\$25.01 billion). The Western and Eastern regions account for **18.1%** (**\$14.17 billion**) and **11.5%** (**\$9.01 billion**) respectively.



Source: ABLE

BioIndustrial Region Share

Region	Bioeconomy (\$ Bn)	Bioeconomy Share (%)
South	30.01	38.4
North	25.01	32.0
West	14.17	18.1
East	9.01	11.5
Total	78.20	100.0

SOUTH INDIA
(\$30.01 billion, 38.4%)

- ✓ Strongest Subsegments: Poultry Feed (\$7.73 bn), Potable Alcohol (\$4.82 bn), Textiles (\$3.30 bn)
- ✓ Top States: Andhra Pradesh (\$9.35 bn), Karnataka (\$6.65 bn), Tamil Nadu (\$7.88 bn), Telangana (\$4.81 bn)
- ✓ Key Insights: Dominates in Poultry Feed with \$7.73 bn, representing 70% of the national market in this subsegment.

NORTH INDIA
(\$25.01 billion, 32.0%)

- ✓ Strongest Subsegments: Potable Alcohol (\$4.98B), Oil Degumming (\$3.85B), BioEthanol (\$2.51B)
- ✓ Top States: Punjab (\$6.57B), Uttar Pradesh (\$6.10B), Madhya Pradesh (\$4.64B)
- ✓ Key Insights: Strong presence in grain-based products with leadership in Potable Alcohol (Grain).

WEST INDIA
(\$14.17 billion, 18.1%)

- ✓ Strongest Subsegments: Textiles (\$2.95 bn), Potable Alcohol (\$3.1 bn)
- ✓ Top States: Maharashtra (\$8.92 bn), Gujarat (\$3.74 bn)
- ✓ Key Insights: Maharashtra alone contributes 68.7% of the West region's total and 11.4% of the national total.

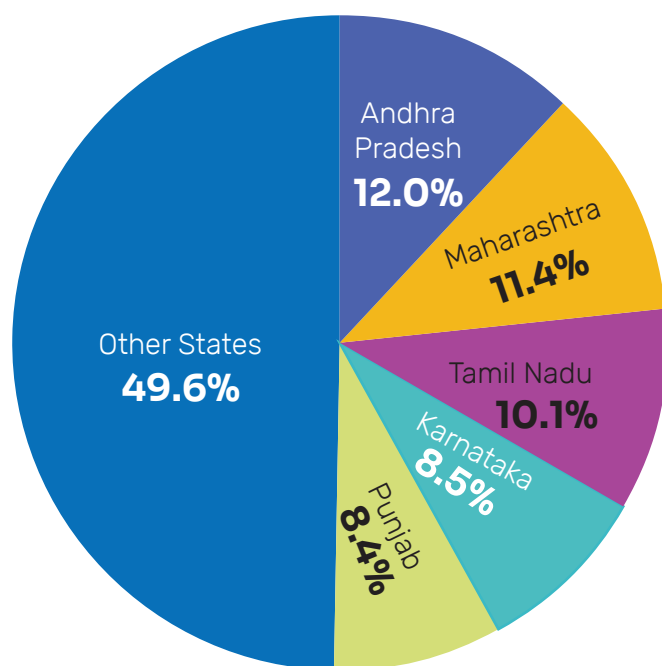
EAST INDIA
(\$9.01 billion, 11.5%)

West Bengal contributes 57.6% of the region's total with strengths across multiple subsegments.

Top States in BioIndustrial Segment

The diversity across the six major key subsegments underscores the sector's resilience and potential for sustainable growth as India continues to advance its position in the global bioeconomy landscape.

Top 5 States for BioIndustrial



Source: ABLE

Andhra Pradesh

Leader in Aqua Feed (**\$4.48 bn**), Poultry Feed (**\$1.51 bn**), Potable Alcohol (**\$2.35 bn**)

Maharashtra

Strong in Potable Alcohol (**\$2.29 bn**), Poultry Feed, and Textiles (**\$1.39 bn**)

Tamil Nadu

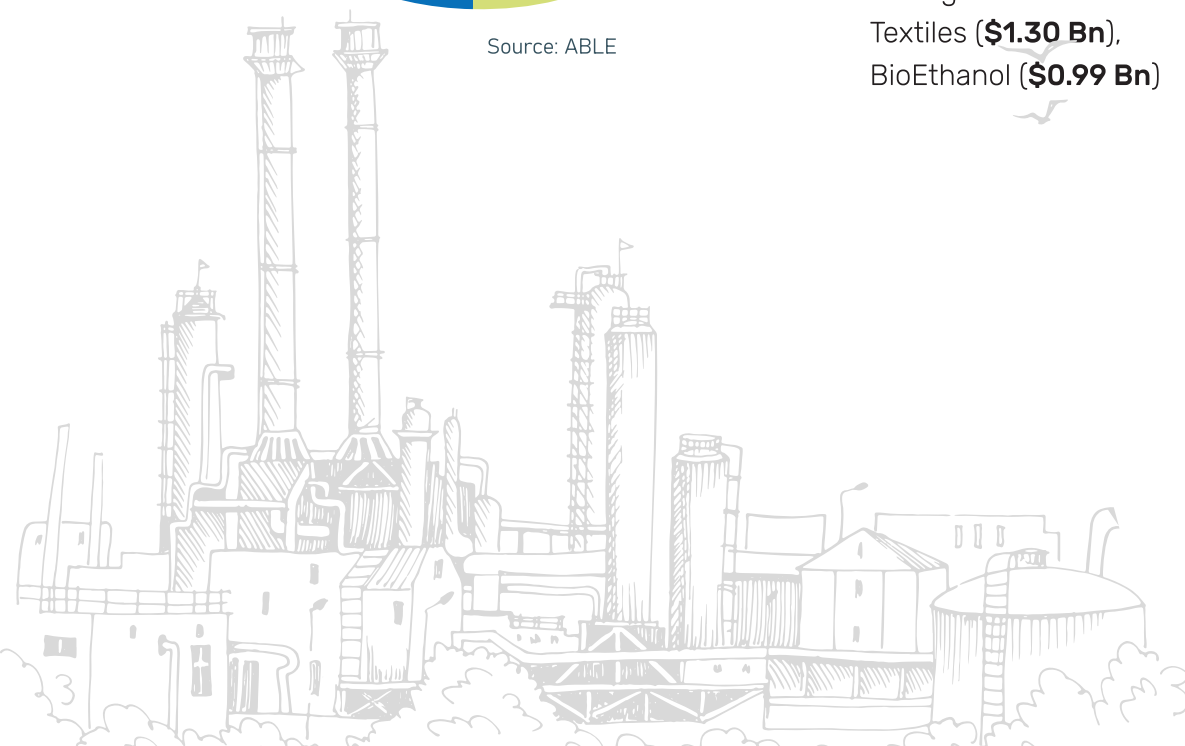
Dominates in Textiles (**\$2.55 bn**), Poultry Feed (**\$2.55 bn**), Leather (**\$1.31 bn**)

Karnataka

Relies heavily on poultry feed (**\$2.18 billion**), beer (**\$1.14 billion**), and textiles (**\$1.13 billion**)

Punjab

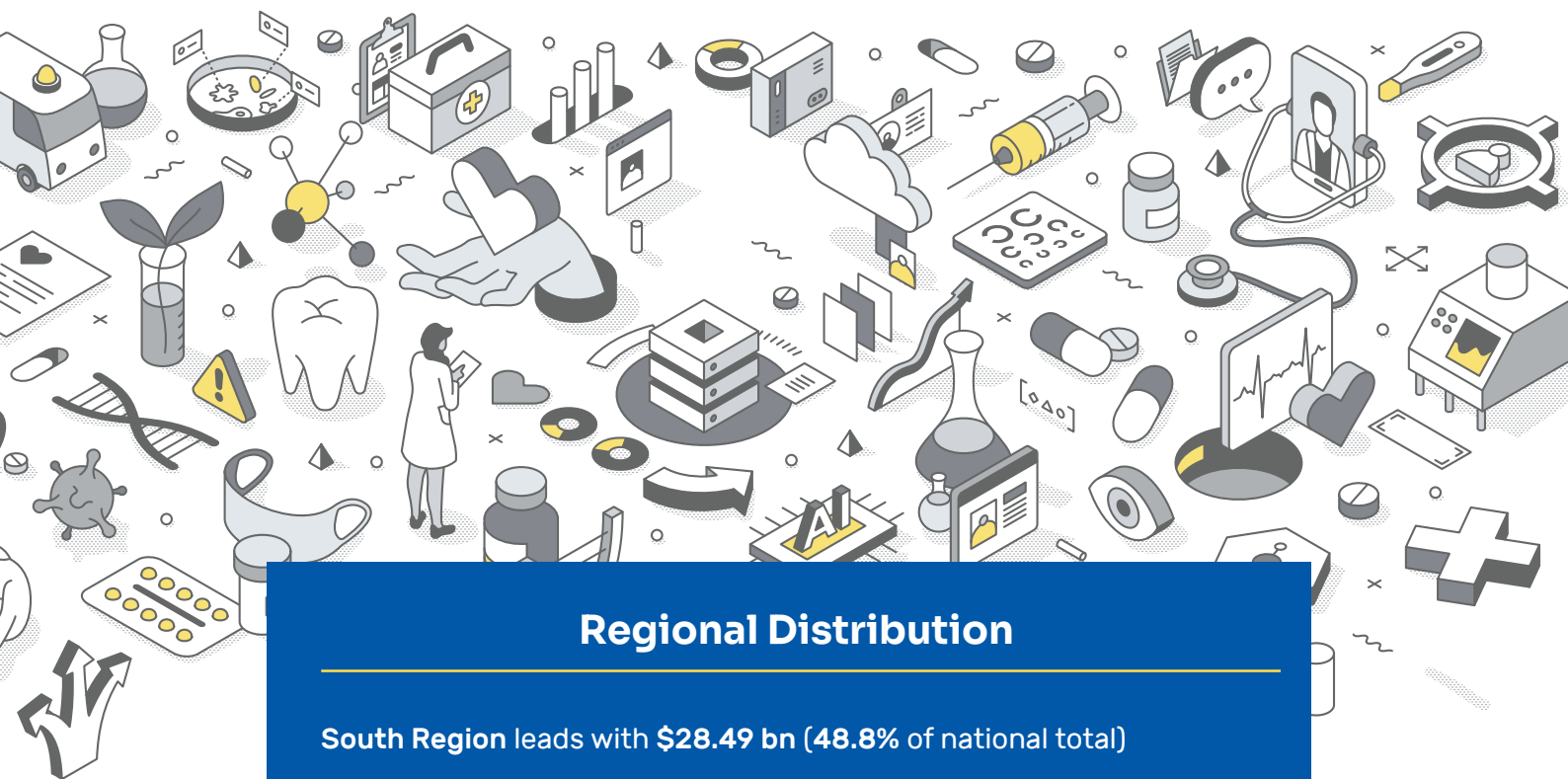
Strong in Potable Alcohol (**\$2.44B**), Textiles (**\$1.30 Bn**), BioEthanol (**\$0.99 Bn**)



BioPharma

India's Growing Healthcare Sector

India's BioPharma sector BioEconomy is **\$58.40** billion spread across four key subsegments: **Therapeutics (\$21.40 billion)**, **Vaccines (\$16.80 billion)**, **Diagnostics (\$12.50 billion)**, and **Medical Devices (\$7.70 billion)**. The industry shows pronounced regional concentration with Southern and Western India accounting for over **91%** of the total BioEconomy value. **Karnataka, Maharashtra, and Telangana** have emerged as the leading states, collectively representing **76.9%** of the national BioPharma economy.



Regional Distribution

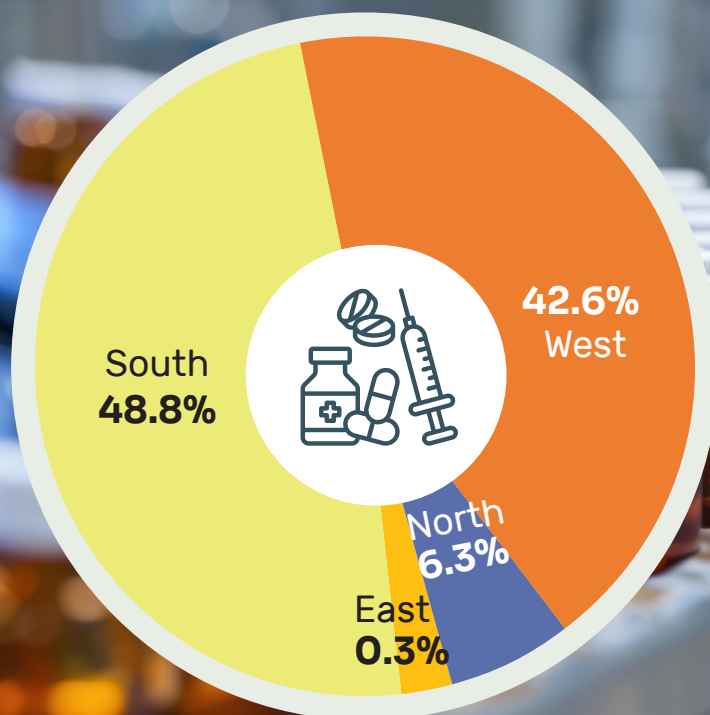
South Region leads with **\$28.49 bn** (48.8% of national total)

West Region follows closely at **\$24.89 bn** (42.6% of national total)

North Region contributes **\$3.67 bn** (6.3% of national total)

East Region and others shows minimal presence with just **\$1.36 bn** (0.3% of national total)

This stark regional disparity highlights the concentration of BioPharma activities in the southern and western corridors of India, which have developed robust ecosystems supporting industry growth.



Source: ABLE

REGIONAL HIGHLIGHTS BIOPHARMA

SOUTH INDIA (\$28.49 bn)

- ✓ Karnataka emerges as the crown jewel of South India's BioPharma industry
- ✓ Telangana has established itself as a vaccines and therapeutics powerhouse
- ✓ The region shows particular strength in Therapeutics (\$13.27 billion)
- ✓ All five southern states feature in the **top 10** BioPharma states nationally

WEST INDIA (\$24.89 bn)

- ✓ Maharashtra dominates with **79.5%** of the region's total
- ✓ The region leads nationally in Vaccines (\$11.09 billion)
- ✓ Gujarat complements Maharashtra with strengths in Therapeutics

NORTH INDIA (\$3.67 bn)

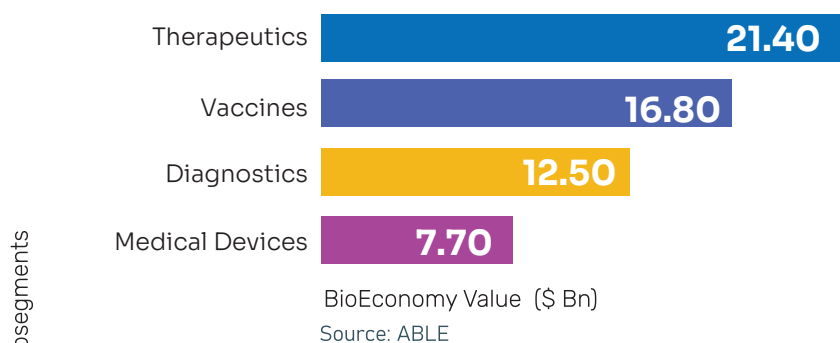
- ✓ More diversified across states compared to other regions
- ✓ Uttar Pradesh leads the region, followed by Delhi
- ✓ Strongest in Diagnostics (\$2.06 billion) and Medical Devices (\$1.18 billion)

EAST INDIA (\$1.35 bn)

- ✓ Minimal presence with only West Bengal showing notable activity
- ✓ Limited to the Diagnostics subsegment
- ✓ Represents a potential growth opportunity for industry expansion



Subsegment Analysis

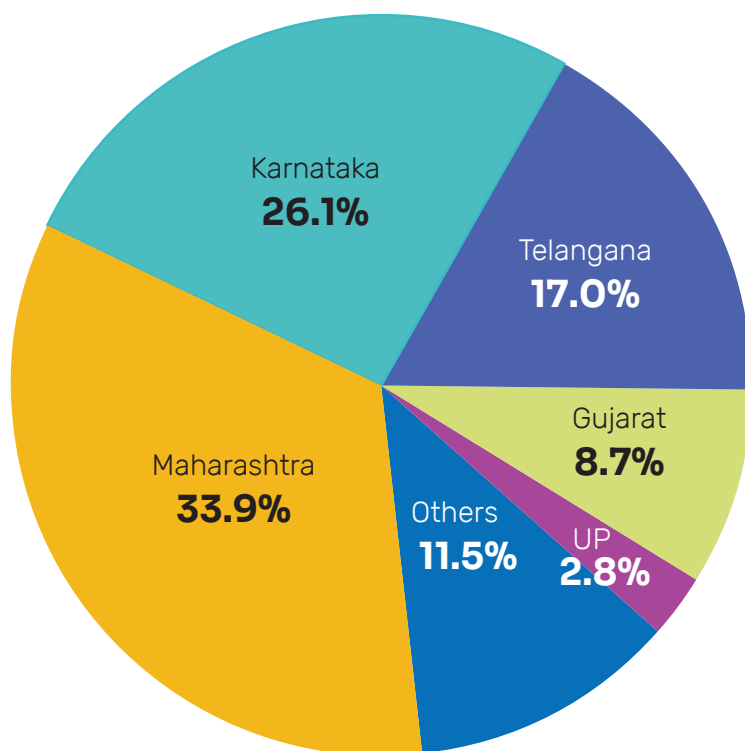


The BioPharma sector can be broken down into four distinct subsegments:

- 1. Therapeutics (\$21.40 bn, 36.6%):** The largest subsegment, dominated by Karnataka (\$8.88 bn) and Maharashtra (\$3.85 bn)
- 2. Vaccines (\$16.80 bn, 28.8%):** Heavily concentrated in Maharashtra (\$11.09 bn) and Telangana (\$5.38 bn)
- 3. Diagnostics (\$12.50 billion, 21.4%):** Led by Karnataka (\$3.75 bn) and Maharashtra (\$3.59 bn)
- 4. Medical Devices (\$7.70 bn, 13.2%):** The smallest subsegment, with Karnataka (\$2.59 bn) leading

The subsegment distribution reveals that Therapeutics and Vaccines together constitute **65.4%** of the total BioPharma market, underscoring India's strength in pharmaceutical manufacturing and research.

Top 5 States for BioPharma



Source: ABLE

1. Maharashtra: \$19.80 bn (33.9% of national total)

- ✓ Leads in Vaccines (\$11.09 bn)
- ✓ Strong presence in Therapeutics (\$3.85 bn) and Diagnostics (\$3.59 bn)

2. Karnataka: \$15.23 bn (26.1% of national total)

- ✓ Dominates in Therapeutics (\$8.88 bn)
- ✓ Significant presence in Diagnostics (\$3.75 bn) and Medical Devices (\$2.59 bn)

3. Telangana: \$9.94 bn (17.0% of national total)

- ✓ Excels in Vaccines (\$5.38 bn) and Therapeutics (\$3.75 bn)

4. Gujarat: \$5.09 bn (8.7% of national total)

- ✓ Strong in Therapeutics (\$3.42 bn)
- ✓ Notable presence in Medical Devices (\$0.95 billion) and Diagnostics (\$0.71 bn)

5. Uttar Pradesh: \$1.63 bn (2.8% of national total)

- ✓ Balanced between Medical Devices (\$0.79 bn) and Diagnostics (\$0.73 bn)

Other States (\$6.71 bn)

Key Insights

1. The BioPharma industry shows extreme geographic concentration with just three states (**Maharashtra, Karnataka, and Telangana**) accounting for **77%** of the national market.
2. Different regions have developed specialized niches:
 - ✓ **South:** Therapeutics and balanced growth across subsegments
 - ✓ **West:** Vaccines and Therapeutics
 - ✓ **North:** Diagnostics and Medical Devices
3. Each subsegment shows different patterns of geographic concentration:
 - ✓ **Vaccines:** **97.6%** concentrated in just two states (Maharashtra and Telangana)
 - ✓ **Therapeutics:** More distributed but still dominated by Karnataka
 - ✓ **Diagnostics and Medical Devices:** More evenly distributed across regions
4. The minimal presence in Eastern India highlights a significant regional disparity and potential opportunity for targeted development initiatives in this region.

