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INDIA BIOECONOMY REPORT 2026

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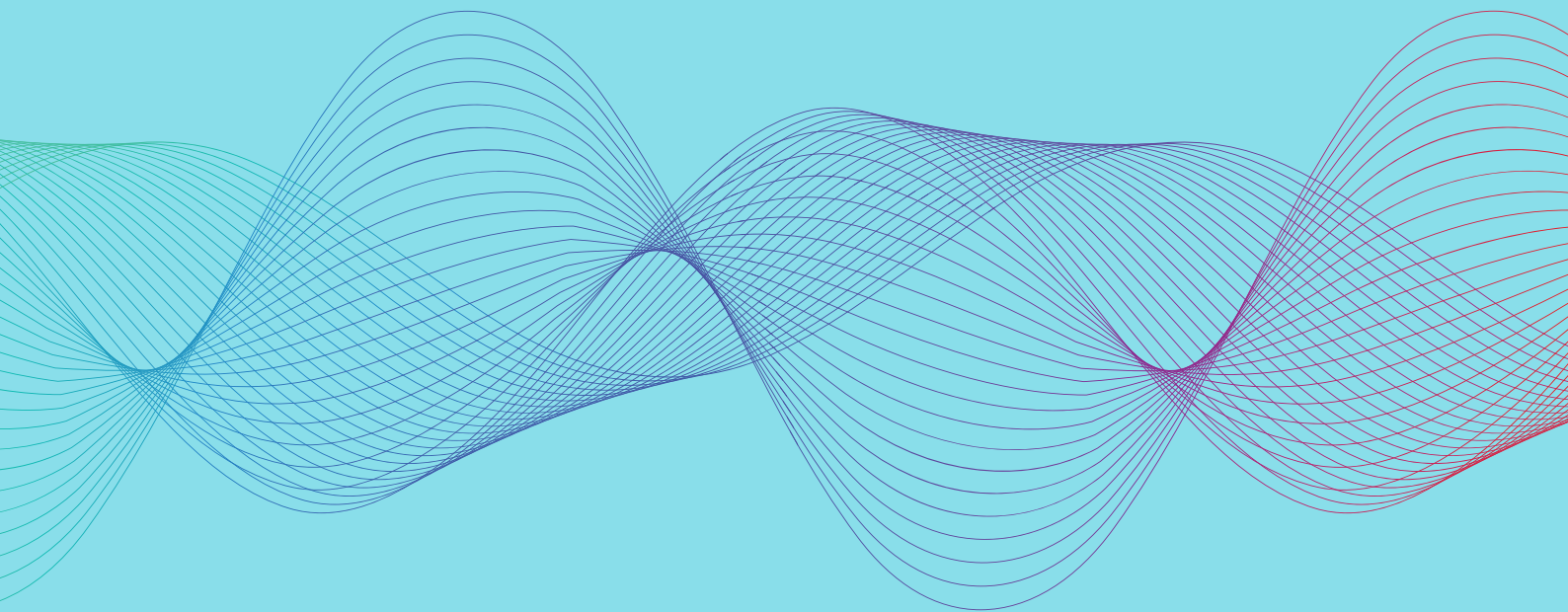
This report has been prepared for "**Make In India Facilitation Cell for Biotechnology**" of Biotechnology Industry Research Assistance Council (BIRAC) by Association of Biotechnology Led Enterprises (ABLE). The report is written by **Narayanan Suresh**, Advisor, ABLE and **Srinivas Rao Chandan**, Editorial Consultant for ABLE under the able guidance of **Mr G S Krishnan**, Hon. President, ABLE and **Dr. Dhiraj Kumar**, Mission Director, Make in India for Biotech Sector, BIRAC, GoI.



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FOREWORD

Dr. Jitendra Singh

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

Science and Biotechnology: Powering India's Next Industrial Transformation

India stands today at a defining moment in its scientific and technological journey. The remarkable expansion of the country's BioEconomy demonstrates how science, innovation and entrepreneurship are converging to shape a new model of development. As highlighted in the India BioEconomy Report (IBER) 2026, India's BioEconomy has grown to over $195 billion, reflecting the increasing integration of biotechnology across healthcare, agriculture, manufacturing and sustainable industrial systems.

This transformation has been driven by sustained policy support and strategic vision under the leadership of Prime Minister Shri Narendra Modi, who has placed science, technology and innovation at the centre of India's development agenda. Over the past decade, biotechnology has received unprecedented encouragement through policy reforms, enhanced funding for research and development and initiatives that foster entrepreneurship and industry–academia partnerships. The emergence of more than 11,850 biotechnology startups and a rapidly expanding network of incubators and research facilities demonstrates how India is steadily moving towards a bio-driven economy.

Biotechnology is widely expected to power what many describe as the next industrial revolution. Emerging technologies from advanced biomanufacturing and gene therapies to biofuels, industrial enzymes and digital biology are transforming how medicines are developed, materials are manufactured and natural resources are utilized. These developments align closely with national priorities such as energy transition, sustainable production systems, improved healthcare and food security.

At the same time, India must continue to think ahead and prepare for the opportunities and challenges of

the coming decades. I have often emphasized that our scientific institutions must not limit their ambition to being the best within the country alone; we must strive to be among the best in the world. India is blessed with a demographic dividend of talented youth who, with the right training and motivation, can drive the next generation of scientific and technological breakthroughs.

Initiatives such as the BioE3 Policy - Biotechnology for Economy, Environment and Employment, new investments in research infrastructure and programmes supporting deep-tech innovation are strengthening the foundations of India's biotechnology ecosystem. The ultimate objective of scientific advancement must always remain the improvement of the ease of living for our citizens, while also positioning India as a trusted partner in the global innovation landscape.

The insights presented in this report highlight both the impressive progress achieved and the vast opportunities that lie ahead. As India aims towards its long-term vision of building a $1 trillion BioEconomy by 2047, sustained collaboration among government, academia, industry and startups will be essential to translate scientific knowledge into technologies that benefit society and strengthen India's leadership in the global BioEconomy.

I congratulate the authors and contributors of the India BioEconomy Report 2026 for documenting this important journey and providing valuable insights to guide the next phase of India's biotechnology-led growth.

From the DBT Secretary's Desk

Dr. Rajesh S. Gokhale

Secretary,
Department of Biotechnology (DBT), Government of India,
Director General, BRIC and Chairman, BIRAC

Strengthening India's BioEconomy through Science and Biomanufacturing

India entered 2026 with its BioEconomy on track to reach $300 billion by 2030, placing biotechnology at the core of Viksit Bharat. Biotechnology has emerged as one of the most powerful drivers of scientific progress and economic transformation in the twenty-first century. Across the world, advances in modern biology are reshaping healthcare, agriculture, industrial manufacturing and environmental sustainability. In India, biotechnology is increasingly becoming a key pillar of innovation-led development and an important contributor to the country's expanding bio-based economy.

The India BioEconomy Report (IBER) 2026 reflects the significant progress India has made in building a vibrant biotechnology ecosystem. Over the past decade, sustained investments in scientific research, infrastructure and entrepreneurship have strengthened the country's capabilities across multiple domains of biotechnology. Today, India is recognized globally for its strong scientific talent, dynamic startup ecosystem and growing leadership in areas such as vaccines, biopharmaceuticals, genomics and industrial biotechnology.

The Department of Biotechnology (DBT) has played a central role in nurturing this ecosystem. Through its focus on discovery research, translational innovation and capacity building, DBT has supported the development of advanced research facilities, strengthened academic–industry partnerships and enabled the emergence of a nationwide network of biotechnology startups and incubators. These efforts are aligned with national priorities such as AatmaNirbhar Bharat, Swasth Bharat, Startup India and Make in India, which seek to harness science and technology for societal and economic advancement.

Recent initiatives are now laying the foundation

for the next phase of India's biotechnology journey. The BioE3 Policy—Biotechnology for Economy, Environment and Employment—provides a strategic framework for advancing biomanufacturing and sustainable biotechnology solutions. Announced in 2024, the policy has driven momentum through the August 2025 establishment of India's National Biofoundry Network - comprising six core biofoundries at premier institutions like ICGEB New Delhi and NABI Punjab, alongside a broader network of 21 bio-enabler facilities nationwide. By focusing on areas such as bio-based chemicals, smart proteins, precision biotherapeutics, climate-resilient agriculture and carbon capture technologies, the policy—and its 2026 implementation updates via DBT's BioE3 hub—are accelerating the transition from scientific discovery to industrial-scale innovation.

These biofoundries, complemented by bio-AI hubs and biomanufacturing platforms, now provide critical infrastructure to support technology scale-up and commercialization. Into 2026, BIRAC's ongoing calls for proposals and dedicated biofoundry funding models are enabling startups and industry to translate cutting-edge research into globally competitive products and processes, positioning India as an emerging biofoundry hub.