BioAgri

A Segment in Transition

India's BioAgri sector is rapidly evolving, driven by the integration of sustainable agricultural practices and technological advancements. This analysis focuses on two key components of the BioAgri market: Bt Cotton and BioAgri Inputs.

Bt Cotton and BioAgri Inputs

Bt Cotton is a genetically modified crop that incorporates genes from *Bacillus thuringiensis* to reduce pesticide use by producing proteins toxic to pests like the cotton bollworm. This technology has significantly increased cotton yields and reduced pesticide applications, transforming India into a major cotton exporter. BioAgri Inputs include biofertilizers, biopesticides, biostimulants, and biocontrol agents, which enhance crop health while minimizing environmental impact.

Out of the total BioAgri BioEconomy of **\$13.5 billion** in 2024, Bt Cotton-based BioEconomy is estimated to be **\$10.3 billion**, accounting for approximately **76%** of the sector, while BioAgri Inputs contributed **\$3.2 billion**, making up about **24%**

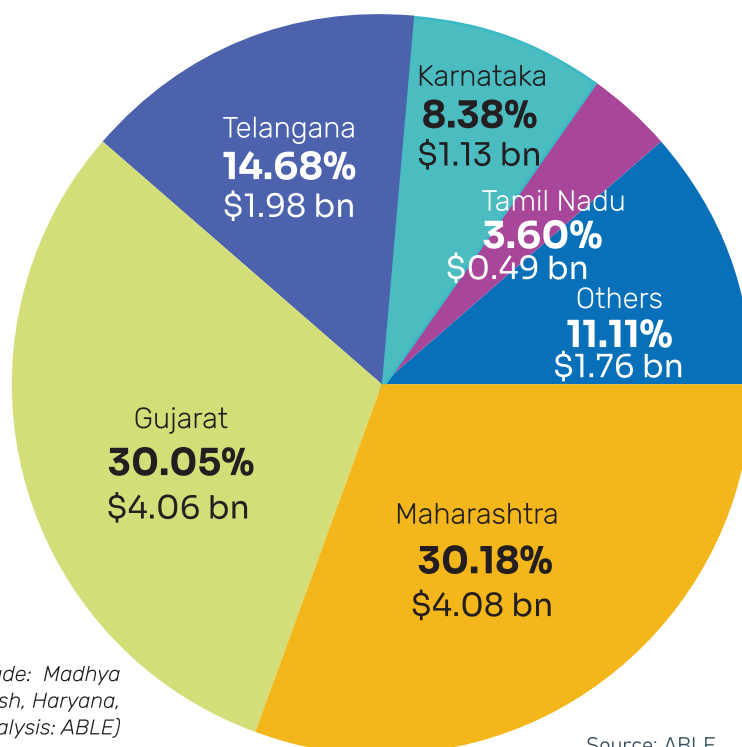
of the pie. This distribution highlights the dominant role of Bt Cotton in India's BioAgri sector.

Regional Distribution

Maharashtra and Gujarat collectively contribute about **60%** of the BioAgri segment's share, driven by their strong agribusiness infrastructure and high demand for precision farming technologies. Telangana and Karnataka are emerging as significant players, with Telangana focusing on modern agricultural practices and Karnataka leading in biotechnology investments.

Despite this growth, challenges such as regulatory frameworks, public perception of genetically modified crops, and the need for more extensive infrastructure in other states may hinder market expansion.

Top 5 States in the BioAgri Segment



Shifting Landscapes: India's Cotton Production Trends in 2024-25

India's cotton industry is experiencing a significant transformation, with traditional cotton-growing regions seeing remarkable declines while southern states rise in prominence. The latest data from the Cotton Association of India, reporting on the 2024-25 season as of January 31, 2025, reveals a complex picture of regional shifts, production challenges, and emerging opportunities in one of the country's most crucial agricultural sectors.

The 2024-25 cotton season has witnessed an overall decline of 7.8% in production, with total output falling to 301.75 lakh bales (of 170 kg each) from 327.45 lakh bales in the previous year. This reduction of 25.70 lakh bales represents a significant shift in India's cotton landscape, but the national figure obscures dramatic regional variations that tell a more nuanced story of India's evolving cotton sector.

The region, comprising Gujarat, Maharashtra,

and Madhya Pradesh, continues to dominate production with 184 lakh bales, representing approximately 61% of India's total cotton output. However, this powerhouse region has experienced an 18.21 lakh bale reduction compared to the previous season, primarily driven by Gujarat's substantial decline.

Meanwhile, the South Zone emerges as the only region showing positive growth, increasing its production to 85 lakh bales, up 11.15 lakh bales from the previous season. This 15.1% increase is largely attributable to Telangana's remarkable performance, which has implications for the shifting geographic focus of India's cotton industry.

The Changing Fortunes of Traditional Cotton Belts

Gujarat's Surprising Decline: Long renowned as one of India's premier cotton-growing states, Gujarat has experienced a sharp 17.1% reduction, with output falling from 90.50 lakh bales to 75.00 lakh bales.



State	2024-25 Production (lakh bales)
Maharashtra	90.00
Gujarat	75.00
Telangana	47.00
Karnataka	23.00
Madhya Pradesh	19.00
Upper Rajasthan	9.20
Lower Rajasthan	9.00
Haryana	8.30
Andhra Pradesh	11.00
Tamil Nadu	4.00
Orissa	2.75
Punjab	1.50
Others	2.00
Total	301.75

North Zone’s Collective Struggle: While Gujarat’s decline is noteworthy due to its scale, the most pronounced percentage decreases occurred in the North Zone, comprising Punjab, Haryana, and Rajasthan. This region collectively experienced a 38.6% reduction, with output falling from 45.62 lakh bales to just 28.00 lakh bales. Punjab registered the most severe percentage decline at 58.9%, though its smaller base means the absolute reduction of 2.15 lakh bales is less impactful on national totals. Similarly, Haryana saw production fall by 37.6%, while Upper Rajasthan and Lower Rajasthan declined by 40.5% and 31.8% respectively.

Telangana’s Remarkable Rise: Telangana has emerged as the standout success story of the 2024-25 season. The state increased its cotton production by an impressive 34.3%, adding 12 lakh bales to reach a total of 47 lakh bales. This growth has propelled Telangana to become India’s third-largest cotton-producing state.

Karnataka’s Steady Progress: Karnataka has also demonstrated positive momentum, increasing production by **1.40 lakh bales** (6.5%) to reach **23 lakh bales**. This growth has elevated Karnataka’s share of national production from **6.6%** to

7.6%, reinforcing the South Zone’s emerging prominence in India’s cotton sector.

The contrasting fortunes of the South Zone versus the North and parts of the Central Zone highlight a geographic reorientation of India’s cotton production that may have long-term implications for infrastructure development, processing capacity, and supply chain logistics.

Maharashtra’s Resilience Amid Challenges: Maharashtra, which remains India’s leading cotton producer with 90 lakh bales, presents an interesting case study in relative stability. Despite experiencing a modest 2.9% decline (2.71 lakh bales), the state has actually increased its market share from 28.3% to 29.8% due to the more substantial drops elsewhere.

An Industry in Transition: The 2024-25 cotton season data reveals an industry in the midst of significant transition. The shifting geographic focus from traditional northern and western growing regions toward southern states represents a fundamental restructuring of India’s cotton landscape with far-reaching implications for farmers, processors, and textile manufacturers.



India's BioAgri Inputs Sector Surges to \$3.2 Billion in 2024

India's commitment to sustainable agriculture is yielding significant results, with the BioAgri Inputs subsegment of the BioEconomy reaching a valuation of \$3.2 billion in 2024, a notable 23.08% increase from \$2.6 billion in 2023. This growth underscores the nation's rapid adoption of biological agricultural solutions, contributing to the broader Indian BioEconomy.

The burgeoning BioAgri sector, a vital component of the \$13.5 billion BioAgri BioEconomy, is witnessing a transformative shift as farmers increasingly embrace biofertilizers, biopesticides, and other biological inputs. This move is focused on enhancing crop yield, improving soil health, and minimizing the environmental impact of conventional chemical practices.

Biofertilizers Lead the Charge: The biofertilizers market has surged to approximately \$1.6 billion, driven by government initiatives and heightened farmer awareness of organic farming benefits. Projections indicate a continued CAGR of around 12% over the next four to five years.

Biopesticides Gain Traction: The biopesticides segment has reached a valuation of approximately \$600 million, with a projected CAGR of 17%. The growing recognition of the environmental and health hazards associated with chemical pesticides is fueling this rapid expansion.

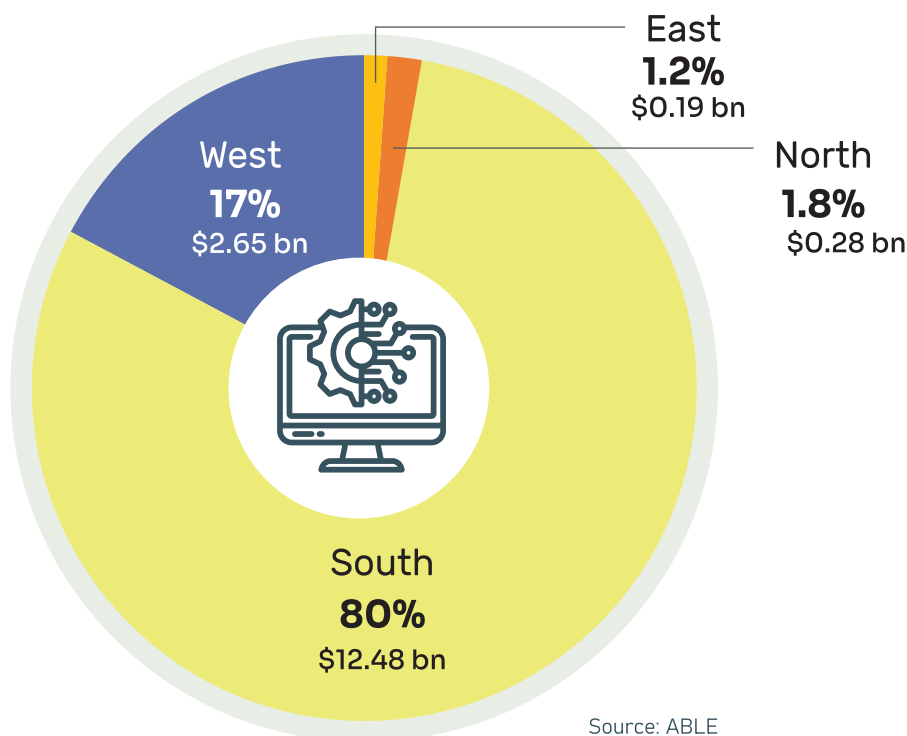
Other Biologicals Expand Footprint: The broader category of agricultural biologicals, including bio-stimulants and bio-control agents, has grown to approximately \$1 billion. This segment is expected to register a CAGR of 14%, driven by the need for sustainable solutions to enhance crop productivity and resilience.

Regional BioAgri Input Dominance: The BioAgri Inputs subsegment shows strong regional concentration. Gujarat leads with 29% of the market share, followed by Maharashtra at 27%. Telangana contributes 15%, Tamil Nadu 11%, and Karnataka 8%, highlighting the significant regional contributions to the national BioAgri growth.

Regional Analysis of BioServices in India

The BioServices sector is at **\$15.6 billion** contributing to **9.4%** percent share of the total BioEconomy. It shows remarkable growth patterns across the three regions. At **24%** growth, this sector represents the highest growth rate in the BioEconomy landscape, highlighting the fundamental importance of research and innovation in advancing biological sciences nationally.

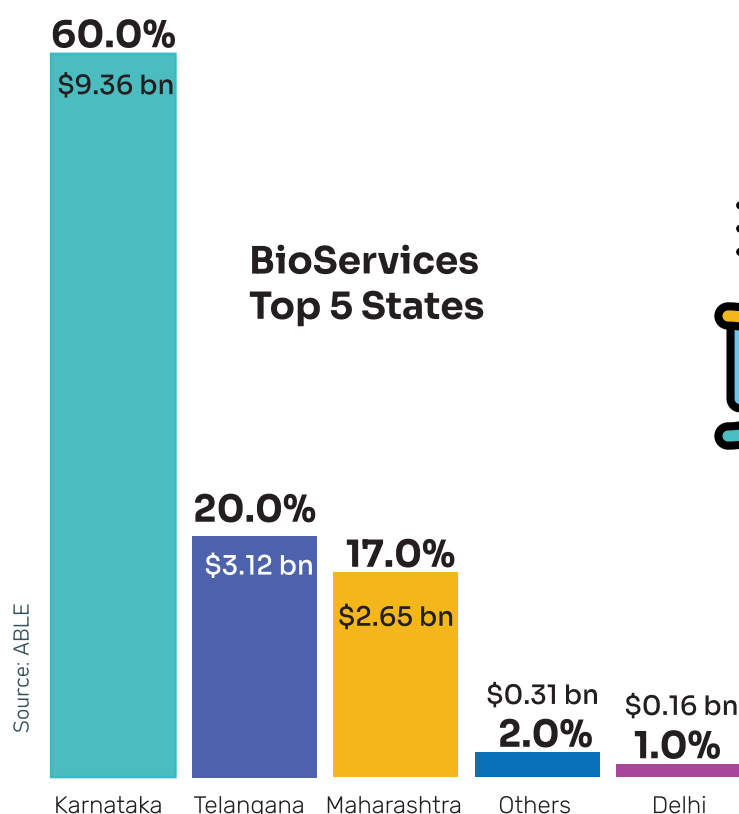
BioServices BioEconomy by Region



Source: ABLE

Examining the regional distribution of BioServices across India reveals significant concentration in specific areas:

- ✓ **South Region** leads with a dominant **\$12.48 billion** of contribution, representing approximately 80% of the total national BioServices output
 - Karnataka is the powerhouse with **60%** contribution of the national total
 - **Telangana** follows with **20%** contribution
- ✓ **West Region** contributes **17%** of national total
 - Maharashtra accounts for the entire regional contribution
 - Gujarat shows potential for growth with current minimal activity
- ✓ **North Region** shows limited activity



Innovation Drivers

The concentrated growth in southern states, particularly Karnataka and Telangana, reflects the established innovation ecosystems in cities like Bangalore and Hyderabad. These regions benefit from:

- Advanced technological implementation in bioinformatics, artificial intelligence, and gene editing
- Proximity to research institutions and academic centers
- Availability of skilled workforce and specialized training facilities

Supporting Infrastructure

The BioServices sector depends on several critical components:

- **Research and Development Platforms:** Companies providing unified

data systems and analytical tools are essential for accelerating innovation

- **BioSuppliers:** Specialized equipment and reagent providers enable efficient research execution
- **Education and Training Services:** These are increasingly vital for transitioning to circular, low-carbon economic models and developing needed skills

Future Growth Potential

The significant regional disparities highlight substantial opportunities for expansion in underdeveloped regions, particularly in eastern and northern states. Strategic initiatives targeting these regions could help balance the national BioServices landscape while leveraging existing expertise from southern innovation hubs.

India's Life Sciences GCCs Driving Global Healthcare Innovation

INDIA'S GROWING LEADERSHIP IN LIFE SCIENCES AND HEALTHCARE (LSHC) GCCs

India is steadily positioning itself as a global leader in Life Sciences and Healthcare Global Capability Centers (LSHC GCCs). These centers are at the forefront of transforming drug development, clinical trials, and supply chain management, while seamlessly integrating cutting-edge technologies and specialized expertise. As digital transformation accelerates, India's strategic role in global research, development, and technological innovation is becoming increasingly significant.

Technological Transformation: Enabling Healthcare Innovation

Indian LSHC GCCs are leading technology-driven innovations across multiple business and corporate functions:

- **Core Technologies:** Artificial Intelligence (AI), Machine Learning (ML), Big Data Analytics, Internet of Things (IoT), Cybersecurity, Cloud Infrastructure, Automation, and Robotic Process Automation (RPA).
- **Business Functions:** Finance, accounting, marketing, supply chain optimization, post-market surveillance, and healthcare IT solutions.

These technologies enhance drug discovery, streamline research workflows, and improve global data management, strengthening India's role in reshaping the global healthcare landscape.

India's Comprehensive Role in the Drug Development Lifecycle

Indian LSHC GCCs are involved at every stage of drug development:

1. **Discovery and Preclinical Research:** Specializing in analytical development, protein engineering, medicinal chemistry, and bioanalytical research.
2. **Clinical Trials:** Managing data, ensuring regulatory compliance, biostatistics, and creating regulatory documentation.
3. **Data Analysis:** Centralized monitoring, statistical analysis, and medical reviews for regulatory submissions.
4. **Post-Market Surveillance:** Handling pharmacovigilance, risk assessments, and safety reporting.

The workforce in these centers, estimated at **25,000–30,000** professionals, underscores India's growing influence in global healthcare innovation.



India's Key LSHC GCC Hubs

While cities like Bengaluru lead with approximately 32% of India's Healthcare and Life Sciences GCCs, other regions, including Hyderabad, Mumbai, and Delhi NCR, are also making significant contributions:

- 🕒 **Hyderabad:** Features Genome Valley, a premier R&D hub with 200+ companies, along with a rapidly expanding MedTech sector.
- 🕒 **Mumbai and Delhi NCR:** Major hubs for pharmaceutical R&D, finance, and regulatory affairs.
- 🕒 **Bengaluru:** A leader in digital innovation and biotech research.

Together, these cities account for nearly 85% of India's Life Sciences GCCs, reflecting the country's widespread and balanced growth in the sector.

National GCC Landscape: Metrics and Trends

- ✓ Approximately 15% of India's total GCC work-

force is focused on Healthcare & Life Sciences.

- ✓ Companies headquartered in the United States account for over 55% of India's GCCs.
- ✓ Around 20% of these centers have operations in three or more Indian cities.

Next-Gen Technologies Powering Indian GCCs

Indian GCCs are adopting cutting-edge technologies to enhance efficiency and innovation:

- ✓ **Big Data & Analytics:** Optimizing clinical trials, accelerating drug discovery, and improving resource allocation.
- ✓ **Automation & RPA:** Increasing efficiency in patient trial matching and data processing.
- ✓ **Cloud Computing:** Supporting scalable solutions for clinical trials and healthcare IT.
- ✓ **Cybersecurity:** Protecting sensitive patient and clinical data.

- ✓ **Blockchain:** Enhancing transparency in supply chains and ensuring secure data management.

Expanding Global Influence: Recent Developments

1. **Sanofi's Expansion:** A €400 million investment, establishing India as its largest global hub with up to 2,600 employees.
2. **AstraZeneca's Growth:** A ₹250 crore investment aimed at expanding GCC operations in India.
3. **Novo Nordisk:** Collaborating with AI startups and expanding its workforce to handle clinical trial data.
4. **Telangana Lifesciences Consortium:** A government-led initiative fostering collaboration across 40+ companies.
5. **Amgen's Hyderabad Facility:** A \$200 million tech and innovation center aimed at enhancing pharmaceutical R&D.
6. **Takeda's Bengaluru ICC:** A new digital innovation center focusing on AI, data science, and generative AI.
7. **Bristol Myers Squibb's Innovation Hub in Hyderabad:** Bristol Myers Squibb (BMS) inaugurated its new state-of-the-art facility in Hyderabad. This \$100 million investment will house over 1,500 employees, transforming Hyderabad into a key innovation center for the company.
8. **Miltenyi Opens India Hub:** Miltenyi Biotec enters India, establishing its first office and a Hyderabad-based Cell and Gene Therapy (CGT) Center of Excellence. This Innovation and Technology Center will offer hands-on training, spanning proof-of-concept to commercialization, for scientists and clinicians.