Equally significant are initiatives such as the GenomeIndia Project and the operationalisation of the Indian Biological Data Centre, which are creating national resources that will accelerate genomics-driven research, precision medicine and data-driven biological discovery.

As this report demonstrates, India's biotechnology ecosystem is evolving rapidly. Continued collaboration between government, academia, industry and entrepreneurs will be essential to fully harness the transformative potential of biotechnology and to position India as a global leader in the emerging bio-based economy.

This compilation by the IBER 2026 authors provides a valuable record of progress to inform future initiatives in India's BioEconomy.

From BIRAC MD's Desk

Dr. Jitendra Kumar

Managing Director, BIRAC

Powering India's BioEconomy through Innovation

India's BioEconomy reached $195.3 billion in 2025, up 18% from $165.7 billion, driven by BioIndustrial leadership at $90.2 billion and robust biotech services and manufacturing. BIRAC sees this surge as testimony to our sustained focus on de-risking deep-tech innovation from ideation to commercialization aligning seamlessly with DBT's BioE3 vision for high-performance biomanufacturing.

BIRAC's programmes form the backbone of this ecosystem. Our flagship Biotechnology Ignition Grant (BIG) has nurtured over 1,000+ innovations from 550+ cities across 38 aspirational districts, yielding 200+ products, 800 IP filings and ₹3,500 crore ($415 million) in follow-on funding for 150 startups. The i4 initiative through SBIRI and BIPP has supported 600+ projects across 750+ beneficiaries, generating 200+ products/technologies, 90+ patents and strengthened academic-industry linkages that convert lab discoveries into market realities.

Equity funds bridge critical scale-up gaps. SEED has backed 153 startups with ₹45 crore ($5 million), catalysing ₹1,162 crore ($140 million) follow-on funding and ₹7,589 crore ($900 million) portfolio valuation across 127 ventures, including 9 exits. Complementing this, LEAP has invested ₹40 crore ($4.7 million) in 62 startups, unlocking ₹893 crore ($106 million) follow-on and ₹4,632 crore ($550 million) valuation with 4 exits demonstrating BIRAC's leverage in attracting private capital.

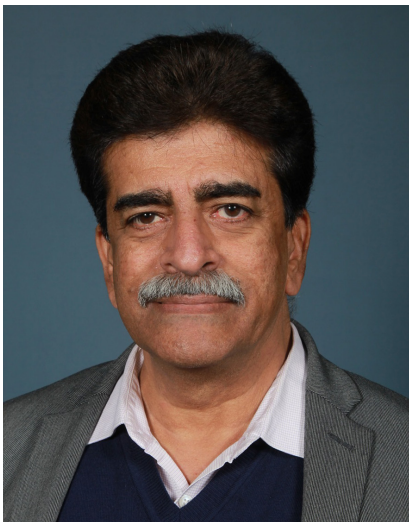
BioE3 integration marks a pivotal evolution. Launched in 2024, it operationalized a nationwide network

of 21 bio-enablers (8 biofoundries, 13 biomanufacturing hubs) spanning precision biotherapeutics, smart proteins, climate-resilient agriculture and carbon capture. BIRAC's joint DBT calls covering Bio-AI hubs, mRNA therapeutics, monoclonal antibodies and bio-based chemicals have launched 16 webinars and multiple funding rounds, spurring PPP models and pilot-scale infrastructure. BioNEST's 94 incubators now support 3,000+ startups with 1,300+ IPs and 800+ products, amplified by MII-PMU platforms like Global Bio-India, AcE Fund and BioSaarthi mentorship.

The BIRAC innovation sink absorbing early risks through BIG/ETA, accelerating translation via PACE/PCP and channeling growth through equity powers this story. We enable startups to capitalize on biofuels (20% ethanol blending saving $19.3 billion forex), enzyme adoption and novel therapies amid global demand.

Looking ahead, BIRAC will deepen BioE3 delivery with niche calls in synthetic biology, guar derivatives and agri-biotech, while scaling equity, BioNEST and IP clinics. With ministerial and DBT secretary's leadership, BIRAC drives toward a $300 billion BioEconomy by 2030 self-reliant, sustainable and globally competitive.

From the ABLE President's Desk



G S Krishnan

Honorary President,
Association of Biotechnology Led Enterprises (ABLE)

10 Years of Chronicling India's BioEconomy

In mid-2016, the ABLE Research team began a small exercise to measure the economic impact of a wide range of biotechnologies driving innovation in BioPharma, BioAgri, and enzyme-driven BioIndustrial processes. Around the same time, India's biotech companies had also begun handling a growing number of research services projects for global majors. The effort sought to build upon emerging work in Europe where economists and industry experts were attempting to quantify the large-scale economic impact of bio-based products. Earlier, in 2012, ABLE had articulated the need to measure the impact of India's BioEconomy.

After studying several global academic papers and policy discussions initiated by economists, the ABLE Research team led by **Mr Narayanan Suresh**, developed methodologies suited to India's specific biotechnology adoption patterns. ABLE received valuable guidance from its leadership. The first report pegged India's BioEconomy at **$35 billion**. These numbers were released at **BIO Philadelphia in June 2016**.

The **India BioEconomy Report (IBER) 2026** that you are now reading represents the 10th edition prepared by the ABLE team.

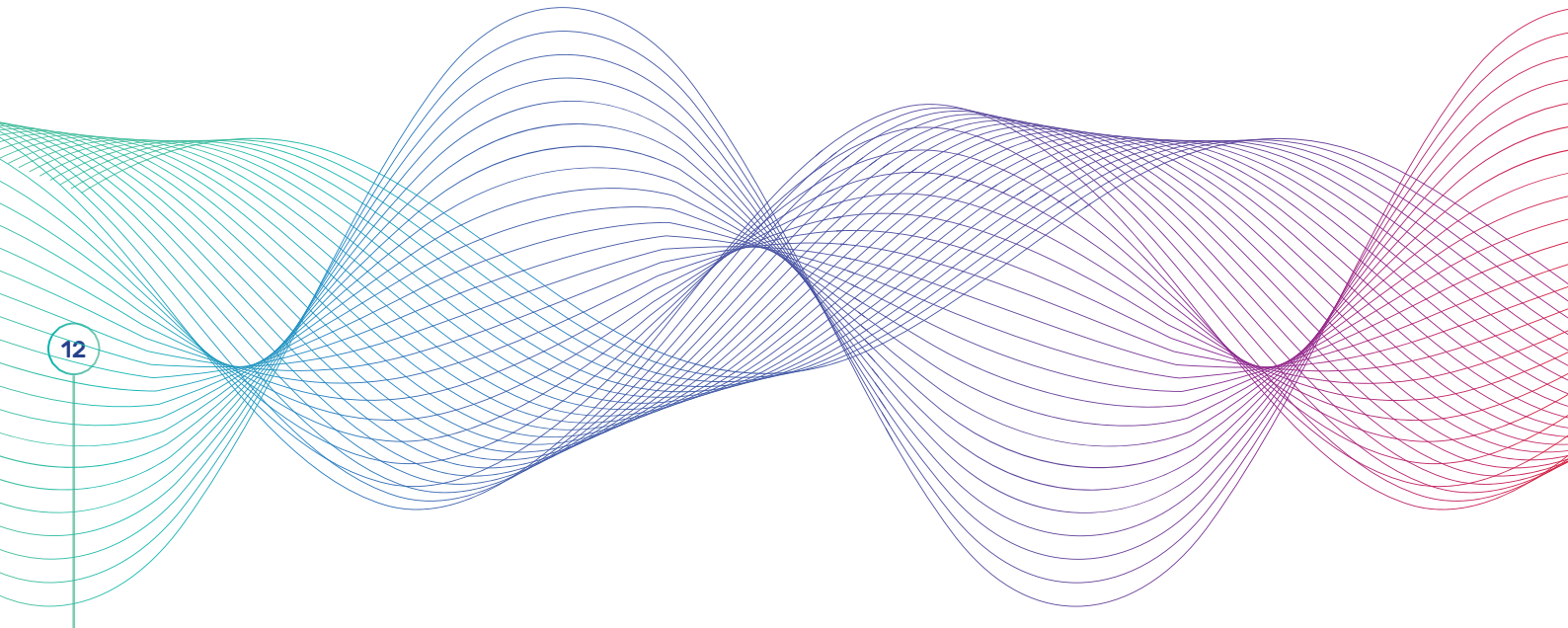
ABLE received strong encouragement from the leadership of the **Department of Biotechnology (DBT)** and **BIRAC**, to continue this annual exercise. **Union Science & Technology (S&T) Minister Dr Jitendra Singh** has consistently taken time each year to release the report and has encouraged ABLE to continuously strengthen the data collection and

analytical approaches used in the study.