India's Growing Dominance in LSHC GCCs

- ✓ **Workforce Growth:**
 - o **2010:** 10+ GCCs | 40,000+ professionals
 - o **2015:** 45+ GCCs | 100,000+ professionals
 - o **2024:** 100+ GCCs | 280,000+ professionals
 - o **2030 (Projected):** 160+ GCCs | 420,000+ professionals
- ✓ **Operational Efficiency:**
 - ⦿ 30-50% cost savings compared to other global locations.
 - ⦿ 76% of centers are enhancing cybersecurity measures.
 - ⦿ 31% leverage AI for faster drug discovery.

Emerging Trends in Indian LSHC GCCs (2025 and Beyond)

- ✓ Adoption of organic and open innovation models.
- ✓ Increasing collaboration with Indian startups.
- ✓ Growing focus on provider-assisted service models.
- ✓ Rising adoption of advanced technologies for competitive edge.
- ✓ Expansion to 2,500 centers with 4.5 million employees by 2030, potentially surpassing a market size of \$100 billion.

Conclusion: India's Global Ascent

India's Healthcare and Life Sciences GCCs are rapidly evolving from operational hubs to strategic drivers of global healthcare innovation. With investments, technological advancements, and a highly skilled workforce, India is set to lead future innovations that will shape global healthcare outcomes. The contributions of multiple cities—Bengaluru, Hyderabad, Mumbai, and Delhi NCR—reflect a well-rounded growth trajectory that solidifies India's role as a global leader in life sciences.

Transformative Launches

Key Trends Shaping the BioEconomy Products Landscape



The healthcare and biopharmaceutical landscape is undergoing a significant transformation as we move into 2025, marked by innovative technologies, a proactive approach to infectious disease management, and a growing emphasis on personalized and preventative care. Recent product launches highlight key trends shaping the industry, including advancements in gene sequencing, cancer treatment, and efforts to combat infectious diseases. The introduction of India's first indigenous antibiotic targeting antimicrobial resistance (AMR) exemplifies the critical need to address this growing global threat.

This new antibiotic, developed with local support, targets Community-Acquired Bacterial Pneumonia (CABP), a condi-

tion increasingly caused by drug-resistant bacteria. The availability of new treatments offers renewed hope amidst the challenges of AMR, which poses a serious risk to public health worldwide. As antibiotic resistance continues to rise, innovative solutions like Nafithromycin are essential for effective treatment options.

Parallel to the fight against bacterial infections, vaccine development remains crucial for preventing widespread illness. The launch of a quadriva-

lent influenza vaccine aims to prevent seasonal epidemics by targeting multiple strains of influenza A and B viruses. Additionally, the introduction of a 14-valent Pneumococcal Conjugate Vaccine provides enhanced protection for children against pneumococcal diseases by covering more serotypes than

existing vaccines. Furthermore, the launch of an oral cholera vaccine aims to combat cholera and address a global shortage of this crucial preventative measure. These launches signify a commitment to proactive healthcare strategies that prioritize disease prevention and safeguard public health.

Advancements in gene sequencing technologies and the development of personalized genomics platforms are providing deeper insights into individual health profiles. This opens the door for more tailored treatment approaches in areas like oncology and immunology. Bio-Rad's ddSEQ Single-Cell 3' RNA-Seq Kit enables

researchers to conduct efficient single-cell gene expression analyses, facilitating breakthroughs in understanding complex diseases.

In the realm of cancer treatment, CAR T-cell therapies introduced by institutions like Amrita Hospital and MOC Cancer Care & Research Centre offer new hope for patients with blood cancers, showcasing the shift toward more targeted and effective treatments that leverage the body's immune system.

2025 promises to usher in a new era of precision medicine and improved well-being through innovative and accessible healthcare solutions. These advancements signal a commitment to empowering individuals to take control of their health while paving the way for more effective disease management

As digital health continues to evolve, there is a growing trend toward integrating technology into everyday health management. Partnerships aimed at creating immersive healthcare experiences and launching user-friendly health monitoring solutions tailored for local markets exemplify this shift. Moreover, AI-driven diagnostics and remote patient monitoring are reshaping

healthcare delivery by enhancing efficiency and accessibility.

Overall, 2025 promises to usher in a new era of precision medicine and improved well-being through innovative and accessible healthcare solutions. These advancements signal a commitment to empowering individuals to take control of their health while paving the way for more effective disease management. The focus will increasingly be on enhancing patient experiences and improving healthcare outcomes through advanced technologies that bridge the gap between traditional care and modern digital solutions.



India Launches Nafithromycin, Indigenous Antibiotic to Combat AMR

India has launched Nafithromycin, an indigenous antibiotic aimed at combating Antimicrobial Resistance (AMR).

Developed with support from BIRAC and marketed by Wockhardt as Mignaf, this innovative antibiotic targets Community-Acquired Bacterial Pneumonia (CABP), a severe illness caused by drug-resistant bacteria. Nafithromycin is designed to address the growing threat of infections that disproportionately affect vulnerable populations, including children and the elderly. It is reported to be ten times more effective than azithromycin and has demonstrated a high clinical cure rate. The drug is anticipated to launch commercially by late 2025.

BIOPHARMA & VACCINES



Bharat Biotech Launches Oral Cholera Vaccine HILLCHOL

Bharat Biotech International Limited has launched HILLCHOL (BBV131), a novel single-strain Oral Cholera Vaccine (OCV). This vaccine represents a significant advancement in combating cholera globally. Bharat Biotech has established large-scale manufacturing facilities capable of producing up to 200 million doses of HILLCHOL annually to address the global shortage of oral cholera vaccines, which currently faces a yearly deficit of approximately 40 million doses. The introduction of HILLCHOL is expected to enhance the availability of this crucial vaccine and improve public health outcomes related to cholera prevention.

Cadila Pharma Launches Quadrivalent Influenza Vaccine in India

Cadila Pharmaceuticals has launched the Cadiflu Tetra Vaccine, an advanced Quadrivalent Influenza Vaccine aimed at preventing influenza. Approved for use in adults and children, this vaccine targets four strains of Influenza A and B viruses responsible for seasonal epidemics. Utilizing proprietary technology with nano-sized particles, Cadiflu Tetra mimics the virus's external structure without containing intact genetic material. It includes hemagglutinin (HA), neuraminidase (NA), and matrix 1 (M1) proteins from the respective strains. This innovative vaccine is expected to provide broad protection against influenza in India.

Abbott Launches 14-Valent Pneumococcal Conjugate Vaccine, PneumoShield 14

Abbott has introduced PneumoShield 14, a 14-valent Pneumococcal Conjugate Vaccine for children over six weeks of age. This vaccine offers broad protection by covering more serotypes than existing PCV-10 and PCV-13 vaccines. As a conjugate vaccine, PneumoShield 14 combines a part of the bacteria with a protein to enhance immune response, making it more effective against severe infections in children. It protects against five additional strains compared to PCV-10 and two more than PCV-13 vaccines currently used in India, significantly improving pediatric healthcare.

ImmunoACT and Amrita Hospital Launch CAR T-cell Therapy for Blood Cancers



ImmunoACT, a pioneering biotechnology company, has introduced CAR T-cell therapy at Amrita Hospital in Faridabad, offering new hope for cancer patients battling certain types of blood cancers. This therapy, considered a breakthrough in treating B-cell lymphoma and leukemia, has shown promising results in relapsed and refractory cases. It involves genetically modifying a patient's T cells to target and destroy cancer cells, which are then infused back into the body. This partnership aims to expand access to this advanced and potentially life-saving treatment for patients across all segments of society.

CELL & GENE THERAPY

Immuneel Launches CAR-T Therapy in India

Immuneel Therapeutics, a cell and gene therapy startup, launched Qartemi, CAR T-cell therapy for adult B-cell non-Hodgkin lymphoma. This breakthrough, utilizing modified T-cells, offers hope for patients failing conventional treatments. Immuneel conducted trials since 2022, demonstrating efficacy comparable to USFDA-approved therapies. Qartemi aims to transform Indian cancer care, addressing the nation's rising blood cancer burden. The therapy is priced between ₹35 lakh to ₹50 lakh.

AGRICULTURE

IIL Launches Indigenous IVF Media to Boost Dairy Farming Affordability



Indian Immunologicals Limited (IIL) has launched "Shashthi," an indigenous In-Vitro Fertilization (IVF) media developed in collaboration with the National Dairy Development Board (NDDB). This launch aims to make IVF technology more affordable for farmers, enhancing animal husbandry and supporting the vision of Atmanirbhar Bharat. IVF involves fertilizing an egg in a controlled lab environment and selecting embryos for transfer. The indigenous media is priced at ₹650 per embryo, which is 33% less than imported options. This initiative is expected to increase the adoption of IVF technology and multiply superior bovine germplasm, transforming the dairy industry in India.

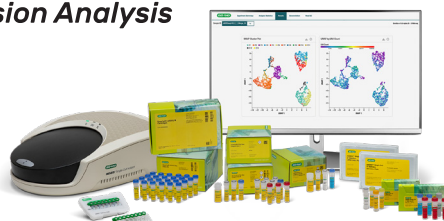
IPL Biologicals & PAU Launch Bio-Fungicide Agenor

IPL Biologicals and Punjab Agricultural University (PAU) have launched Agenor, a bio-fungicide designed to address challenges faced by paddy farmers. This collaboration aims to combat Bakane disease, a seed-borne ailment that can cause yield losses ranging from 3% to 95% annually. Developed by PAU scientists, Agenor is formulated as Trichoderma asperellum 2% WP. This bio-fungicide targets significant issues in North India, particularly in Basmati rice-growing areas.



Bio-Rad Launches ddSEQ Single-Cell 3' RNA-Seq Kit for Streamlined Gene Expression Analysis

Bio-Rad Laboratories has launched the ddSEQ Single-Cell 3' RNA-Seq Kit along with Omnition v1.1 analysis software. Designed for use with the ddSEQ Cell Isolator, this kit delivers high-quality single-cell 3' RNA-Seq libraries, enabling researchers to conduct gene expression and regulation analyses efficiently and affordably. The accompanying Omnition v1.1 Analysis Software facilitates quality control, analysis, and reporting of data generated from the kit. This innovative solution supports research in oncology, immunology, neurology, and stem cell biology by providing valuable insights into single-cell transcription and gene expression.



Stryker Introduces InSpace, India's First Biodegradable Balloon Implant for Shoulder Surgery

Stryker has introduced InSpace, India's first biodegradable balloon implant for the arthroscopic treatment of massive irreparable rotator cuff tears (MIRCTs). This groundbreaking solution aims to restore the subacromial space without the need for sutures or fixation devices, offering a less invasive surgical option that improves shoulder motion and function. By providing an innovative alternative to traditional surgical methods, this implant enhances patient care and outcomes for those suffering from shoulder dysfunction.

MEDICAL DEVICE / DIAGNOSTICS / GENOMICS

Neuberg Diagnostics Introduces Geniee: A Personalized Genomics Platform for Tailored Health Insights

Neuberg Diagnostics has launched Geniee – Decode Your DNA, a personalized genomics platform designed to transform healthcare management. Geniee provides tailored health insights by decoding users' genetic information, empowering them to make informed decisions about their health and wellness. The Complete Wellness Genetics Test provides actionable insights into potential health risks, such as obesity or nutritional deficiencies, while recommending optimal dietary choices. This service aims to significantly improve overall well-being through personalized health strategies.



Medtronic has launched the Percept RC, the smallest and thinnest dual-channel

Medtronic has launched the Percept RC, the smallest and thinnest dual-channel rechargeable neurostimulator designed for Deep Brain Stimulation (DBS). This cutting-edge device allows for highly personalized treatments for various movement disorders, including Parkinson's disease, essential tremor, dystonia, and epilepsy. Equipped with BrainSense technology, the Percept RC captures and records brain signals, providing valuable insights that enable healthcare providers to tailor therapy to individual needs. Its rechargeable battery ensures reliable performance with an extended service life, marking a significant advancement in neurological care.

Beurer India Launches GL 22 Blood Glucose Monitor Under “Make in India” Initiative



Beurer India has launched the GL 22 Blood Glucose Monitor, unveiled by cricket legend Sourav

Ganguly. Manufactured under the “Make in India” initiative, this monitor combines German precision with advanced technology tailored for the Indian market. The device offers comprehensive monitoring capabilities, including average readings for 7, 14, 30, and 90 days, providing insights into blood glucose trends that align closely with HbA1c levels. This launch underscores Beurer’s commitment to providing innovative and user-friendly health solutions, enabling users and healthcare providers to manage diabetes more effectively.

HEALTHCARE & TECHNOLOGY

BharatBox and GOQii Partner to Launch Healthcare Metaverse Experience in India

BharatBox, a metaverse venture, and GOQii, a health and wellness platform, have launched India’s first healthcare platform in the metaverse. This collaboration will allow users to explore a fully immersive digital world that blends physical wellness routines with metaverse experiences powered by the Universal Health Token (UHT). This partnership enables a smart-tech health ecosystem within the metaverse, adopting UHT to gamify preventive healthcare. Users can earn tokens for healthy actions, access health services, and benefit from a rewards system, integrating fitness, mental well-being, and nutrition in an interactive digital space.

Skye Air Mobility and CARITAS Hospital Launch Drone Medical Deliveries in Kerala



Skye Air Mobility and CARITAS Hospital in Kottayam, Kerala, have launched a drone-based medical delivery system. This initiative transforms healthcare logistics in South Kerala by using drones to transport medical supplies and diagnostic samples, significantly enhancing efficiency and accessibility. The Caritas Drone Medical Supply Delivery Unit utilizes drones capable of carrying payloads up to 3 kilograms over 10-15 kilometers. This system connects the hospital with satellite facilities and remote areas, reducing delivery times from hours to just 5-7 minutes, while also reducing carbon emissions by minimizing reliance on road transport.

CitiusTech Launches Generative AI-Enabled HEDIS Solution for Healthcare Payers

CitiusTech has launched the industry’s first Generative AI-enabled HEDIS (Healthcare Effectiveness Data and Information Set) solution. Seamlessly integrated into the company’s PERFORM+ Clinical Convergence Platform, this innovative toolset represents a major shift in how healthcare payers approach HEDIS and quality management processes. The solution includes conversational rules functionality, which allows users to create and adjust rules using simple text or voice commands. It also offers a Gen AI foundational library and AI-augmented engineering, accelerating the time-to-market for new capabilities and streamlining processes through AI-powered enhancements.



Driving Biotech Innovation and Economic Growth

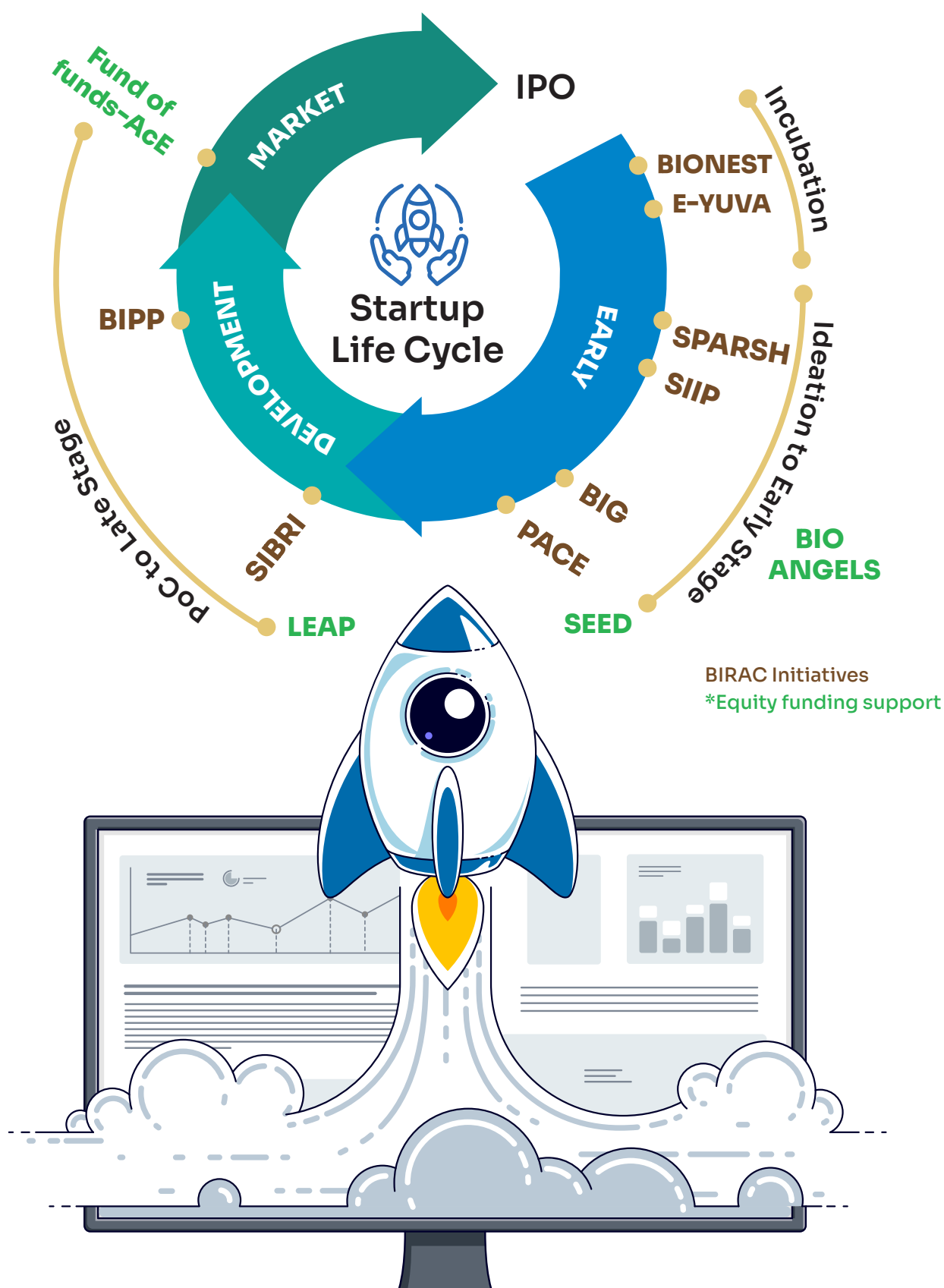
Biotechnology Industry Research Assistance Council (BIRAC) was established in 2012 by the Department of Biotechnology (DBT) as a Sector 8 Public Enterprise. It serves as an interface between industry and academia, empowering researchers and entrepreneurs with comprehensive support for strategic research and innovation.

Over the past decade, through Public-Private Partnerships, BIRAC has fueled the biotech start-up life cycle at all stages: Idea to Commercialization, systematically empowering innovators, startups, and research institutions through targeted funding, incubation, capacity building, mentoring and policy support. By fostering a thriving biotech ecosystem, DBT-BIRAC has significantly contributed to India's Bioeconomy, which is on track to reach \$300 billion by 2030.

BIRAC's programs, schemes and policy initiatives are supplemented through strategic collaborations, partnerships with National & International bodies, Government departments, Agencies, States, Industry, Angels/ VCs, Mentors, Experts, Philanthropic organizations, NGOs etc. Its initiatives can be broadly categorized into

- 1. Scheme-driven programs that nurture entrepreneurship.**
- 2. Mission-driven programs that shape long-term growth.**

SCHEME-DRIVEN INITIATIVES FOR STARTUP & TECHNOLOGY ENABLEMENT



Scheme-Driven Initiatives For Startup & Technology Enablement

A. EARLY STAGE

BIRAC's strategic funding mechanisms have been instrumental in advancing research and translating innovations into market-ready products. The Biotechnology Ignition Grant (BIG), along with initiatives like SIIP (Social Innovation Immersion Program) and SPARSH (Social Innovation Programme for Products: Affordable & Relevant to Societal Health), has laid a strong foundation for early-stage ideas, enabling more than **1,000+** biotech innovations to emerge from over **550 cities**, including **38** aspirational districts.

B. INCUBATION & MENTORSHIP

To ensure these ideas mature into viable enterprises, the BioNEST and E-YUVA programs have established over **95 incubation centres** across the country. These facilities provide nurturing grounds to nascent ideas by providing access to high end infrastructure, specialized and advanced equipment, business mentorship, IP, legal and regulatory guidance, and networking opportunities. These facilities are located within Universities, Research Institutes, Research Hospitals, or as stand-alone centres. The centres have also been seeded in emerging clusters of Tier 2/3 cities bringing opportunities closer to the entrepreneurs, thereby eliminating the need to relocate from their home towns due to limited local opportunities. These incubation centres have nurtured over **2,500 startups** and students, resulting in more than **1,300+ IP filings** and the successful commercialization of over **800+ biotech products**.