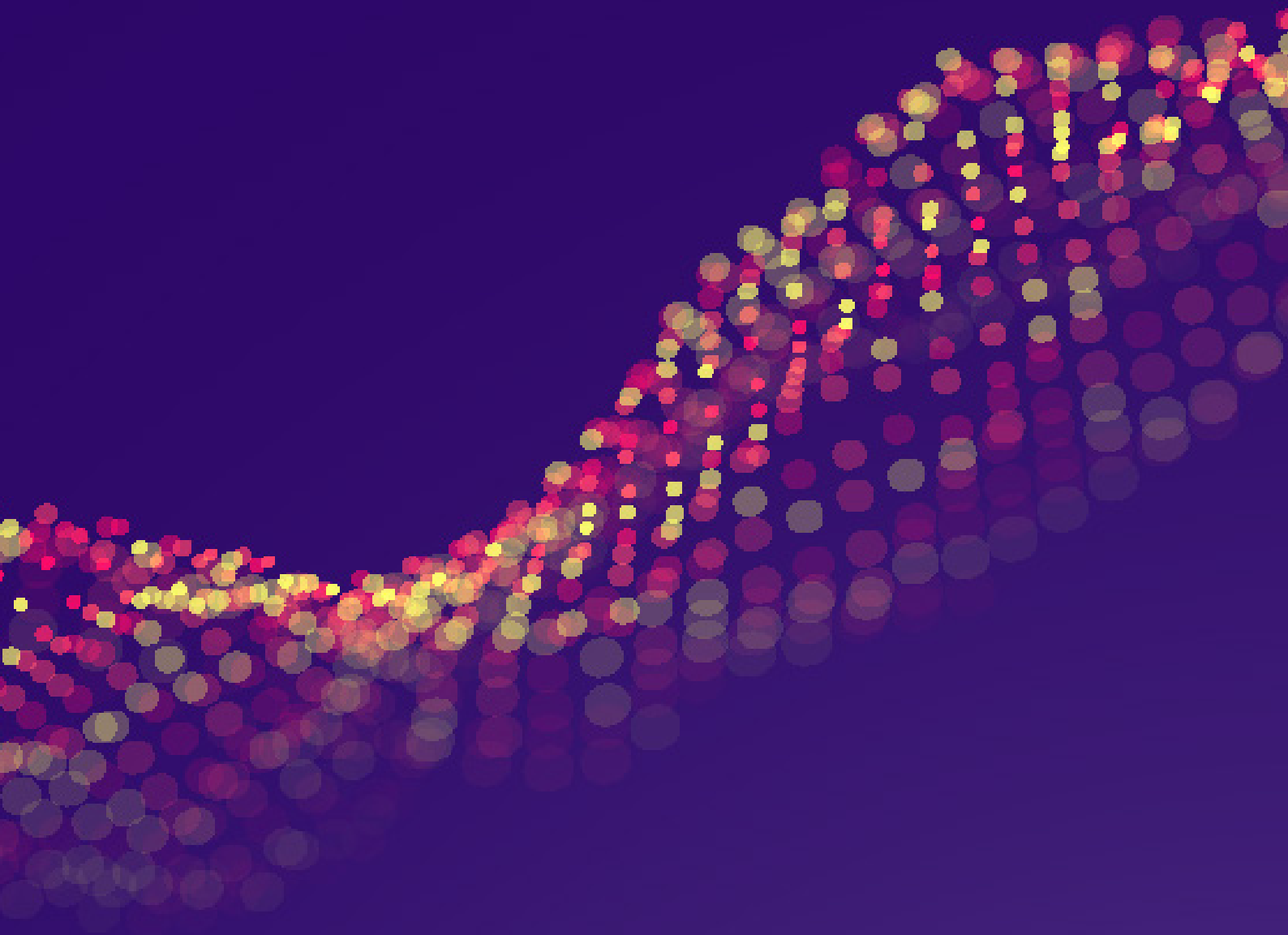
Over the past decade, the methodology used to compile the annual BioEconomy estimates has improved significantly. Over time, the process of estimating India's BioEconomy has matured into a structured analytical exercise. This work is further strengthened through ongoing engagement with industry leaders and subject matter experts, whose insights help refine the evolving BioEconomy framework. The ABLE Research team now tracks biotechnology-enabled economic activity across four broad segments—**BioIndustrial, BioPharma, BioServices, and BioAgri**—capturing the expanding role of biological processes, enzymes, fermentation technologies, and life science innovations across industries.