C. POC (PROOF OF CONCEPT) TO LATE STAGE

Moving beyond early-stage support, BIRAC has strengthened the biotech innovation pipeline and product/technology development through the i4 (Intensifying the Impact of Industrial Innovation) initiative, that focuses on strengthening R&D capabilities through two schemes: Small Business Innovation Research Initiative (SBIRI)

and Biotechnology Industry Partnership Program (BIPP). These schemes have driven the research and development of cutting-edge biotechnological solutions, with SBIRI supporting **341 projects** leading to **89 new products** and BIPP enabling **249 projects**, culminating in **103 commercialized technologies**.

The PACE (Promoting Academic Research Conversion to Enterprise) initiative has complemented these efforts by fostering translational research within academia and subsequent validation by an Industrial partner, supporting **176 projects** that have led to the development of multiple technologies and products.

D. FINANCIAL SUPPORT

BIRAC Equity schemes constitute another major vertical of support for startups and biotech companies helping entities to attract private investment from Angels and VCs. By FY 2023-24, nearly **210 startups** have been supported through equity support under SEED and LEAP. Recognizing that financial constraints often hinder innovation, BIRAC has established equity funding mechanisms such as:

- ▶▶ SEED (Sustainable Entrepreneurship and Enterprise Development) Fund which is the 1st equity exposure to startups with New innovations/Technologies implemented through selected BioNEST incubators
- ▶▶ LEAP (Launching Entrepreneurial Driven Affordable Products) Fund for startups to pilot their products/technologies
- ▶▶ **BioAngels program has been launched by BIRAC with Indian Angels Network (IAN):** to encourage and mobilize Private Equity into the ecosystem, especially early-stage investments, from strategic Investors who also bring deep domain expertise. It aims to fuel the ecosystem through interactions with high-quality investors and industry leaders, creating a consortium of Angels,

HNIs and early-stage VCs. Under the BioAngels program, it is expected that about 145 startups would receive equity investment of about **INR 350 Cr.**

- ▶▶ AcE (Accelerating Entrepreneurs) Funds of funds programs which aims to foster R&D and innovation by plugging the gap of “**Valley of Death**” encountered during the product development and growth phase through SEBI-registered Alternate investment funds (Venture Funds and Angel Funds)

There is a significant increase in the number of Startups getting investments from Angels, HNIs, and early-stage VCs, contributing to the growth story of the biotech industry. More than **250 startups** have been invested through SEED and LEAP. Through AcE initiatives, the department has successfully attracted investments exceeding **INR 5,500 crore** into biotech startups and SMEs, with **INR 1,200 crore** coming from SEBI-registered Alternate Investment Funds (AIFs) and an additional **INR 4,300 crore** raised through follow-on investments. The AcE fund portfolio is being expanded by onboarding new daughter fund partners.

E. REGULATORY NAVIGATION

Often a complex challenge for biotech startups, has been streamlined through BIRAC’s initiative such as:

- ▶▶ Regulatory Affairs and Policy Advocacy (RAPA) which aims at strengthening the regulatory and policy milieu of India.
- ▶▶ The “Ask Me Anything” platform “FIRST HUB” is first of its kind single window facilitation platform, with experts from regulatory bodies such as CDSCO, ICMR, BIS, NIB, GeM, ICM and FSSAI available, to address the queries of start-ups, entrepreneurs, researchers, academicians, incubation centres, SMEs etc.

Together these facilitation cell have addressed over **800+ queries**.

F. INTELLECTUAL PROPERTY (IP) AND TECHNOLOGY TRANSFER

Securing technological innovation through different regimes of IP is an important aspect in the growth strategy for the knowledge economy. BIRAC’s in-house IP & Technology Management group (IPTeM) facilitates technology transfer, filing of Intellectual Property Rights and commercialization through the BIRAC-PATH (Patenting and Technology Transfer for Harnessing Innovation) program for its grantees.

Key highlights of DBT-BIRAC support to startups

- ▶▶ Abolishment of **Angel tax** has been approved, a major policy push to promote Startup India national mission.
- ▶▶ Custom duty recalibration for small volume biotech reagents and standards imports under HS 9802 from **150%** back to **10%**.
- ▶▶ Number of Startups in the country has increased to **10,000+**, adding **1500+** new startups this year.
- ▶▶ The Incubation center network supported by BIRAC has expanded to **95** across **24 States/ UT**.
- ▶▶ **Product launch platform: 11 new** biotech products launched in the international platform of **Global Bio-India 2024**
- ▶▶ Invigoration of BRIC’s NCR biotech cluster as India’s first planned Bioscience Innovation Park under **BioE3 policy**.
- ▶▶ **Fund of funds – AcE:** This initiative by allocating **INR 150 Cr** by the department, which is implemented by BIRAC, so far, has been able to bring in a total infusion of **INR 5500+ Cr** investments for biotech sector through private equity and Venture Capital.
- ▶▶ Deep Tech Startups draft Policy by the Gol now includes **bio-based innovations** and **bio-manufacturing** which was not covered initially.

MISSION DRIVEN POLICIES



While BIRAC supports comprehensive growth of the biotechnology sector, it has also launched niche initiatives aligned with national missions to shape India's long-term biotech vision.



The **Make in India (MII)** PMU of the Department of Biotechnology at BIRAC ensures wider dissemination of Government programmes and other information relevant to the establishment and growth of startups, SMEs, and large companies. MII PMU also contributes to the Start-up India action plan integrating BIRAC's facilitation for funding and incubation support to start-ups. It carries out annual mapping of India's Bioeconomy, facilitation of biotech innovation ecosystem, VCs, Angels & HNIs investors, Startups, and entrepreneurs onto the gamut of business-related issues in biotechnology such as regulatory landscape in the country, investment opportunities, FDI/EXIM/ Industrial policies while working closely with Invest India and Startup India Cell at DPIIT and DBT. Policy-level inputs, leading new initiatives, and identifying and creating national and international opportunities for the biotech ecosystem are essential functions of the biotechnology Industry facilitation under MII PMU.

A significant aspect of DBT/BIRAC's **MII initiatives** is the establishment of Bioclusters,

designed to bring together academia, industry, and government. The invigoration of the **NCR biotech cluster** as India's first planned Bioscience Innovation Park, the **iBRIC+ Bioscience Innovation Park**, along the Faridabad-Gurgaon highway, exemplifies this approach. Spanning **200 acres**, this mega bioscience cluster integrates India's premier research institutions, including **THSTI, RCB, NII, ICGEB, NIPGR and NBRC**.

Advanced infrastructure, including **NABL-accredited bioassay labs, Bio-Safety Level-3 experimental animal facility, vaccine design and development centres**, and India's only **Ferret facility**, has positioned the NCR Bio-tech Cluster as a leading hub for translational research and commercial biotech solutions. The cluster has already attracted global stakeholders, with over **800 researchers** working on high-impact projects encompassing high impact areas such as monoclonal antibodies, microbiome research, next-generation vaccines, and in-vitro diagnostics.



BioE3 (Biotechnology for Economy, Environment, and Employment) policy formulated in alignment with national programs like "Make in India" and "Startup India," aims to transform India into a global biomanufacturing hub. This policy underpins the **Bio-RIDE (Biotechnology Research Innovation and Entrepreneurship Development)** scheme, which focuses on building critical infrastructure, regulatory frameworks, and intellectual property poli-

cies to support a thriving biotech ecosystem. One of the objectives of the policy is setting a framework for adopting advanced technologies. The **"मूलानुसार BioEnablers: Biofoundries and Biomanufacturing Hubs"** initiative is the first step towards implementing the policy by fostering high performance biomanufacturing. New infrastructure will be developed under this initiative to facilitate innovation in the sector and to provide scale up support for early-stage technologies.



Grand Challenges India (GCI), a collaborative endeavour between DBT, the Bill and Melinda Gates Foundation and other partners including USAID and the Wellcome Trust provides funding support to scientific solutions aiming to alleviate global health and development issues. With a total joint investment of USD **75 million**, the initiative is benefiting people in India and across the globe. Since inception in 2012, GCI has supported **258 projects**, with over **36 projects supported through GCE-India** (Grand Challenges Explorations-India).



National Biopharma Mission (NBM), a flagship initiative under BIRAC's leadership, represents a crucial step in strengthening India's capabilities in bio-pharmaceutical development. NBM is strategically aligned with the goals of national initiatives like **"Make in India"** and **"Start Up India"**. With a total budget of **INR 1,500 crore**-co-supported by the World Bank, the mission has accelerated discovery research and early-stage development for biopharmaceuticals by reinforcing India's position as a global leader in affordable healthcare innovations. NBM has already supported **215 grantees** working in different verticals, **143 projects** for product development and of which **19 products** have been launched and set up a network of **46 GCP compliant** clinical trial sites.



The Ind-CEPI mission, designed to support vaccine development for the diseases of epidemic potential in India aligned to the global initiatives of CEPI (Coalition of Epidemic Prepared-

ness Innovations). The mission has already supported two key vaccine candidates- an mRNA platform vaccine for COVID-19 by Genovio Bio-pharmaceuticals Ltd, that has already received market authorization and a chikungunya vaccine by Bharat Biotech International Ltd is ready for phase 2/3 clinical trials.

In addition, BIRAC also rolls out **theme driven programs** to catalyze and diversify innovative ideas in niche areas such as women entrepreneurship (WInER), Synthetic biology, Digital HealthCare Innovations, JanCARE, Clean Technology-scale up and Demo, Gaur Gum, Antimicrobial Resistance, New Drug Development Program, Swachh Bharat, Secondary Agriculture Entrepreneurial Network and SoCH (Solutions for Community Health). By encouraging innovators in these targeted areas early on, BIRAC broadens the scope of its support while ensuring that sector-specific innovations are nurtured. This integrated approach ensures that once these niche innovations move from ideation into further development, they benefit from the same robust ecosystem.

IMPACT

The economic impact of BIRAC's initiatives is evident in the tangible outcomes it has generated in the form of commercialization of over **800** biotech products, the exponential growth of startups, and the infusion of billions in private investment. BIRAC's influence, therefore, extends far beyond funding and incubation; it has fundamentally reshaped India's biotech ecosystem by creating a seamless pipeline from ideation to commercialization. BIRAC's enabling efforts are recognized as fundamental in the growth of deep-tech biotech startups from **<50** biotech startups in 2012 to **10,000+** in 2024 (IBER 2025). The culmination of these efforts was showcased at Global Bio-India (GBI) 2024, a landmark event showcasing India's potential and growth opportunities to the world. GBI 2024 brought together over **10,000 delegates** from **27 countries**, providing a global platform for India's biotech startups, researchers, and industry leaders. With over **400 startups**, **90 bioincubation centres**, and **key stakeholders** from regulatory bodies and investment firms participating,

the event reinforced India's growing prominence in the global biotech landscape.

An important element of BIRAC's strategy is to help catalyze technology transfer between academia and industry both within and outside the country. BIRAC under the National Bio-Pharma Mission has supported **7 Technology Transfer Offices (TTOs)** complementing the BioNEST Incubators. BIRAC has also created a Biotech Innovation Showcase e-Portal (<https://biotechinnovations.com>) which features 750+ products/technologies from BIRAC supported Biotech Startups for global access and facilitates connections between technology seekers and innovators.

The success of the BIRAC model is primarily the outcome of the vision of the DBT to promote innovation and R&D. BIRAC's programs,

schemes and activities have been designed for the ecosystem growth requirements. Based on ground-level assessment by Project Divisions & Stakeholder's consultations, new schemes/programs are added & existing ones improvised. BIRAC schemes and activities are meant to create a pipeline of entrepreneurs & Startups in the country by providing systematic and value-added handholding during the journey of an idea maturing into a product for commercialization.

The Road Ahead: Strengthening India's Global Biotech Footprint

The future of India's BioEconomy looks exceptionally promising with substantial growth anticipated across key sectors. By 2030, the India Bioeconomy is projected to double to **\$300 billion**, up from **\$150.1 billion** in 2023, reflecting a robust compound annual growth

The Future is Bio

Global trends indicate that various Governments are building capacities for biotech innovations and local biomanufacturing for economic growth and sustainable future. This includes national prioritization for following BioEconomy as the growth parameter for GDP, establishing high end infrastructure, attracting global talent and rolling out special policies.

The BioE3 Policy, approved on August 24, 2024, represents a bold strategic initiative aimed at transforming India's biotechnology and biomanufacturing landscape by fostering high-value innovation. At its core, the policy is designed to bridge research and commercialization, ultimately creating an ecosystem where cutting edge technology and sustainable practices converge to drive economic growth, environmental sustainability, and job creation.

BioE3 Policy will be supported by the **Bio-RIDE** (Biotechnology Research Innovation and Entrepreneurship Development) scheme, approved by Union cabinet in Sept 2024, with an added focus on biomanufacturing and bio foundry infrastructure. Funding support of **INR 1500 Cr** under the Bio-RIDE scheme for promoting high performance Bio-manufacturing and Bio foundry support to Startups, SMEs, R&D institutions for the pilot and validation facilities, and undertaking high risk, IP driven bio-innovations would be provided.

The following key points highlight the main pillars of the BioE3 policy.

Thematic Sectors of Biomanufacturing

1 Bio-based Chemicals & Enzymes Catalyzing Greener Reactions	2 Functional Foods & Smart Proteins Taste without Cruelty	3 Precision Biotherapeutics Remedies that understand YOU
4 Climate Resilient Agriculture Krishi that makes earth happy	5 Carbon Capture & Utilization Recover to Prosper	6 Futuristic Marine & Space Research Diving into Infinity



rate (CAGR) of **12.3%**. Achieving the 2030 Bio-Economy target would necessitate a focused and strategic use of current resources, additional resource mobilization and effective integration with national and international stakeholders through **Public-Private Partnership** models. As we progress, BIRAC will continue to be the catalyst that drives innovation, investment, and impact, further identifying key components that need development. Priorities will include ad-

vancing **Atmanirbhar Bharat**, establishing India as a biomanufacturing hub, and transitioning from biosciences to bioeconomy.

The BioE3 policy championed by DBT/ BIRAC is very timely with an implementation plan focussed on augmenting both Bio-manufacturing and Bio-innovation. With the continued development of Bioclusters, advanced Biomanufacturing and Bio-AI hubs, and targeted funding programs, DBT-BIRAC continues to lay the groundwork for a resilient, globally competitive bioeconomy. Promotion of increased strategic partnerships with VCs, angel investors, and international organizations is poised to further propel India towards its vision of becoming a **\$100 billion biomanufacturing hub** and a **\$300 billion bioeconomy**.

1. THEMATIC AREAS

The salient features of BioE3 policy include innovation-driven support to R&D and entrepreneurship across thematic sectors. Aligned with the national priorities of green growth, net-zero targets, and sustainable industrial practices, the BioE3 policy identifies six key strategic/thematic sectors — high value bio-based chemicals, biopolymers & enzymes; smart proteins & functional foods; precision biotherapeutics; climate resilient agriculture; carbon capture & its utilization; marine and space research.

By clearly delineating these focus areas, the policy creates a well-defined roadmap that channels efforts and investments into sectors where high-impact innovations can thrive.

2. ECOSYSTEM: BUILDING BIOCLUSTERS

Biotechnology Research and Innovation Council (BRIC) was set up by Department of Biotechnology (DBT), integrating 15 research institutions under one umbrella for consolidation of



academic excellence. These BRIC institutions are suitably placed, to impact in developing a sustained pipeline of innovations: as they nurture top-of-the line research and encourage entrepreneurship and startups.

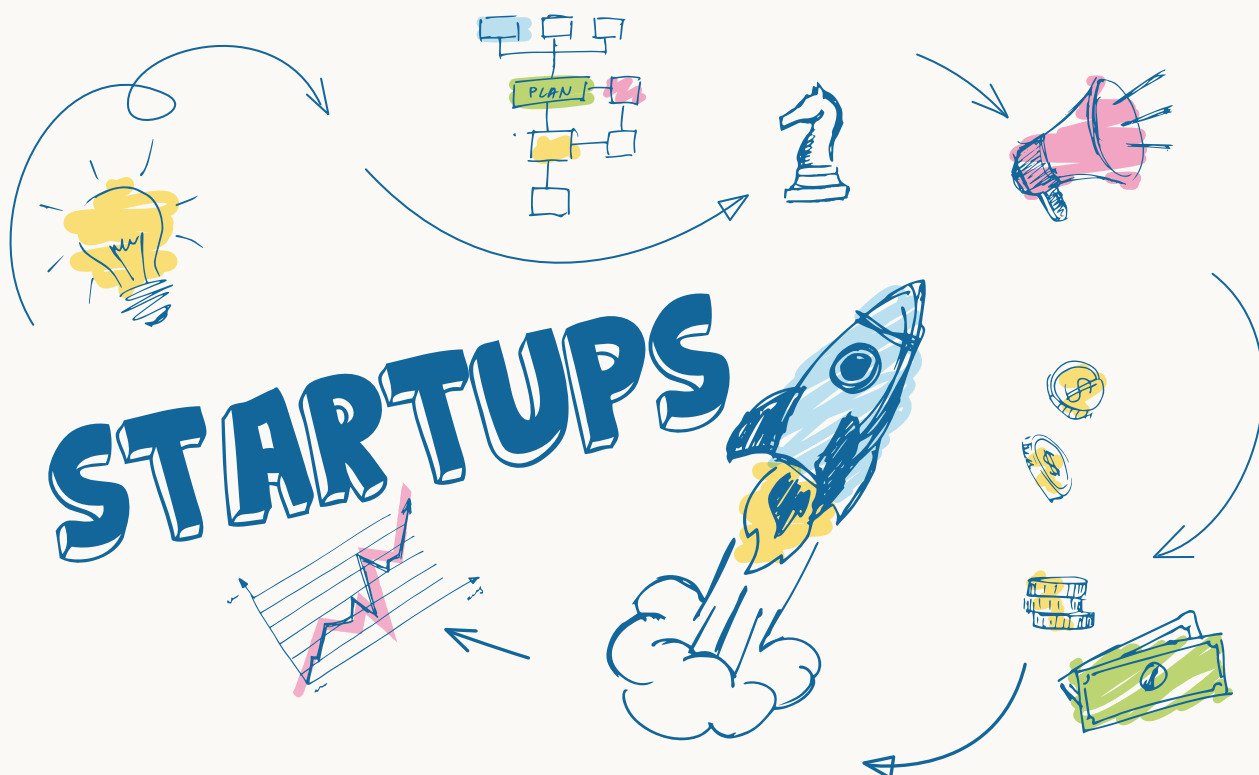
DBT under the purview of BioE3 policy, shall develop Bioscience Innovation Parks in campus of BRIC institutions. Based on the Triple helix model - these iBRIC + Bioclusters will act as collaborative hubs where academic researchers provide knowledge, industries offer technological expertise and market access, and government facilitates funding, infrastructure, and policy support. Such Bioclusters essentially drive the process of innovation and new product development by attracting global talent and private investors, self-propelling development.

India's BioEconomy

STARTUP ECOSYSTEM ACHIEVES 10,000+ MILESTONE

India's BioEconomy-driving startup ecosystem has reached a significant milestone in 2024, surpassing **10,000** registered startups to reach **10,075**. This reflects an **18.1%** year-over-year growth from **2023**, underscoring the sector's continued momentum despite a 13.1% drop in new registrations, which totaled **1,544** in 2024 compared to 1,776 in 2023.

The geographical concentration remains strong, with Maharashtra, Karnataka, and Telangana collectively accounting for **38.8%** of the total BioEconomy startup base in the country. These states also led in new registrations in 2024, highlighting their role as key hubs for BioEconomy innovation. This report examines the growth trajectory, geographical distribution, and state-wise contributions to the BioEconomy startup landscape from 2020 to 2024, with a special focus on recent developments in 2024.