The analysis also increasingly tracks the growth of India's biotechnology startup ecosystem, drawing on information available through national startup platforms, corporate filings, and innovation networks.

As we mark ten years of the India BioEconomy Report, it is encouraging to see how biotechnology has moved from a specialized scientific domain to a foundational driver of economic growth, sustainability, and innovation. The continued expansion of India's BioEconomy reflects the collective efforts of researchers, entrepreneurs, industry leaders, and policymakers working together to harness the power of biology for the country's future.



EXECUTIVE SUMMARY



Snapshots of

Scale of India's Bioeconomy

India's BioEconomy Value 2025

$195.3 bn

Growth (2024–2025)

18%

CAGR (2020–2025)

17.8%

GDP Contribution

4.8%

Total Biotech Startups

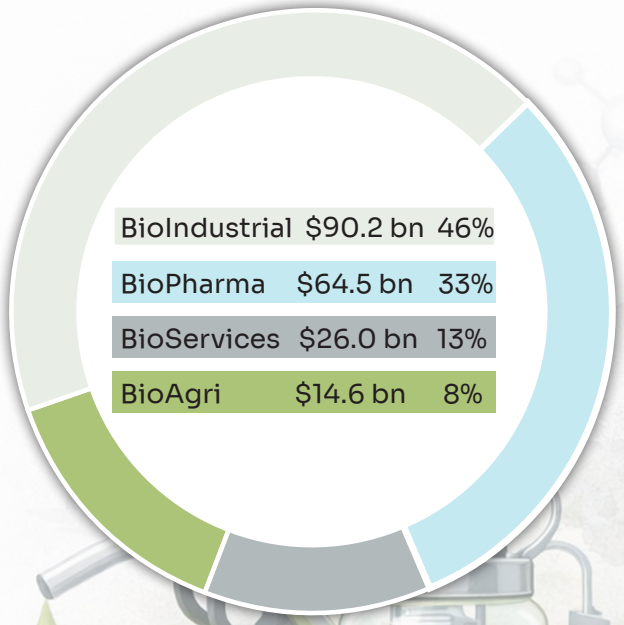
11,855

Manufacturing-led segments (BioIndustrial and BioPharma) account for nearly three-quarters of India's BioEconomy. Services-linked activities such as digital life sciences platforms and global capability centres are expanding rapidly.

Bioeconomy Growth (2020–2025)

2020	2021	2022
$86bn	$106bn	$137bn
2023	**2024**	**2025**
$151bn	$166bn	$195bn

BioEconomy Value by Segments



India's BioEconomy

Innovation & Ecosystem Landscape

Ecosystem Indicators

Core Biotech Workforce	Life Sciences Workforce
350k - 400k	**3–3.5 M**

Biotechnology Startup Ecosystem

Total Biotech Startups	New Startups In 2025
11,855	**1,780**

Investment Landscape

Total Deals **208**

Total Investment **$4.6 Bn**

Investments in 2025 **$1.58 Bn**

Private Equity Exits **45 companies**

Exit Value **$6.15 Bn+**

States Crossing the $10 Billion BioEconomy Threshold

Seven states crossed the $10 billion BioEconomy threshold, together accounting for nearly four-fifths (78%) of India's national BioEconomy.

State	BioEconomy Value ($ Bn)
Maharashtra	40.42
Karnataka	39.54
Telangana	21.29
Gujarat	13.92
Andhra Pradesh	13.74
Tamil Nadu	12.40
Uttar Pradesh	10.93

Combined Contribution:
78%
of India's BioEconomy

BIRAC Innovation Impact

Beneficiaries Supported
15 lakh+

Cities Covered
550+

Aspirational districts reached
38

Startups Supported
5000+

IP Filings
1350+

Products & Technologies Developed
900+

The following section provides an overview of the key developments that shaped India's BioEconomy in 2025.

Chapter 1

1 Executive Summary

A $30 billion surge in India's BioEconomy valuation in a single year 2025 has propelled the sector into an accelerated growth phase. In 2025, the BioIndustrial and BioServices segments significantly contributed to the growth. This is the first time such a change in phase is noticed since the formal measurement of BioEconomy began a decade ago.