Milestone Achievement

India's BioEconomy startup base crossed the 10,000 mark in 2024, reaching 10,075 registered startups

New Registrations

1,544 new BioEconomy startups were registered in 2024, a 13.1% decrease from 2023 (1,776)

Growth Rate

18.1% year-over-year growth from 2023 to 2024, showing continued momentum despite a slight deceleration in new registrations

Leading States for New Startups

Maharashtra, Karnataka, and Telangana remained the top three states for new BioEconomy startup registrations in 2024

Geographical Concentration

The top 3 states (Maharashtra, Karnataka, and Telangana) account for 38.8% of the total BioEconomy startup base

KEY FINDINGS



TOTAL BIOECONOMY STARTUP BASE

The BioEconomy startup ecosystem in India has experienced consistent growth over the past five years.

Growth Trends (2020-2024)

Year	Total Startups	YoY Growth (%)
2020	4,237	-
2021	5,365	26.6%
2022	6,755	25.9%
2023	8,531	26.3%
2024	10,075	18.1%

The total number of BioEconomy startups has more than doubled from 4,237 in 2020 to 10,075 in 2024, representing a compound annual growth rate (CAGR) of 24.2% over this five-year period.

The BioEconomy sector in India has witnessed remarkable growth over the past few years, with a significant increase in the number of startups. This growth is indicative of the sector's potential and the favorable conditions that support innovation and entrepreneurship



YEARLY GROWTH ANALYSIS

2020

The year 2020 recorded a total base of **4,237 startups**. This number reflects the foundational strength of the BioEconomy sector before the significant growth phase.

2021

In 2021, the total number of startups increased to **5,365**, marking a YoY growth of **26.6%**. This surge can be attributed to increased awareness and investment in biotechnology, as well as government initiatives aimed at fostering innovation.

2022

The following year, 2022, witnessed further growth, with the total number of startups reaching **6,755**. The YoY growth rate was **25.9%**, indicating sustained momentum in the sector. This period saw increased focus on biotech research and development, supported by funding programs and partnerships.

2023

In 2023, the sector continued to expand, with **8,531** startups recorded. The YoY growth rate was **26.3%**, demonstrating consistent growth and highlighting the sector's resilience and potential for further expansion.

2024

The latest data for 2024 shows a total of **10,075** startups, with a YoY growth rate of **18.1%**. Although this represents a slight decrease in the growth rate compared to previous years, it still indicates a robust expansion of the sector



KEY OBSERVATIONS

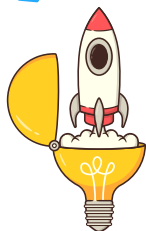
CONSISTENT GROWTH

The BioEconomy sector has shown consistent growth over the past four years, with an average YoY growth rate exceeding 24%. This consistency underscores the sector's resilience and potential for long-term expansion.



SLIGHT DECELERATION IN 2024

The growth rate in 2024 was 18.1%, marking a slight deceleration compared to previous years. This could be due to various factors, including market saturation, increased competition, or external economic conditions. However, the sector still maintains a strong growth trajectory.



GOVERNMENT SUPPORT AND INNOVATION

The growth of the BioEconomy is significantly influenced by government policies and initiatives aimed at promoting biotechnology. Programs like funding grants and tax incentives have encouraged entrepreneurship and innovation in the sector.

GEOGRAPHICAL DISTRIBUTION

TOP 10 STATES BY TOTAL BIOECONOMY STARTUP BASE (2024)

Rank	State	Number of Startups	Share of Total (%)
1	Maharashtra	1,641	16.3%
2	Karnataka	1,232	12.2%
3	Telangana	1,032	10.2%
4	Delhi	1,017	10.1%
5	Uttar Pradesh	834	8.3%
6	Gujarat	747	7.4%
7	Tamil Nadu	658	6.5%
8	West Bengal	288	2.9%
9	Odisha	284	2.8%
10	Andhra Pradesh	274	2.7%
	Top 10 Total	8,007	79.5%
	Others	2,068	20.5%
	Grand Total	10,075	100.0%

The **top 10 states** account for **79.5%** of the total BioEconomy startup base in India, indicating a high level of geographical concentration. The dominance of the top 10 states in the BioEconomy startup landscape is evident, with **Maharashtra, Karnataka, and Telangana** alone accounting for **38.8%** of the national total. This concentration suggests that these states have favorable conditions for biotech innovation, such as robust infrastructure, access to funding, and availability of skilled talent.



LEADING STATES



MAHARASHTRA

With 1,641 startups, Maharashtra leads the pack, contributing 16.3% of the national total. Its strong pharmaceutical and biotech research infrastructure supports this position. The state is home to several major biotech companies and research institutions, which provide a conducive environment for startups.



KARNATAKA

Karnataka is second, with 1,232 startups, contributing 12.2%. Bengaluru, the state's capital, is renowned for its thriving startup ecosystem, making it a hub for biotech innovation. The city hosts numerous biotech parks and incubators, which offer resources and networking opportunities essential for startup growth.



TELANGANA

Telangana ranks third, with 1,032 startups, contributing 10.2%. The state's diverse biotech sectors, including pharmaceuticals and research, support its position. Hyderabad, the state's capital, is a major center for biotechnology and pharmaceutical companies, providing a strong foundation for startups.

OTHER NOTABLE STATES



DELHI

With 1,017 startups, Delhi is fourth, reflecting its role as a national capital with access to funding and regulatory bodies. The city's proximity to government institutions and funding agencies makes it an attractive location for biotech startups.



UTTAR PRADESH & GUJARAT

Also feature prominently, indicating their growing importance in the BioEconomy. These states are leveraging their agricultural and industrial strengths to foster biotech innovation, particularly in areas like bioagriculture and bioenergy.



FACTORS CONTRIBUTING TO CONCENTRATION



Infrastructure and Funding: States like Maharashtra and Karnataka have well-established biotech infrastructure, including incubators and accelerators, which attract startups. Government initiatives and funding programs further support this ecosystem. For instance, the Biotechnology Industry Research Assistance Council (BIRAC) provides grants and funding opportunities that help startups scale up their operations.



Government Policies: The BioE3 policy, focusing on bio-manufacturing and green growth, is expected to further boost the BioEconomy in these states by promoting public-private partnerships and innovation. Such policies create a favorable regulatory environment that encourages entrepreneurship and investment in the biotech sector.



Talent and Innovation: The presence of top research institutions and universities in these states fosters innovation and provides a skilled workforce, essential for biotech startups.

REGIONAL DYNAMICS

SOUTH INDIA

The southern states, particularly Karnataka and Telangana, have a strong presence of biotech companies and research institutions. This region benefits from a well-developed ecosystem that supports innovation and entrepreneurship.

NORTH INDIA

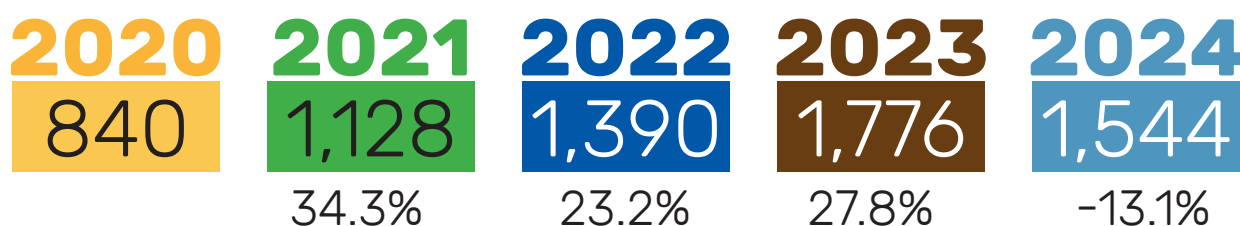
Delhi and Uttar Pradesh are emerging as significant players in the BioEconomy, leveraging their strategic locations and access to resources. Delhi's role as a national capital provides it with unique advantages in terms of policy influence and funding access.

WEST INDIA

Maharashtra's dominance in the BioEconomy is complemented by Gujarat's growing presence, particularly in sectors like bioenergy and bioagriculture. These states are capitalizing on their industrial strengths to diversify into biotechnology.

NEW STARTUP REGISTRATIONS

The annual number of new BioEconomy startup registrations has shown a mixed trend:



While new registrations grew steadily from 2020 to 2023, there was a 13.1% decline in 2024, with 1,544 new startups registered compared to 1,776 in 2023. This suggests a potential stabilization or maturation phase in the ecosystem.

TOP 10 STATES BY NEW BIOECONOMY STARTUP REGISTRATIONS (2024)

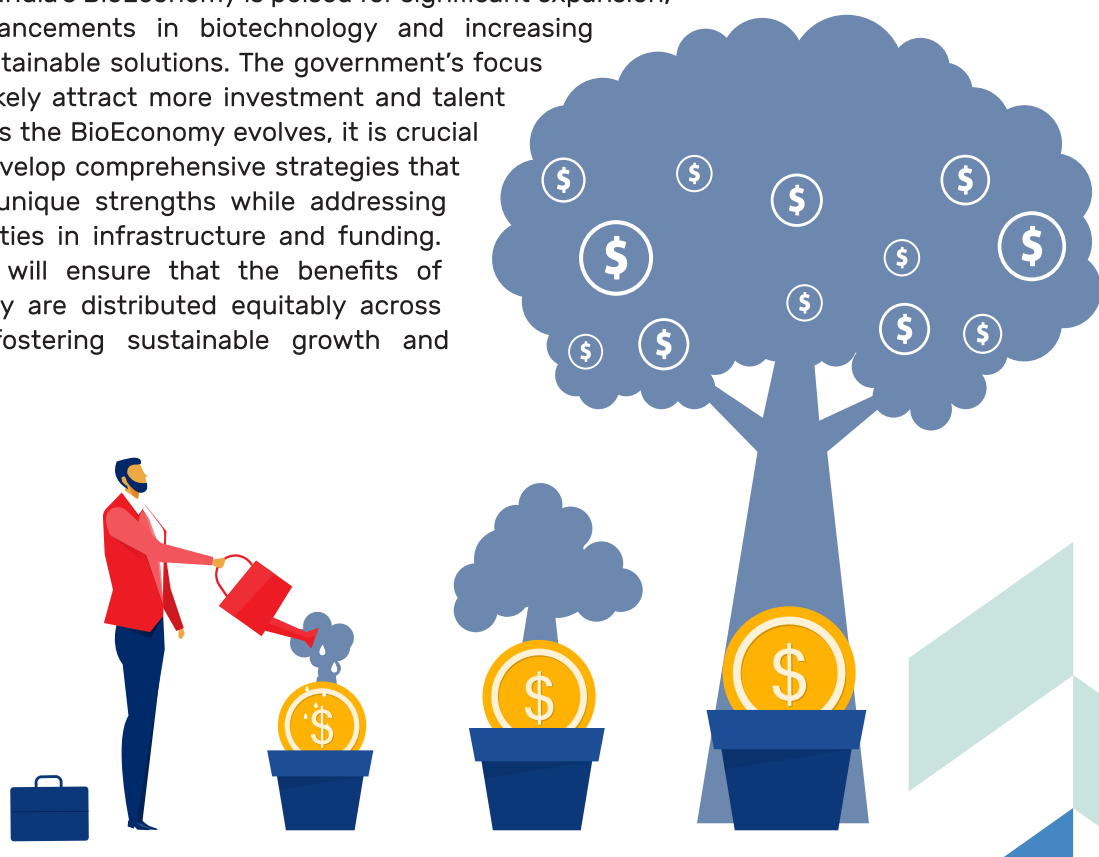
Rank	State	New Registrations	Share of New Registrations (%)
1	Maharashtra	220	14.2%
2	Karnataka	178	11.5%
3	Telangana	160	10.4%
4	Delhi	142	9.2%
5	Uttar Pradesh	135	8.7%
6	Gujarat	105	6.8%
7	Tamil Nadu	93	6.0%
8	Haryana	84	5.4%
9	Odisha	45	2.9%
10	West Bengal	45	2.9%
Top 10 Total		1,207	78.2%
	Others	337	21.8%
Grand Total		1,544	100.0%

Similar to the total base, new registrations in 2024 were also concentrated in the same top states, with the top 10 states accounting for 78.2% of all new BioEconomy startups registered during the year.

The concentration of BioEconomy startups in a few states highlights the importance of infrastructure, funding, and government support in driving innovation. As India's BioEconomy continues to grow, these states are likely to remain at the forefront, with opportunities for other regions to emerge as new hubs for biotech innovation. The geographical concentration also underscores the need for balanced regional development, where other states can benefit from similar infrastructure and policy support to foster their own biotech ecosystems.

FUTURE PROSPECTS

Looking ahead, India's BioEconomy is poised for significant expansion, driven by advancements in biotechnology and increasing demand for sustainable solutions. The government's focus on BioE3 will likely attract more investment and talent to the sector. As the BioEconomy evolves, it is crucial for states to develop comprehensive strategies that leverage their unique strengths while addressing regional disparities in infrastructure and funding. This approach will ensure that the benefits of the BioEconomy are distributed equitably across the country, fostering sustainable growth and innovation.



ROLE OF BIRAC IN FOSTERING GROWTH

BIRAC has been instrumental in creating a conducive ecosystem for biotech startups. Key achievements include:

Bio-Incubators: BIRAC has successfully established an ecosystem comprising 95 bio-incubators across 21 states and 4 union territories. This extensive network provides essential infrastructure for startups, facilitating research and development.

Support to Beneficiaries: Over 4,800 beneficiaries have been supported by BIRAC, enabling them to innovate and commercialize their products. This support has led to over 1,300 intellectual property (IP) filings and the successful market entry of more than 800 biotech products and technologies.

Follow-on Funding: BIRAC-supported startups and companies have generated significant follow-on funding, amounting to INR 8,050 Cr. This demonstrates the viability and potential of these ventures for further investment.

Integration with National Missions: BIRAC integrates with various national missions, such as Make in India, Startup India, National Biopharma Mission, and Ayushman Bharat. This integration ensures that biotech innovation aligns with broader national goals, enhancing its impact and relevance.

FACTORS CONTRIBUTING TO GROWTH



Infrastructure Development: The establishment of bio-incubation centers by BIRAC has provided crucial infrastructure for startups to develop proof-of-concept products. These facilities offer 'plug and play' laboratories, making it easier for startups to carry out their research and development¹.



Talent and Innovation: The presence of top research institutions and universities in India fosters innovation and provides a skilled workforce, essential for biotech startups. This talent pool is a key driver of the sector's growth.



Government Policies: Initiatives like the BioE3 policy, focusing on bio-manufacturing and green growth, have created a favorable regulatory environment that encourages entrepreneurship and investment in the biotech sector¹.

The BioEconomy sector in India has demonstrated remarkable growth over the past few years, driven by favorable conditions, government support, and innovation. BIRAC's role in creating a robust ecosystem for biotech startups has been pivotal, providing infrastructure, funding, and regulatory support. As the BioEconomy continues to evolve, it is crucial for stakeholders to address challenges such as market competition and external economic factors while leveraging opportunities in emerging areas like bio-manufacturing and green technologies.

THE ROLE OF MSMEs IN INDIA'S BIOECONOMY



India's BioEconomy is a vibrant and diverse sector, comprising over **10,075 companies**, ranging from large corporations to micro startups. The BioPharma and ethanol sectors are particularly strong, with a robust manufacturing base complemented by a growing number of startups focused on innovative platforms, research services, and devices. Micro, Small, and Medium Enterprises (MSMEs) form the backbone of this sector, constituting approximately 90–91% of the total, highlighting their crucial role in the broader BioEconomy.

Definition of MSMEs: MSMEs are categorized based on their turnover: Micro companies have turnovers under **\$0.6 million** (Rs 5 crore), Small companies fall between **\$0.6 million** and **\$6 million** (Rs 5–50 crore), and Medium Enterprises report turnovers between **\$6 million** and **\$30 million** (Rs 50–250 crore). Companies with turnovers exceeding **\$30 million** (Rs 250 crore) are classified as large enterprises.

Sector Breakdown: A detailed analysis reveals that micro industries account for **36%**, small industries for **32%**, and medium-scale industries for **25%** of the sector. Large industries, which make up only **7%**, are primarily concentrated in industrial hubs such as **Mumbai, Pune, Bengaluru,**

Baddi, NCR, and Chennai. MSMEs play a vital role as essential suppliers to larger pharmaceutical and biotech firms, as well as other industries within the green economy. They provide crucial raw materials, intermediary products, platforms, and services necessary for the operations of these larger entities.

Challenges Faced by MSMEs: Despite their importance, MSMEs face several challenges, particularly in scaling their operations to meet both national and international regulatory standards. Several struggle with inadequate infrastructure, including high-end research and development facilities, digital laboratories, and advanced testing centers. Limited access to advanced R&D facilities, digital labs, testing centers, and even basic needs like captive power plants restricts their ability to improve efficiency and maintain quality.

Future Prospects: Despite these challenges, MSMEs remain the backbone of India's BioEconomy. Their contributions are vital for the sector's growth and resilience. With continued support and development, they are well-positioned to sustain their crucial role in the industry's future.

Foreign Direct Investment (FDI) in the Lifesciences Sector

The Indian government has implemented an investor-friendly FDI policy to attract investments in the pharmaceutical sector.

- ⦿ For medical devices, 100% foreign investment is allowed under the automatic route. In pharmaceuticals, up to 100% FDI is permitted for greenfield projects, while brownfield projects allow up to 74% FDI under the automatic route. Any foreign investment exceeding 74% in brownfield projects requires government approval.

Contribution to FDI Inflows

The pharmaceutical sector has contributed approximately **3.24%** to the total FDI inflows in India. From April 2000 to December 2024, FDI inflows into the Drugs & Pharmaceuticals sector reached **\$23.3 billion**, while Medtech activities attracted **\$3.9 billion**.

Recent FDI Trends

In the financial year 2024-25 (up to December 2024), FDI inflows in the pharmaceutical sector were **\$800 million** from drugs & pharmaceuticals activities and **\$618 million** from medtech activities, totaling \$1.4 billion. In the previous year (2023-24), these figures were **\$1.06 billion** from drugs & pharmaceuticals and **\$477 million** from medtech, totaling **\$1.54 billion**. Notably, medtech FDI increased from **\$375 million** in 2022-23 to **\$477 million** in 2023-24. Biotech FDI accounts for an estimated **40%** of the total FDI in drugs & pharmaceuticals activities.

Impact on Sector Growth

The combined FDI in medical devices and drugs & pharmaceutical activities continues to play a crucial role in bolstering the sector's growth, despite fluctuations in annual inflows. This

investment has been instrumental in enhancing the sector's capabilities and positioning India as a significant player in the global pharmaceutical market.

The combined FDI in medical devices and drugs & pharmaceutical activities continues to play a crucial role in bolstering the sector's growth, even amidst fluctuating annual inflows and accounts for 3.8 percent share.



FDI Inflows (\$ Million)

Year	Drugs & Pharmaceuticals	Medtech
2018	221	133
2019	438	264
2020	1,322	61
2021	1,266	185
2022	1,998	375
2023	1061	477
2024	800	618

Source: FDI Linked Compliance Monitoring; Portal
(pharmaceuticals.gov.in)



Promoting Entrepreneurship in BioClusters and Industrial Growth

The Department of Biotechnology (DBT) has been instrumental in driving entrepreneurship and industrial growth through its Industrial and Entrepreneurship Development (IED) scheme. This initiative aims to translate research into commercially viable products and services by establishing biotechnology parks and incubators across the country. These parks provide state-of-the-art infrastructure, technology demonstration platforms, and pilot plant facilities, enabling startups and small and medium enterprises (SMEs) to scale their

operations. DBT's efforts have helped accelerate the commercialization of innovative biotech solutions, fostering a vibrant ecosystem of scientific advancement, economic growth, and job creation.

The Biotechnology Industry Facilitation Cell (PMU) for Make in India at BIRAC has played a pivotal role in bioeconomy mapping, strategic analysis of startup innovation, policy recommendations, and facilitating venture capital (VC) and private investments. India's

Sector	No. of Factories	Invested Capital (INR Bn)	GVA of Plant & Machinery (\$ Bn)	% Share
Pharma, Medicinal Chemical and Botanical Products	4,893	33.31	19.21	7%
Food Products, Beverages, and Tobacco Products	38,753	78.69	24.91	10%
Textiles, Wearing Apparel	23,101	43.49	17.27	7%
Rubber, Plastic, Paper, and Related Products	18,414	40.80	15.67	6%
Other Sectors	1,21,362	534.07	184.68	71%
Total	2,06,523	731.36	261.73	100%

Sector	Estimated No. of employees	Percentage of Workforce
Pharmaceuticals, Medicinal Chemical, and Botanical Products	925,811	0.91
Food Products, Beverages, and Tobacco Products	2,732,642	10.18
Textiles, Wearing Apparel	3,042,844	12.81
Electrical Equipment, Computer, Electronic, and Optical Products	1,195,705	6.47
Rubber, Plastic, Paper, and Related Products	1,298,692	11.21
Other Sectors	9,299,268	58.42
Total	18,494,962	100.00

biotech startup count has crossed 10,000, with over 95 incubation centers established across 24 states and union territories.

India's BioEconomy Ecosystem: Industrial Strength and Growing Trade

The Ministry of Statistics and Programme Implementation (MoSPI) released the Annual

Survey of Industries (ASI) 2022-23, providing a detailed overview of India's industrial landscape. The data helps put together the critical role of BioEconomy-linked sectors, particularly Food Products, and Beverages, in driving economic growth.

Key Industrial Insights

- ☉ The ASI 2022-23 data underscores that

BioEconomy-linked sectors account for a significant share of the country's industrial strength:

- ☉ **Food Products and Beverages Products sector** leads in terms of the number of operating factories (38,753), invested capital (78.69 billion), and Gross Value Added (GVA) of plant and machinery (\$24.91billion).
- ☉ **Pharmaceuticals, Medicinal Chemical, and Botanical Products sector** reported an invested capital of \$33.31 billion and a GVA of \$19.21 billion.
- ☉ **Textiles and Wearing Apparel sector** had the third-highest GVA of \$17.27 billion, supported by 23,101 factories.

Employment Trends in BioEconomy-Linked Manufacturing

ASI 2022-23 also provides insights into employment across manufacturing sectors linked to the bioeconomy:

- ☉ **Textiles and Wearing Apparel sector** employs the highest proportion of the workforce at 12.81%.
- ☉ **Food Products, Beverages, and Tobacco Products sector** follows closely, engaging 10.18% of the workforce.
- ☉ **Pharmaceuticals, Medicinal Chemical, and Botanical Products sector**, despite its high capital investment and GVA, employs just 0.91% of the workforce.

Biotech M&A and PE Landscape

The Pharma, Healthcare, and Biotech sector emerged as a key driver of deal activity in 2024, accounting for 254 deals valued at **\$16.6 bn**—a **53%** increase in deal value over the previous year. The sector accounted for 34% of the total deal value, highlighting its strategic importance in India's healthcare ecosystem, according to a report by Grant Thornton.

Key transactions in the sector included:

- Mankind Pharma's \$1.6 bn acquisition of Bharat Serums and Vaccines—the largest pharma deal of the year.
- SeQuent Scientific's \$1.0 bn acquisition of Viyash Life Sciences – reinforcing India's strength in contract development and manufacturing (CDMO) and active pharmaceutical ingredients (API).

The hospital segment led the sector in terms of deal value, contributing 44% of the total. The \$5 bn merger between Aster DM Healthcare and Quality Care was the largest healthcare deal of the year, reflecting growing consolidation within the sector. Additionally, General Atlantic's \$192 mn investment in Ujala Cygnus highlighted the growing interest in regional hospital networks and single-specialty care models.

IPO Market: Strong Momentum in 2024

India's IPO market witnessed a surge in activity in 2024, raising \$21 bn across 86 listings—a sharp rise from 57 IPOs raising \$6.2 bn in 2023, according to a report by Grant Thornton. Pharma, healthcare, and biotech accounted for 10% of the IPO

value, with several high-value listings underscoring the sector's growth potential. The market's appetite for innovative and growth-oriented healthcare enterprises remained strong, reinforcing confidence in the sector's future outlook.

Three-Year Pharma and Biotech Deal Trend

Over the past three years, the Pharma and Biotech sector has consistently led in deal value across both M&A and PE, driven by India's strength in generic drugs, biosimilars, and export-oriented CRAMS (Contract Research and Manufacturing Services). The sector's deal activity has shown consistent growth:

In 2024, CDMOs contributed 40% of the deal value, followed by APIs at 25%, reflecting the scalability and rising global demand for these segments. HealthTech continued to dominate PE deal volumes, accounting for 29% of total investments as digital health platforms and telemedicine gained traction.

Investment Drivers: Why Pharma and Healthcare Are Thriving

The robust deal activity in the Pharma and Healthcare sector is supported by several long-term drivers:

- Demographic shifts – An aging population and rising incidence of chronic diseases have boosted demand for healthcare services.
- Preventive healthcare – Growing focus on wellness and home-based care solutions.

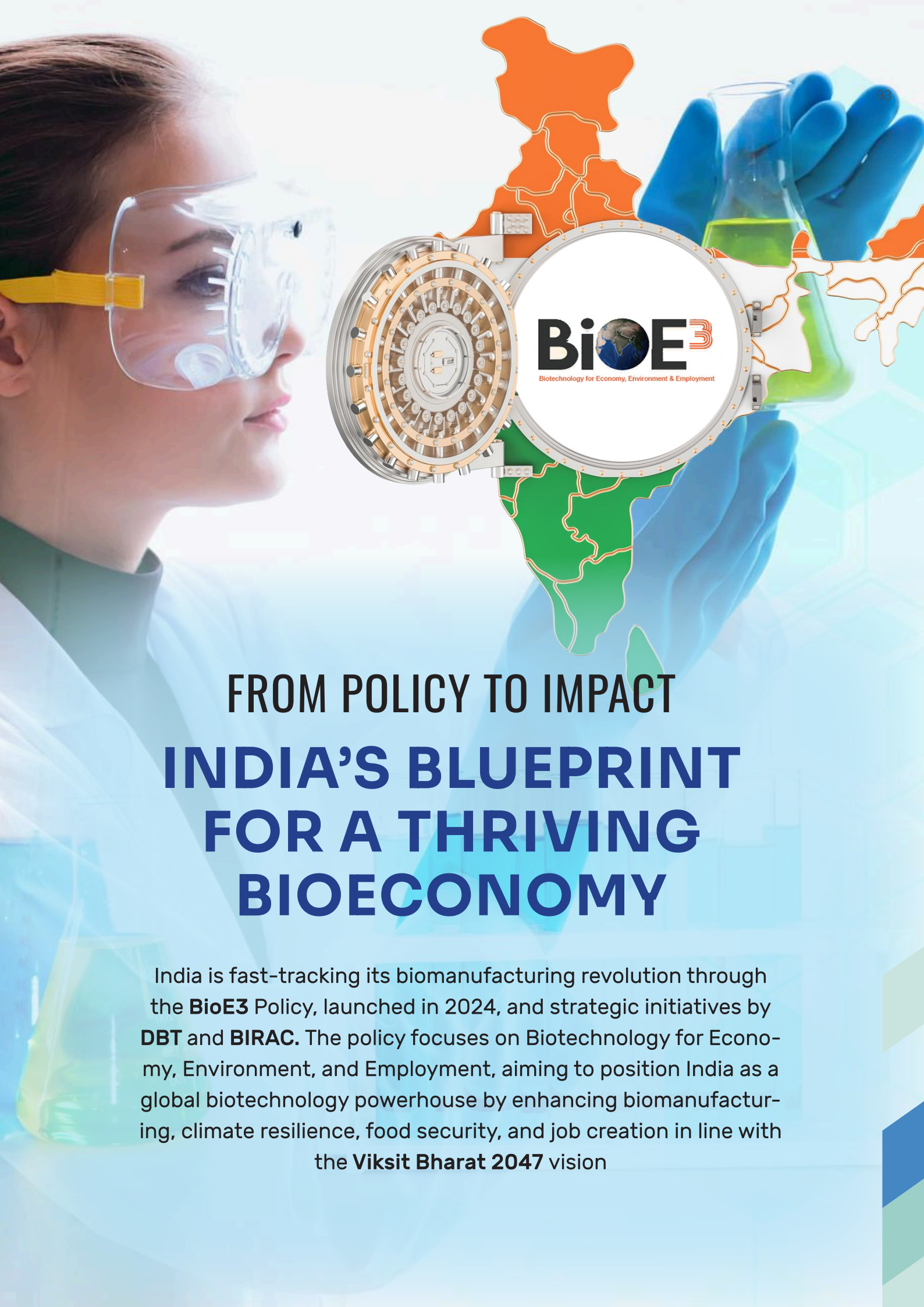


- Government policies—Supportive initiatives such as universal health coverage and increased insurance penetration have enhanced market growth.
- Consolidation and strategic expansion—Multi-specialty hospital chains have aggressively pursued strategic acquisitions to strengthen regional presence.

Outlook for 2025: Continued Growth Amid Macroeconomic Challenges

Looking ahead, India's M&A and PE landscape in 2025 is poised for transformative growth, driven by supportive government policies, corporate realignments, and improving economic conditions. The Pharma and Healthcare sector is expected to remain a key focus area, with sustained demand for affordable and quality healthcare services likely to drive further consolidation.

Pharma companies are also expected to pursue international acquisitions to expand market access, while increased insurance penetration and greater technology integration across healthcare delivery models will fuel further deal activity. The continued rise of CDMO and API businesses, coupled with a healthy IPO pipeline, is set to sustain momentum in 2025, according to a report by Grant Thornton.

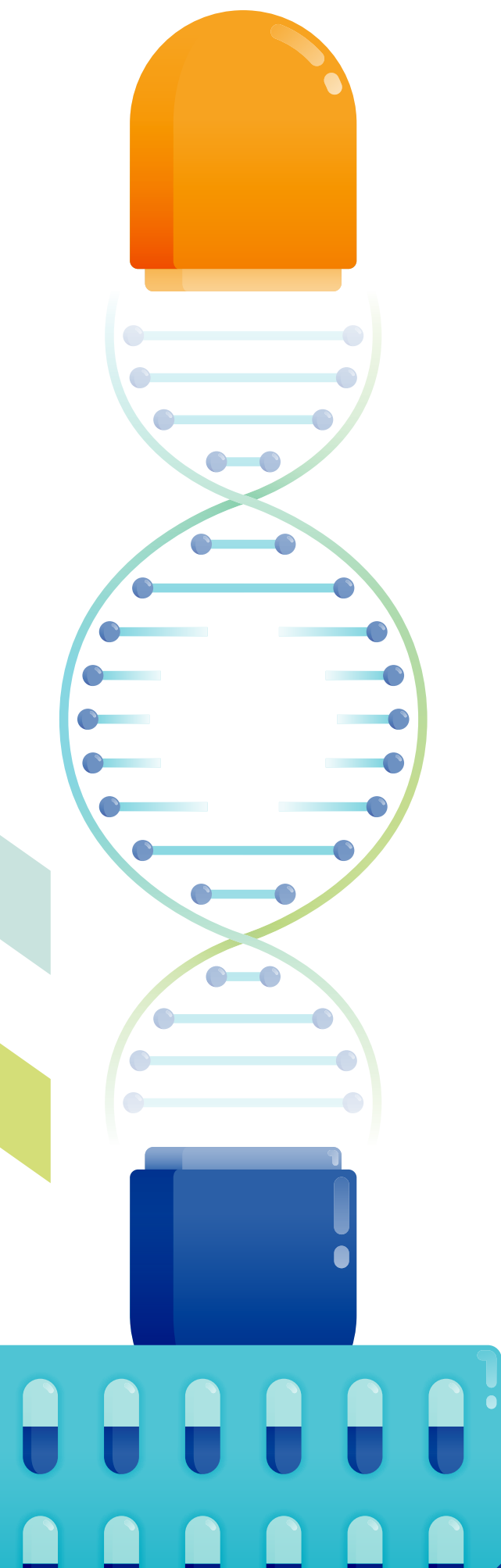


FROM POLICY TO IMPACT INDIA'S BLUEPRINT FOR A THRIVING BIOECONOMY

India is fast-tracking its biomanufacturing revolution through the **BioE3** Policy, launched in 2024, and strategic initiatives by **DBT** and **BIRAC**. The policy focuses on Biotechnology for Economy, Environment, and Employment, aiming to position India as a global biotechnology powerhouse by enhancing biomanufacturing, climate resilience, food security, and job creation in line with the **Viksit Bharat 2047** vision

Key elements include **Moolankur Bio-Enabler Hubs**, AI-driven biomanufacturing, cross-sector regulations, and data governance. **The BioRIDE scheme** bridges lab research and commercialization via Biofoundries, Biomanufacturing Hubs, and Bio-AI Hubs, focusing on bio-based chemicals, smart proteins, precision biotherapeutics, climate-resilient agriculture, carbon capture, and futuristic marine and space research.

Several Indian states have implemented policies that promote biotechnology, life sciences, pharmaceuticals, medical devices, biofuels, research, and MSME development. These policies provide targeted incentives, infrastructure support, and regulatory frameworks to drive industry growth. Some of the states having active initiatives include **Andhra Pradesh, Assam, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh, and West Bengal.**



State-Level Biotechnology Policies Driving Growth




KARNATAKA Scaling to a \$100B BioEconomy

Karnataka's **Biotechnology Policy 2024-2029** strengthens biomanufacturing, investment, and industry-academia ties to propel the sector to **\$100 billion by 2030**.



ODISHA: Emerging BioEconomy Hub

Odisha's **Biotechnology Policy 2024** prioritizes agriculture, biopharma, biofuels, and waste-to-wealth initiatives, backed by financial and infrastructure incentives.



ANDHRA PRADESH Expanding Biotech Horizons

Andhra Pradesh focuses on pharma, medical devices, the blue economy, and agri-biotech, boosting R&D, API manufacturing, and sustainable marine biotechnology.



TELANGANA

Innovating Beyond Vision 2030

Telangana's **Life Sciences Policy 2025** will drive advancements in **personalized medicine, cell & gene therapy, AI-driven biotech, and genomic research**.

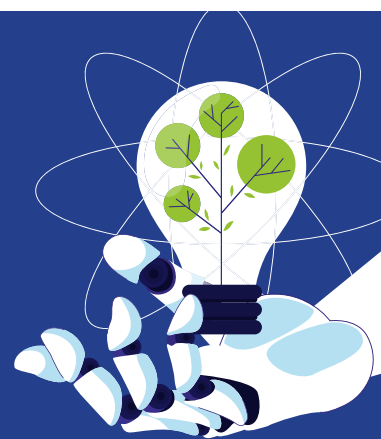


GUJARAT Billion-Dollar Biotech Investments

Gujarat's **Biotechnology Policy 2022-27** has attracted **\$1 billion** in MoUs from **30 companies**, solidifying its position as an emerging biotech hub. The policy offers **tiered financial incentives**, including up to **\$10M for MSMEs** and **25% capital support (capped at \$240M) for larger projects** over five years.

Strategic Impact and Future Outlook

India's biotech policies drive **innovation, investment, and sustainability**, aligning with climate goals—**45% emission intensity reduction by 2030** and **net-zero by 2070**. These initiatives position India as a **global biomanufacturing leader**, unlocking economic growth and job creation in the evolving BioEconomy.



INDIA ACCELERATES BIOMANUFACTURING REVOLUTION WITH BIOE3 POLICY & STRATEGIC INITIATIVES

India is making significant strides in its ambition to become a global leader in the BioEconomy sector, driven by the integrated “**BioE3 Policy**” and a series of strategic initiatives launched by the Department of Biotechnology (DBT) and the Biotechnology Industry Research Assistance Council (BIRAC). These efforts aim to foster **high-performance biomanufacturing, address climate change, enhance food security, and create employment opportunities**, aligning with the nation’s vision of “**Viksit Bharat**” by 2047.



The BioE3 Policy, unveiled in 2024, provides a comprehensive framework focusing on Bio-technology for Economy, Environment, and Employment. It aims to transform India into a hub for cutting-edge biotechnology research and development, ensuring the benefits of the BioEconomy reach all sectors of society. Recognizing the immense potential of biomanufacturing, projected to create \$2-4 trillion in direct annual economic impact over the next decade, the policy outlines key tenets to empower Indian institutions, universities, startups, and industries. These include intensifying research and innovation, boosting domestic biomanufacturing capability, accelerating the transition to biomanufacturing through AI and digitalization, establishing “Moolankur” Bio-Enabler Hubs, developing a skilled workforce, creating cross-sectoral regulatory frameworks, and implementing a comprehensive data governance framework.

BIORIDE IMPLEMENTATION AND MOOLANKUR BIO-ENABLERS

Following the BioE3 Policy, the DBT launched a detailed implementation plan for the Bio-manufacturing and Biofoundry component of its **BioRIDE** scheme. This plan strategically addresses the gap between laboratory research and commercial manufacturing, a major barrier in India’s biotech ecosystem. A central element is the DBT-BIRAC Moolankur

BioEnablers, a network of advanced facilities including Bio-Artificial Intelligence Hubs, Biofoundries, and Biomanufacturing Hubs. These platforms will drive innovation across six thematic sectors: bio-based chemicals and enzymes, functional food and smart

proteins, precision biotherapeutics, climate-resilient agriculture, carbon capture and utilization, and futuristic marine and space research. The

initiative provides substantial financial support, with Bio-AI Hubs eligible for up to INR 50 crore, Biofoundries up to INR 65 crore, and Biomanufacturing Hubs up to INR 75 crore, through various funding mechanisms.

JOINT CALLS FOR PROPOSALS Smart Proteins, Carbon Capture, and Precision Biotherapeutics

DBT and BIRAC announced joint calls for proposals targeting specific areas crucial for advancing biomanufacturing:

Smart Proteins: Recognizing the potential of smart proteins to address food security and environmental challenges, this initiative aims to establish a robust ecosystem for developing high-quality, cost-effective alternatives to traditional food production. The call supports research and scale-up efforts in fermentation-derived, plant-based, and cell culture-based smart proteins.

The BioE3 Policy and its associated initiatives are expected to play a pivotal role in helping India achieve its climate goals, including a 45% reduction in emission intensity by 2030 and net-zero emissions by 2070, while simultaneously driving economic growth through sustainable biomanufacturing



CARBON CAPTURE AND UTILIZATION

(CCU): This initiative focuses on harnessing biotechnological interventions to address climate change by converting captured carbon dioxide into value-added products. The call seeks innovative proposals emphasizing energy efficiency, cost-effectiveness, and scalability for industrial deployment of CCU technologies, including microbial platforms, engineered enzymes, and retrofitting existing industrial setups.

PRECISION BIOTHERAPEUTICS - CELL AND GENE THERAPY (CGT):

Aiming to foster high-performance biomanufacturing and accelerate India's capabilities in the CGT sector, this call seeks to build a robust innovation ecosystem for CGT development. Proposals are invited for developing safer gene delivery vectors, advanced gene editing techniques, and scaling up viral vectors for cGMP manufacturing. Collaboration between academia, industry, and clinical researchers is emphasized.

STRATEGIC IMPACT AND FUTURE OUTLOOK

These initiatives collectively underscore India's commitment to leveraging biotechnology for economic growth, environmental sustainability, and employment generation. By fostering innovation, building infrastructure, and supporting targeted research and development, India is positioning itself as a global hub for biomanufacturing and a leader in the BioEconomy.

The BioE3 Policy and its associated initiatives are expected to play a pivotal role in helping India achieve its climate goals, including a 45% reduction in emission intensity by 2030 and net-zero emissions by 2070, while simultaneously driving economic growth through sustainable biomanufacturing.

KEY TENETS OF THE BIOE3 POLICY

The BioE3 Policy outlines several foundational principles to empower Indian institutions, universities, startups, and industries

✔ **Intensified Research and Innovation:**

Addressing climate change mitigation and decarbonization challenges through focused research initiatives.

✔ **Boosting Domestic Biomanufacturing**

Capability: Fostering synergy between science, technology, engineering, and manufacturing to enhance domestic production capacity.