This nuanced expansion is based on four pillars.
(by ABLE's research experts, **Mr Narayanan Suresh** and **Mr Srinivas Rao Chandan**)

The unprecedented milestone of **20% blending of ethanol in petrol**, resulting in nearly **18 billion (1,800 crore) liters of biofuel supply**, saving the country $12-14 billion in foreign exchange due to reduction in petrol imports

India's obsession with the consumption of the **GLP-1 class of drugs** such as **Semaglutide** and **Tirzepatide for diabetes** and **weight loss management** in the first year of introduction, often topping the charts in monthly sales, pushing aside a host of legacy drugs from the titular position

The opening of dozens of new **Global Capability Centers (GCCs)** in our Bioclusters by some of the world's topmost pharmaceutical and biotech innovation organizations to tap the immense talent of Indian professionals, employing over 300,000 of them in a short span of time.

Continued usage of Biosolutions using enzymes and microbes in the various Industrial sectors especially **textiles, detergents, food processing, animal nutrition, beverage alcohols and biofuels** apart from the identified bioeconomic value from probiotics, nutraceuticals and other fermented food ingredients has led to a surge in the BioIndustrial segment, projected to reach $121 billion by 2030.

These four emerging trends and new product areas, along with the other traditional biotechnology segments, have led to **India's BioEconomy adding $29.6 billion** in **2025** to reach **$195.3 billion** from **$165.7 billion** in **2024**. This 18 per cent growth is the highest witnessed in the last few years. Remarkably, the **national BioEconomy has more than doubled in size** from just $80 billion in 2020, in the pre-Covid era to $195.3 billion in 2025.

As the BioEconomy grows, its contribution to the national GDP has also touched a high of **4.8 per cent**, from a just 4.2-4.3 per cent share in the last few years. The sector contributed 4.8 per cent of India's GDP, reflecting the deep integration of biotechnology across manufacturing, agriculture, healthcare, industrial processing, and research services.

India's BioEconomy has entered an accelerated growth phase. In 2025, the sector reached an estimated value of $195.3 billion, reflecting strong growth across multiple biotechnology-driven industries. The BioEconomy is no longer defined solely by BioPharmaceutical or BioIndustrial. It now spans a broader industrial ecosystem where biofuels, enzyme solutions, digital biology platforms, contract research, biologics manufacturing, and agricultural biological inputs collectively contribute to national economic output.

BioEconomy developments in 2025 offer clear examples of biotechnology's growing economic impact across sectors.

1.1 Sector Drivers

1.1.1 Biofuels Expansion Industrial Biotechnology & Energy Security

India's biofuel programme has emerged as one of the clearest examples of biotechnology translating into measurable economic and strategic gains. Ethanol blending under the national energy transition strategy has accelerated rapidly in recent years, supported by investments in fermentation infrastructure, feedstock diversification, and policy incentives.

The biofuel consumption momentum that started two years ago with strong policy inputs and supply side push has continued in the current **Ethanol Supply Year (ESY) 2025–26**, where ethanol blending in petrol reached **20 per cent** in December 2025, marking a key milestone in India's blending programme.

The programme has also stimulated supply expansion across the country. For ESY 2025–26, manufacturers submitted offers totaling 17.8 billion litres of ethanol, reflecting strong production capacity across feedstocks such as sugarcane, maize, and surplus grains.

The biofuel supply data in December 2025 is an indicator of trends. Oil Marketing Companies received **1.02 billion litres** of ethanol under the Ethanol Blended Petrol programme, of which **900 million litres** were blended into petrol.

The ethanol consumption in 2025 is much higher than **13.3 billion liters in 2023-24**. A decade ago, this was hovering around **1.5 billion litres** a year. This indicates how rapidly the biofuel supply and consumption systems have scaled up within a decade.

Beyond its industrial scale, ethanol blending has

generated significant macroeconomic benefits. The programme is estimated to have resulted in foreign exchange savings exceeding **$13–14 billion** by reducing crude oil imports while simultaneously strengthening linkages between agriculture and industrial biotechnology.

From a BioEconomy perspective, biofuels illustrate how fermentation-based biotechnology can reshape traditional sectors such as energy and agriculture, making bioenergy one of the most visible pillars of India's BioIndustrial segment.