✔ **Accelerating Transition to Biomanufacturing:**

Integrating artificial intelligence, digitalization, and upstream biotechnology innovations to streamline the transition.

✔ **Establishing "Moolankur" Bio-Enabler**

Hubs: Creating a network of Biomanufacturing Hubs, Biofoundries, and Bio-AI centers for scaling up and pre-commercial manufacturing.

✔ **Developing a Skilled Workforce:**

Investing in training and education to create a specialized workforce in biomanufacturing.

✔ **Creating Cross-Sectoral Regulatory**

Frameworks: Aligning regulatory standards with global best practices to facilitate seamless operations.

✔ **Implementing a Comprehensive Data**

Governance Framework: Promoting AI-based discovery through robust data management.

The "Moolankur" Bio-Enabler Hubs are strategically designed to serve as the cornerstone for discovery and translational research across six priority sectors: specialty chemicals, smart proteins, biotherapeutics, agriculture, decarbonization, and the blue economy.



BIOMANUFACTURING & BIOFOUNDRY INITIATIVE

KEY HIGHLIGHTS



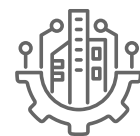
LAUNCH

January 2025, under the Department of Biotechnology (DBT), Ministry of Science & Technology.



OBJECTIVE

Accelerate the transition from research to commercial-scale biomanufacturing in India.



KEY INFRASTRUCTURE

- ✓ DBT-BIRAC Moolankur BioEnablers – a network of cutting-edge innovation hubs.
- ✓ Core Components: Bio-AI Hubs, Biofoundries, and Biomanufacturing Hubs.



FOCUS SECTORS

- ✓ Bio-based chemicals & enzymes
- ✓ Functional food & smart proteins
- ✓ Precision biotherapeutics
- ✓ Climate-resilient agriculture
- ✓ Carbon capture & utilization
- ✓ Marine & space biotechnology



FUNDING SUPPORT

- ✓ Bio-AI Hubs – Up to 50 crore
- ✓ Biofoundries – Up to 65 crore
- ✓ Biomanufacturing Hubs – Up to 75 crore



FUNDING MODELS

Grants-in-aid, co-funding, equity financing, and royalty-sharing.



IMPACT

Strengthening India's BioEconomy, fostering deep-tech innovation, and enhancing global competitiveness in sustainable biomanufacturing.

100



KARNATAKA

UNVEILS BIOTECH POLICY 2024-2029
**TO STRENGTHEN
BIOECONOMY LEADERSHIP**

Karnataka has launched its Biotechnology Policy 2024-2029, reinforcing its leadership in India's BioEconomy. As a major contributor to the country's biotechnology sector, Karnataka aims to propel the industry toward a \$100 billion valuation by 2030. The state continues to leverage its robust ecosystem of research institutions, startups, and manufacturing hubs to drive innovation and economic growth.

Building on a Strong Foundation: Since the introduction of the Millennium Bio-Technology Policy in 2001, Karnataka has consistently led India's biotech landscape. The subsequent Millennium Bio-Technology Policy-II (2009) and Karnataka Biotech Policy 2017-22 played crucial roles in building infrastructure, fostering research, and creating a thriving biotech ecosystem. Key initiatives included the Vision Group on Biotechnology, the eBiz platform for regulatory approvals, and the Invest Karnataka Forum (IKF) to attract global investments. Additionally, the Skill Vigyan Centre, Bengaluru Life Sciences Park, regulatory sandboxes, and the Biotechnology Skill Enhancement Program (BiSEP) strengthened workforce development.

Key Focus Areas of Biotech Policy 2024-2029: The newly unveiled policy aims to address emerging challenges and leverage Karnataka's strengths to create a globally competitive biotech ecosystem. Its core objectives include:

Regulatory Streamlining: Simplifying biotech-related regulations to encourage investments.

Biomanufacturing Hub: Strengthening Karnataka's role in biomanufacturing, aligning with health, climate, and energy goals.

Investment and Innovation: Encouraging R&D, providing incentives for startups, and supporting scale-up initiatives.

Industry-Academia Collaboration: Expanding skilling programs to enhance workforce readiness.

Employment Generation: Boosting job creation in emerging technologies.

Government Procurement Preference: Promoting 'Made-in-Karnataka' biotech products.

Growth Potential and Future Roadmap: Karnataka's BioEconomy is projected to grow at a CAGR of 19% to reach \$100 billion by 2030. BioPharma is expected to contribute \$30 billion, focusing on vaccines, therapeutics, and diagnostics. The BioIndustrial sector, encompassing biofuels, biorenewables, green chemicals, and other industrial applications is set to quadruple its value to \$30 billion. Meanwhile, the BioAgri sector is projected to reach \$15 billion, emphasizing sustainable agricultural solutions. Bio-IT, AI-driven biotech, and BioServices such as contract research and clinical trials will contribute significantly.

Strategic Initiatives for Industry Growth: Karnataka's Biotechnology Policy 2024-2029 includes multiple interventions to strengthen its global biotech standing. These initiatives focus on workforce development, startup scaling, and ease of doing business.

Skill Development for a Future-Ready Workforce: Karnataka is enhancing workforce development programs through rigorous assessment and certification of training providers. The state plans to establish competence centers in universities, partnering with





Karnataka will establish high-tech clusters and biotech cities, encouraging industries to expand beyond Bengaluru to cities like Mysuru and Hubballi-Dharwad

international institutions and corporations to provide advanced training in digital and biomanufacturing skills. Research grants will be extended to academic institutions to foster innovation, while specialized training programs will equip entrepreneurs with biomanufacturing and business development expertise.

Strengthening the Biotech Startup Ecosystem: Karnataka will establish high-tech clusters and biotech cities, encouraging industries to expand beyond Bengaluru to cities like Mysuru and Hubballi-Dharwad. The policy offers incentives for deep-tech areas such as vaccine development, drug discovery, and synthetic biology. Recognizing the capital-intensive nature of biotechnology, the policy extends biotech startup recognition for up to 15 years.

The state is also developing shared biomanufacturing hubs under a public-private partnership model, providing state-of-the-art facilities to startups. The Karnataka Bio Startup Accelerator Programme (K-SAP) will be restructured to support early-stage businesses, while the KITVEN Fund-5 will focus on biotech investments in disruptive technologies.

Investments and International Collaborations:

Karnataka is fostering a robust biotechnology ecosystem through research and commercialization initiatives. A green-field Biofoundry and a Vaccine Research and Pilot Production Facility will support vaccine innovation. The state aims to become a global hub for clinical trials, streamlining processes and incentivizing high-end biomanufacturing, particularly in CAR-T and mRNA vaccines.

Participation in international biotech programs like the Global Innovation Alliance – Market Access Program (GIA-MAP) will facilitate global market access. The K-Tech-California Lifesciences Startup Program will further accelerate biotech enterprises, strengthening Karnataka's global presence.

Grassroot and Rural Biotech Innovations:

Karnataka is launching the Grassroot Innovation Centre of Excellence to support biotech startups focusing on sustainability. The Rural Biotechnological Innovation & Application Centre will drive biotech applications in healthcare, agriculture, and environmental sustainability, alongside a "Bio-Village" model aimed at improving rural livelihoods.

EMERGING AREAS OF FOCUS

KARNATAKA IS ADVANCING BIOTECHNOLOGY ACROSS MULTIPLE EMERGING SECTORS

The Biotechnology Policy 2024-2029 lays the foundation for Karnataka to establish itself as a premier global hub in the world BioEconomy. By integrating regulatory reforms, investment incentives, skill development, and infrastructure expansion, the state is well-positioned to achieve its ambitious \$100 billion BioEconomy target by 2030. The policy reflects Karnataka's commitment to innovation, sustainability, and economic growth, setting a benchmark for other states and global players.



BIOAGRICULTURE

Climate-resilient farming, genome editing, and precision agriculture using big data and drones.



BIOINDUSTRIAL

BioIndustrial Applications: Investments in bioenergy, smart proteins, and nutraceuticals, including the Nutra Phyto Incubation Centre.



MARINE BIOTECHNOLOGY

Seaweed cultivation and the creation of an Aqua Marine Biotech Cluster.



SYNTHETIC BIOLOGY & BIOMANUFACTURING

Research at IBAB and partnerships with global biotech players.

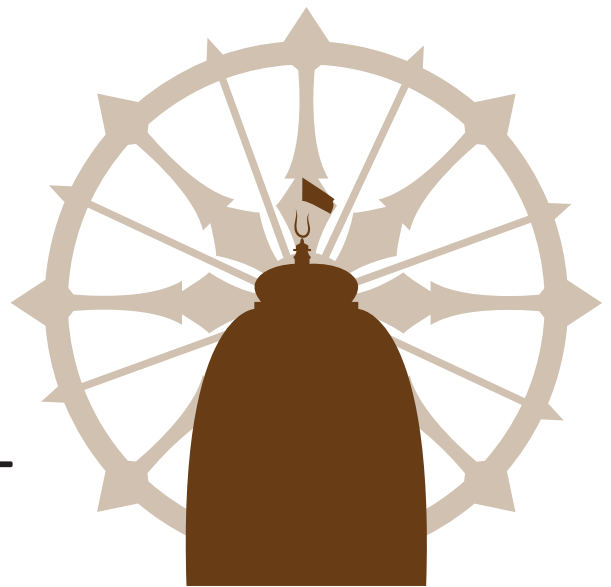


MEDICAL DEVICES & DIAGNOSTICS Development of accelerators and centers of excellence.

ODISHA

SETS SIGHTS ON
BECOMING INDIA'S NEXT
BIOECONOMY HUB WITH

NEW BIOTECHNOLOGY POLICY



Strategic Focus Areas: Odisha's Biotechnology Policy 2024 prioritizes 14 key biotech domains, including agriculture and food technology, biomedical and biopharmaceuticals, biofuels and bioenergy, and waste-to-wealth initiatives. Key initiatives under the policy include:

- ✔ Establishing Centers of Excellence (CoEs) to drive cutting-edge research and innovation.
- ✔ Promoting industry-academia collaborative research funding.
- ✔ Supporting biotech startups through incubation centers and pilot-scale testing facilities.
- ✔ Facilitating technology transfer through dedicated Technology Transfer Offices (TTOs).
- ✔ Encouraging women's participation in biotechnology.
- ✔ Developing GLP/GMP-accredited laboratories to meet global standards.

Investment & Economic Impact: Odisha's strong Gross State Domestic Product (GSDP) growth rate of over 11.5% in 2024, coupled with surplus power and water resources, provides a stable economic foundation for biotech investments. The success of initiatives like "Make in Odisha" further underscores the state's potential to attract significant funding in the biotechnology sector.

Policy Framework & Incentives: To accelerate biotech sector growth, the policy introduces a three-tier single-window clearance mechanism:

- ✔ District Level Single Window Clearance Authority (DLSWCA), State Level Single Window Clearance Authority (SLSWCA), and High Level Clearance Authority (HLCA) to ensure fast-track approvals, with Industrial Promotion and Investment Corporation of Odisha Limited (IPICOL) as the nodal agency.
- ✔ The "Industry Care" mechanism to promptly resolve industry grievances.

- ✔ Risk-based inspection frameworks to streamline regulatory oversight.

Financial & Infrastructure Incentives
– Land & Financial Support: Eligible biotech units receive concessional land rates, SGST subsidies, and capital investment subsidies.

- ✔ **Employment Generation**

Incentives: Special financial incentives for employing Odisha domiciles, with enhanced support for female employees.

- ✔ **Support for R&D and Innovation:** Funding for technology acquisition, patent registrations, and global trade fair participation.

- ✔ **Eco-Friendly Infrastructure:** Incentives for green building initiatives, waste water treatment, and zero-liquid discharge facilities.

- ✔ **Soft Loan Assistance:** Available for large-scale projects leveraging high-end biotechnology.

Strengthening Biotech Park Development: In a significant move to establish Odisha as a biotechnology hub, the government has introduced targeted incentives for biotech park development:

- ✔ A capital grant of up to 30% (excluding land costs) for infrastructure development, capped at \$12 million (INR100 crore) per biotech park.
- ✔ The grant is extended to existing biotech parks that meet investment and infrastructure completion criteria within the policy period.

Implementation & Governance: To ensure effective execution, the government will



establish a dedicated Directorate of Biotechnology. Additional governance measures include:

- ✔ **Technical Advisory Committee (TAC):** Providing expert guidance on emerging technologies.

- ✔ **Odisha Biotech Vision Group (OBVG):** A think tank comprising industry leaders, researchers, and policymakers to steer strategic direction.

- ✔ **Flexible Incentive Framework:** High-value projects will receive customized incentive packages, assessed by a high-level committee chaired by the Chief Secretary.

Vision for the Future: With a robust policy framework, rich natural resources, and strategic incentives, Odisha is setting the stage for sustained biotech sector growth. By fostering innovation, attracting investments, and strengthening research and development, the state aims to emerge as a leading destination for biotechnology in India.

ANDHRA PRADESH

UNVEILS AMBITIOUS INDUSTRIAL VISION WITH 2024-29 POLICIES

In a significant move to propel its economic trajectory, the Andhra Pradesh government unveiled a comprehensive suite of industrial development policies for the period 2024-29. These policies, officially released in late 2024, are designed to transform the state into a leading industrial hub by fostering innovation, attracting investments, and promoting sustainable growth.

The cornerstone of this initiative is the Andhra Pradesh Industrial Development Policy (4.0) 2024-29. This policy, alongside sector-specific initiatives, signals the state's proactive approach to shaping its industrial landscape for the next five years. The vision is to create a dynamic and inclusive industrial ecosystem that drives sustainable economic growth and generates employment opportunities for the youth.

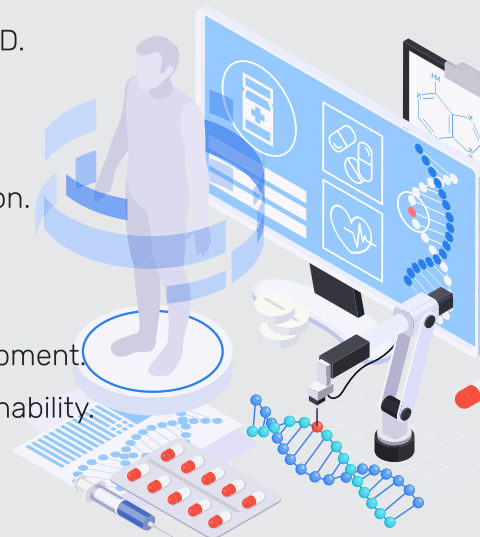
Strategic Focus on Sustenance and Propelling Growth: The policies are structured around a dual strategy, focusing on both “sustenance” and “propelling” sectors. Sustenance sectors are those where Andhra Pradesh already possesses a strong foundation, while propelling sectors represent emerging areas with high growth potential.

Sustaining Existing Strengths: Andhra Pradesh aims to solidify its position in key sustenance sectors:

- ✓ **Pharma and Life Sciences:** The state envisions becoming a pharmaceutical powerhouse by strengthening the API ecosystem, promoting research and development, and attracting investments in high-value manufacturing.
- ✓ **Medical Devices:** Creating a dedicated ecosystem for medical device manufacturing is a priority, with a focus on diagnostic equipment, implants, and collaborations with research institutions.
- ✓ **Blue Economy:** Leveraging its extensive coastline, Andhra Pradesh will focus on sustainable aquaculture, seafood processing, marine biotechnology, and maritime cluster development.
- ✓ **Agri-Biotechnology and Food Processing:** The state aims to enhance agricultural productivity through biotechnology and add value to produce through advanced food processing, including cold chain infrastructure.
- ✓ **Apparel:** Strengthening the apparel industry through textile parks, value-added produc-

HIGHLIGHTS OF AP'S FOCUS SECTORS

- ✓ **Pharma & Life Sciences:** Strengthening API ecosystem, promoting R&D.
- ✓ **Medical Devices:** Dedicated ecosystem, cutting-edge technologies.
- ✓ **Blue Economy:** Sustainable aquaculture, marine biotechnology.
- ✓ **Agri-Biotech & Food Processing:** Enhanced productivity, value addition.
- ✓ **Apparel:** Textile parks, value-added production.
- ✓ **Biotechnology:** Robust ecosystem, investment in R&D.
- ✓ **MSME Support:** Technology upgrades, financial assistance, skill development.
- ✓ **Implementation:** Ease of business, infrastructure, digitalization, sustainability.



tion, and skill development is a key objective.

- ✓ **Biotechnology:** Andhra Pradesh is focusing on building a robust biotechnology ecosystem, attracting investments in industrial, healthcare, and agricultural biotechnology.

MSME and Entrepreneur Development - The Backbone of Growth: Recognizing the vital role of Micro, Small, and Medium Enterprises (MSMEs), the Andhra Pradesh MSME & Entrepreneur Development Policy 4.0 (2024-2029) aligns with the broader industrial strategy. This policy provides targeted support to MSMEs, including technology upgradation, skill development, access to finance, marketing assistance, and infrastructure support. A strong emphasis is placed on entrepreneurship development, particularly in rural areas.

Implementation Guidelines for Success: The policies outline clear implementation guidelines, emphasizing:

- ✓ **Ease of Doing Business:** Streamlining regulations and providing online services.
- ✓ **Infrastructure Development:** Creating industrial parks, clusters, and special eco-

nomic zones.

- ✓ **Skill Development:** Collaborating with educational institutions and industry.
- ✓ **Investment Promotion:** Attracting domestic and foreign investments through incentives.
- ✓ **Sustainability:** Promoting environmentally friendly practices.
- ✓ **Digitalization:** Encouraging digital technology adoption.
- ✓ **Single Desk Portal:** Streamlining approvals and clearances.
- ✓ **Export Promotion:** Assisting industries in exporting products.

The Andhra Pradesh government's ambitious industrial policies reflect a strategic vision to drive economic growth, create employment opportunities, and enhance the state's competitiveness. By focusing on both established and emerging sectors, and by providing targeted support to MSMEs, the state aims to create a vibrant and sustainable industrial ecosystem.



The Government of Gujarat is making significant strides in establishing the state as a global biotechnology powerhouse. The **“Gujarat Biotechnology Policy 2022-27”** has successfully attracted Memorandums of Understanding (MoUs) worth approximately \$1 billion from about 30 biotech companies as of December 2024. This substantial influx of capital is solidifying Gujarat’s position as a burgeoning hub for life sciences innovation.

The policy, designed to foster collaboration between NGOs, scientific establishments, and industries, offers tiered financial support to biotechnology enterprises. Micro, Small, and Medium Enterprises (MSMEs) with capital investments below approximately \$50 million can receive assistance up to \$10 million. Larger projects exceeding this investment threshold are eligible for support covering up to 25% of total capital expenditure, capped at approximately \$240 million, disbursed strategically over five years.

Operational support forms a cornerstone of the policy, with eligible projects benefiting from assistance covering up to 15% of total operating costs, reaching a maximum of approximately \$30 million annually. This comprehensive support covers essential expenses including power tariffs, patent assistance, and marketing development.

The policy places particular emphasis on mega and strategic projects, especially those involving emerging technologies in challenging areas, with customized support packages available. Furthermore, the government is actively promoting the development of specialized infra-

structure, including pre-clinical testing facilities, genome sequencing centers, and private BSL-3 labs crucial for vaccine development and research.

The government has allocated targeted funding for key initiatives in 2024: approximately \$4 million for biotechnology-based solutions under the Gujarat Biotechnology University, approximately \$5 million for green energy and biofuel projects, and approximately \$14 million for establishing biogas plants across various institutions.

Gujarat’s success in attracting these investments builds upon its established reputation as a hub for industrial growth, leveraging the momentum of initiatives like Vibrant Gujarat to propel growth in emerging sectors alongside its existing strengths in green energy, tourism, semiconductors, and aerospace.

In 2024, the Government of Gujarat further demonstrated its commitment to advancing the biotechnology and life sciences sectors through several complementary initiatives:

The **“One District-One Product” (ODOP)** initiative highlights unique biotechnology potential in each district, thereby promoting regionally balanced economic development and innovation.

Gujarat has strengthened institutions like the Gujarat Biotechnology Research Centre (GBRC) to accelerate research in critical areas. These centers provide world-class infrastructure and technical support to research institutions and companies, fostering a self-sustaining ecosystem of innovation within the state.



TELANGANA

LIFE SCIENCES SECTOR SHAPING A NEW ERA BEYOND VISION 2030

Telangana's life sciences sector, one of the key drivers of India's pharmaceutical and biotechnology industries, is strategically evolving. While "Vision 2030" provided the initial framework, the state is accelerating progress with a new Life Sciences policy, expected in 2025.

Anticipated Policy Directions: The upcoming policy aims to adapt to evolving industry dynamics and capitalize on emerging opportunities. It is designed to incorporate trends like personalized medicine, cell and gene therapy, and digital innovation, shifting focus towards specialized technologies such as genomics, biologics, and advanced R&D. This strategic move aims to position Telangana as a life sciences innovation hub.

Strategic Initiatives: Telangana plans to establish an Artificial Intelligence (AI) advisory council for the sector to facilitate AI adoption and fostering innovation. Key policy objectives are designed to:

- ✔ **Drive Investment and Growth:** Attract new investments and foster the expansion of existing enterprises, creating a competitive and vibrant ecosystem.
- ✔ **Enhance Industry-Academia Collaboration:** Forge stronger partnerships between industry and academic institutions, facilitating seamless knowledge transfer and research partnerships.
- ✔ **Champion Technological Advancement:** Advance cutting-edge technologies, including personalized medicine, biomanufacturing, and digital solutions, positioning Telangana

at the forefront of innovation.

- ✔ **Streamline Regulatory Processes:** Simplify regulatory procedures to create a business-friendly environment and reduce operational hurdles.
- ✔ **Cultivate a Skilled Workforce:** Address the talent-employability gap through targeted training and education programs, potentially including a dedicated Life Sciences University.
- ✔ **Expand Infrastructure Development:** Continue and expand development of Green Pharma City and pharma villages, demonstrating commitment to industry infrastructure.

Current Progress: The state's early vision highlighted existing strengths like robust infrastructure and strategic partnerships. Recent developments include 11 new Memorandums of Understanding (MoUs), adding to existing agreements, with approximately \$65.6 million (USD) in investments and 9,800 new jobs. Total investment in Green Pharma City is now around \$133.7 million (USD), creating over 22,300 jobs. The development of 10 pharma villages is projected to generate over 500,000 jobs.






Telangana's upcoming Life Sciences policy is anticipated to be a strategic evolution, building on its existing strengths and proactively addressing future trends. The approach is aimed to solidify Telangana's position as a leading force in the global life sciences industry.

STRATEGIC ROADMAP FOR INDIA'S BIOECONOMY

VISION 2030 AND BEYOND

The **BioEconomy Conclave 2025** held by ABLE in February articulated an ambitious vision for India's BioEconomy: to grow from the current **\$165.7 billion** (2024) to **\$300 billion** by 2030, and further aim to target \$1 trillion by 2047. This strategic roadmap synthesizes key insights from industry leaders, policymakers, and innovators to outline the path toward achieving these targets. With a required CAGR of approximately 10.6% to reach the 2030 milestone and 7.5% thereafter to achieve the 2047 vision, India must implement coordinated policy interventions, strategic investments, and ecosystem development across five key sectors: BioPharma, BioAgri, BioIndustrial, TechMed, and the Startup Ecosystem.

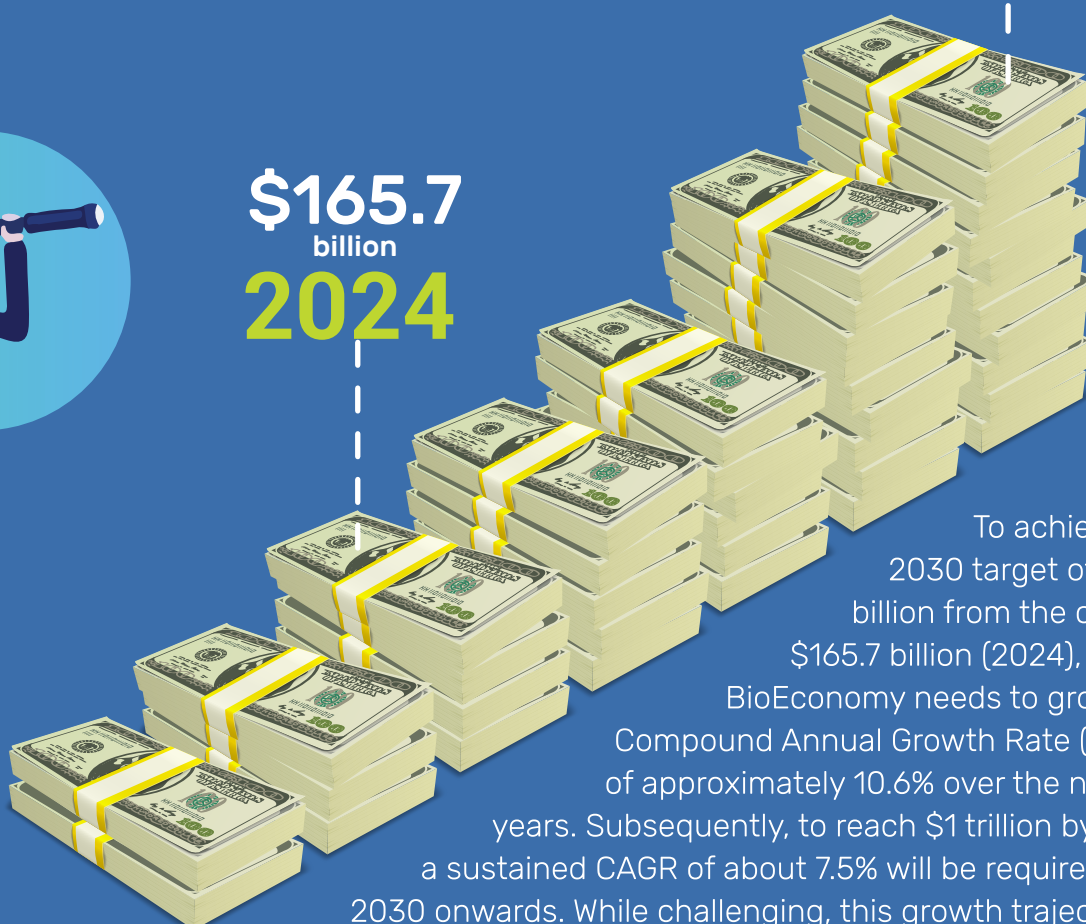
Growth Targets and Required CAGR

	Timeline	Current (2024)	Short-term (2030)	Long-term (2047)
	Market Size	\$165.7 billion	\$300 billion	\$1 trillion
	Required CAGR	-	10.6% (2024-2030)	7.5% (2030-47)
	Job Creation	~3.5 million	~10 million	~20 million
	Focus Areas	Accelerate growth	Scale & integrate	Global leadership



\$165.7
billion
2024

\$1
trillion
2047



To achieve the 2030 target of \$300 billion from the current \$165.7 billion (2024), India's BioEconomy needs to grow at a Compound Annual Growth Rate (CAGR) of approximately 10.6% over the next six years. Subsequently, to reach \$1 trillion by 2047, a sustained CAGR of about 7.5% will be required from 2030 onwards. While challenging, this growth trajectory is achievable with strategic interventions across all BioEconomy sectors, considering that the sector grew from \$151 billion in 2023 to \$165.7 billion in 2024 (9.7% annual growth).

Strategic Pillars for BioEconomy Growth



BIOPHARMA

*High-Value Therapeutics
and Precision Medicine*

While India has established itself in generic pharmaceuticals with a **25% global market share**, it needs to build capabilities in cell and gene therapies urgently, where the global market is already around **\$20 billion**.

BioPharma contributes approximately **35%** to India's bioeconomy. The sector has showed significant capabilities in biosimilars and fermentation-based drugs, but there is immense potential for growth in advanced therapies.

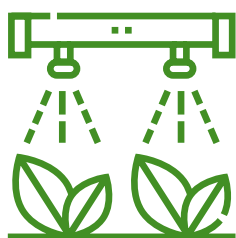
Policy Recommendations

- Increase R&D support through targeted tax incentives for private sector research
- Develop an integrated model that connects research capabilities with commercial distribution
- Simplify regulatory pathways to reduce approval timelines from the current 3 years to match global standards of 15-18 months
- Create specialized infrastructure for high-tech manufacturing, particularly for cell and gene therapies
- Establish programs to address the talent gap through upskilling and reskilling initiatives
- Reward the development of affordable CAR-T therapies and gene therapies for treating genetic disorders
- Develop infrastructure for genomic data collection, storage, and analysis to facilitate biomarker discovery

Key Strategies recommended by Industry experts

- Establish cell and gene-therapy manufacturing hubs across India
- Create a BioPharma Innovation Fund with public-private participation
- Reduce regulatory approval timelines from 36 months to 15 months in few years
- Develop specialized biotech manufacturing parks with plug-and-play infrastructure
- Launch a National Biomarker Discovery Program with participation of medical institutions

Strategic Pillars for BioEconomy Growth



BIOAGRI

Climate-Resilient and Nutrition-Enhanced Agriculture

Agriculture employs **40-50%** of India's workforce and contributes **12-15%** to GDP. The BioAgri experts emphasized the need to reimagine agriculture as an industry rather than just a livelihood activity.

While India has achieved self-sufficiency in staple foods, significant gaps remain in livestock productivity, oilseeds, and other high-value agricultural products.

Policy Recommendations

- Address regulatory uncertainty around gene editing technologies, particularly SDM (Site-Directed Mutagenesis) to speed up innovation
- Harmonize the Protection of Plant Varieties and Farmers' Rights Act with the Patent Act to encourage innovation
- Develop comprehensive climate resilience strategies using biotechnology for crop stress tolerance
- Focus on productivity enhancement in areas where India faces deficits, such as oilseeds, pulses, feed, and cotton
- Encourage precision agriculture technologies for optimal resource utilization
- Develop bio-fortification strategies to address micronutrient deficiencies
- Increase investment in agricultural biotechnology focused on "producing more with less"
- Create mechanisms for capturing value from traditional knowledge and genetic resources

Key Strategies recommended by Industry experts

- Develop clear regulatory framework for gene editing technologies
- Establish biotech parks focused on oilseeds, pulses, and cotton
- Create a large fund for climate-resilient crop development
- Launch a National Bio-fortification Mission to address micronutrient deficiencies
- Implement AI-driven precision agriculture programs across the country.

Strategic Pillars for BioEconomy Growth



BI INDUSTRIAL

Sustainable Manufacturing and Biomaterials

The BioIndustrial experts suggested to focus on biomanufacturing and its potential to create sustainable materials and processes.

Industry experts assert that biomanufacturing in India faces fewer regulatory hurdles compared to other biotech sectors, but lacks scaling capabilities and specialized talent.

Policy Recommendations

- Establish consortia for biomanufacturing to enable knowledge sharing and resource optimization
- Create single-window clearance mechanisms for biomanufacturing facilities
- Incentivize academic institutions to establish manufacturing setups that can be used by industry
- Develop specialized programs to attract talent in biomanufacturing, including initiatives for reverse brain drain
- Invest in downstream processing innovations that have seen limited advancement over the past 40 years
- Support the development and scaling of bioplastics and other biomaterials, particularly PLA (Polylactic Acid)
- Create milestone-based matrices for tracking progress in biomanufacturing capabilities

Key Strategies recommended by Industry experts

- Establish a national biomanufacturing consortia
- Create single-window clearance system for biomanufacturing facilities
- Develop bio-foundries for scaled prototype development
- Implement preferential procurement policies for bio-based materials in government
- Launch a fund for downstream processing innovations

Strategic Pillars for BioEconomy Growth



TECHMED

*Digital Health and
Diagnostic Technologies*

The TechMed leaders emphasized the role of technology in improving healthcare access and outcomes, particularly in the context of universal health coverage.

Experts believe that healthcare challenges are significant barriers to economic growth, with health-related issues potentially reducing IQ development by 20%, according to some studies presented.

Policy Recommendations

- Strengthen the Ayushman Bharat Digital Mission (ABDM) to facilitate seamless data exchange
- Expand the ABHA (Ayushman Bharat Health Account) registration beyond the current 60 million
- Develop human resources for healthcare by training high school students for primary healthcare roles
- Utilize cloud computing & satellite technology for healthcare surveillance and delivery
- Support diagnostic innovations focused on infectious diseases, particularly those prioritized by WHO
- Encourage AI applications in medical imaging and diagnostics
- Develop platforms for disease surveillance integrating genomic data
- Create regulatory pathways for digital therapeutics and personalized medicine approaches

Key Strategies recommended by Industry experts

- Aim for increase in ABHA (Ayushman Bharat Health Account) registrations
- Establish a National Health Data Grid with participation from all states
- Develop AI-based diagnostic platforms for the top 20 disease conditions
- Create a fund for point-of-care diagnostic technologies
- Implement satellite-based telemedicine networks in villages

Strategic Pillars for BioEconomy Growth



BIOTECH STARTUP ECOSYSTEM

*Innovation to
Commercialization*

India has established **95 BioNEST** (bioincubator facilities) providing approximately **900,000 square feet** of incubation facilities. However, several challenges remain in the startup ecosystem.

Policy Recommendations

- Strengthen mentorship programs that focus on go-to-market strategies rather than just technical aspects
- Address the evolving regulatory landscape that creates additional burdens for biotech startups
- Establish incubators in locations where the surrounding ecosystem can support startup growth
- Increase availability of risk capital for biotech ventures, particularly for early-stage funding
- Create specialized accelerator programs for biotech startups that account for longer development timelines
- Develop mechanisms for industry-academia collaboration focused on commercialization
- Establish strategic funds that can provide patient capital for deep tech biotech ventures
- Support manufacturing hubs and bio-foundries that can serve multiple startups

Key Strategies recommended by Industry experts

- Expand BioNEST incubation facilities
- Establish a Biotech Venture Fund with tiered funding mechanisms
- Create specialized biotech accelerator programs with industry linkages
- Develop mentor networks of domain experts
- Implement specialized IP protection and fast-track patent examination for biotech

Strategic Pillars for BioEconomy Growth



CROSS CUTTING ENABLERS

Several suggestions emerged across all sessions that require coordinated policy interventions.

Human Capital Development

- Train more specialized biotech professionals
- Establish Centers of Excellence for frontier biotech education across the country
- Create industry-academia exchange programs with global institutions
- Develop specialized curricula for convergent technologies (Bio+AI, Bio+Engineering)

Investment and Funding

- Create sector-specific funds with patient capital approaches
- Implement tax incentives for R&D investments in biotech
- Develop outcome-based funding mechanisms for high-risk innovations
- Create corporate innovation funds with matching government contributions

Policy and Regulatory Framework

- Create a National BioEconomy Mission with representation from all stakeholders
- Establish a single-window regulatory mechanism for biotech innovations
- Reform the Biodiversity Access regime to facilitate research while ensuring equitable benefit sharing
- Develop specialized regulatory pathways for emerging technologies
- Create regulatory sandboxes for testing innovative approaches

Other Industry Suggestions

- Develop integrated biotech clusters with complete value chains
- Establish a National Biological Data Repository
- Create shared technology platforms accessible to startups and academic institutions
- Implement preferential procurement policies for biotech innovations
- Develop Global Alliance Networks for international market access

FIVE CORE ENABLERS NEEDED BY INDUSTRY

- 1. **Policy:** Favorable regulatory environment and incentive structures
- 2. **People:** Skilled workforce and specialized talent development
- 3. **Platforms:** Shared infrastructure and technology platforms
- 4. **Partnerships:** Public-private collaborations and international alliances
- 5. **Promotion:** Marketing, branding, and global positioning

STRATEGIC FOCUS AREAS FOR ACCELERATED GROWTH

Frontier Technologies

Five frontier technologies that can drive disproportionate growth in India’s BioEconomy

Technology	Current Stage	2030 Vision	Impact Areas
Cell & Gene Therapy	Early adoption	Manufacturing hub	Rare diseases, Cancer
Synthetic Biology	Research stage	Commercial applications	Materials, Agriculture
AI + Biology	Emerging	Integrated platforms	Drug discovery, Diagnostics
Precision Agriculture	Pilot projects	Nationwide adoption	Climate resilience, Nutrition
Biomanufacturing	Limited scale	Industrial scale	Sustainable materials, Enzymes

ANNUAL GROWTH TRAJECTORY TO 2030

Year	Projected Size (\$ billion)	Annual Growth Rate
2024	165.7 (Current)	-
2025	179	8.02%
2026	197	10.1%
2027	217	10.2%
2028	240	10.6%
2029	268	11.7%
2030	300	11.9%

CONCLUSION

REALIZING THE “INDIAN BIOTECH CENTURY”

This strategic roadmap recommended by industry experts, provides a comprehensive framework for achieving India's ambitious BioEconomy targets of \$300 billion by 2030 and aim for \$1 trillion by 2047. Based on the current baseline of \$165.7 billion (2024), the required growth rates of 10.6% CAGR to 2030 and 7.5% CAGR from 2030 to 2047 are challenging but achievable with coordinated efforts across all stakeholders.

The vision of making the next 25 years the “Indian Biotech Century” is both ambitious and realistic given India's strengths in talent, biodiversity, and innovation capacity. By focusing on the five key sectors, implementing the 5-5-

5 model, and strategically investing in frontier technologies and regional clusters, India can establish itself as a global leader in biotechnology.

This roadmap calls for immediate action across all stakeholders to start the acceleration phase and set in motion the transformation of India's BioEconomy from potential to reality. With consistent policy support, strategic investments, and ecosystem development, the BioEconomy can become a major driver of India's economic growth, job creation, and global competitiveness while addressing critical challenges in healthcare, agriculture, and environmental sustainability.



ACKNOWLEDGEMENTS AND SOURCES

This report has been compiled by sourcing information from a variety of reputable web sources and publicly available data. The comprehensive nature of the research involved accessing diverse online platforms and mining publicly accessible information to ensure the accuracy and breadth of the content presented. The acknowledgment extends to the wealth of data contributed by these sources, enabling a thorough and well-informed report.

- Biotechnology Industry Research Assistance Council (BIRAC), a public sector enterprise of DBT, Government of India.
- Department for Biotechnology (DBT), Ministry of Science and Technology, Government of India.
- Department of Commerce, Ministry of Commerce & Industry, Government of India.
- Directorate of Economics and Statistics (DES), Department of Agriculture, Cooperation and Farmers Welfare (DAC&FW), Government of India.
- Ministry of Petroleum & Natural Gas, Government of India.
- Ministry of Statistics & Programme Implementation National Statistical Office.
- Ministry of Textiles, Government of India.
- The Department of Pharmaceuticals, Ministry of Chemicals & Fertilizers, Government of India.
- World Health Organization.

Information has been gathered from diverse sources, including reports from Industry sources, including reports from Industry Associations, Market Research Organizations, Investment Trackers, Press Releases, Newspapers, Magazines, presentations at leading events and conferences. The food and Agriculture Organization (FAO) of the United Nations, European Commission's BioEconomy - Research & Innovation, press releases from various organizations and media publications have contributed to the compilation of data.

CONTRIBUTORS

This report has been prepared for the “Make In India Facilitation Cell for Biotechnology” of Biotechnology Industry Research Assistance Council (BIRAC) by the Association of Biotechnology Led Enterprises (ABLE).

ABLE is a non-profit nationwide forum dedicated to representing the Indian Biotechnology Sector. With a membership exceeding 400, ABLE (www.ableindia.in, Twitter @able_indiabio) encompasses diverse stakeholders from across India, including Agribiotech, BioPharma, Industrial, biotech, Bioinformatics, Investment banks, Venture Capital firms, leading Research and Academic Institutes, Law Firms, and Equipment Suppliers, collectively representing all verticals within the sector.

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The Annual India BioEconomy Report has been tracking the evolution of the country's BioEconomy for several years. It has now become a key reference for national and international stakeholders, as well as policymakers.



— Dr. Manish Diwan

Mission Director – Make In India PMU for biotech sector, BIRAC
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LINKS TO SOME REFERENCE WEBSITES SOURCE

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