Biofuel Programme Highlights

- **20% ethanol** blending milestone
- **17.8 Billion** litres ethanol supply offers
- **Rapid scale-up** from 1.5 Billion litres a decade ago
- **$13–14B** foreign exchange savings
- Strengthening **bioenergy economy**

1.1.2 GLP-1 Therapies: BioPharmaceutical Innovation & Market Expansion

The global surge in **GLP-1 class therapies** for diabetes and obesity management has become one of the fastest-growing developments in modern pharmaceutical markets in the last three years. Drugs such as **semaglutide** and **tirzepatide**, marketed globally under brands including **Ozempic**, **Wegovy,** and **Mounjaro**, have created a rapidly expanding therapeutic category with strong demand across healthcare systems.

India too has logged on the global weight loss bandwagon. Within a few months of introduction, one of these products crossed monthly sales of ₹100 crore ($12 million). Till then the market leader antibiotics topped with monthly sales of just ₹80 crore ($9 million). GLP-1 class of drugs have been inching up the top seller list and industry data indicates it is No. 7 in the sales, despite high costs.

The best is yet to come. With many of these going off patents in 2026 and 2027, some of India's top biotech companies are preparing to make available their generic versions at 40 to 60 per cent lower costs that may spur more consumption due to better affordability.

Global sales of GLP-1 drugs crossed **$40 billion in 2024**, and industry projections suggest that the market could exceed **$100 billion** by the early **2030s**. These therapies represent a new generation of metabolic medicines that combine advances in molecular biology, peptide engineering, and clinical pharmacology.

For India, this shift carries important implications for the BioEconomy. As patents for several leading GLP-1 therapies begin to expire later in the decade, Indian pharmaceutical companies are expected to play an increasing role in biosimilar development, peptide manufacturing, and contract development services. This is expected to increase the BioPharma BioEconomy significantly in the next 2-3 years.

India's established capabilities in biopharmaceutical manufacturing, process development, and global clinical research support position the country to participate in the expanding GLP-1 ecosystem. In addition to manufacturing opportunities, Indian research and data

science teams are also contributing to clinical trials, pharmacovigilance, and regulatory documentation for global pharmaceutical companies. The rapid expansion of GLP-1 therapies therefore illustrates how advances in biotechnology can generate **new global therapeutic markets**, while simultaneously expanding opportunities for manufacturing, research services, and innovation within India's BioPharma segment.

GLP-1 Therapy Market Highlights

- **$40B** global market (2024)
- **Projected $100B+** market by early 2030s
- **Rapid uptake** in India
- **Biosimilar opportunity** for Indian BioPharma

1.1.3 Global Capability Centres: India as A Life Sciences Knowledge Hub

The development of new medicines is a long and complex process, often requiring years of laboratory research, clinical trials, and regulatory evaluation before a therapy reaches patients. Traditionally, much of this work was concentrated in a few pharmaceutical research hubs in North America and Europe.

In recent years, however, multinational pharmaceutical companies have increasingly distributed parts of this work across global networks. **Global Capability Centres (GCCs)** have emerged as a key mechanism through which companies are expanding research, analytics, and regulatory capabilities in India.

Today, India hosts **more than 150 healthcare and life sciences GCCs**, employing over **300,000 professionals** across functions such as clinical research, bioinformatics, regulatory science, data analytics, and digital health platforms. Several major pharmaceutical companies have expanded their centres in India over the past decade. **Novartis**, which established one of the earliest GCCs in Hyderabad nearly 25 years ago, has developed the center into one of its largest global hubs, supporting biomedical research, drug development, and corporate functions. Similar expansions have been undertaken by companies including **Novo Nordisk, Merck, Sanofi, AstraZeneca, Roche, and Takeda**.

Industry studies suggest that distributed R&D models supported by GCCs can **shorten drug development timelines by one to two years and reduce R&D-to-launch costs by around five per cent**. Artificial intelligence and advanced analytics are further accelerating processes such as clinical trial design, patient recruitment, and regulatory documentation.

The expansion of GCCs reflects India's growing role in the **scientific, analytical, and digital layers of the pharmaceutical value chain**, strengthening the BioServices segment of the BioEconomy.

Life Sciences GCC Ecosystem

- **150+ GCCs** in healthcare & life sciences
- **300,000+** professionals
- **Clinical research** & **bioinformatics**
- **Regulatory science** & **data analytics**
- **Digital health platforms**

1.1.4 Industrial Enzymes & Microorganisms: Continued Transformation Across Various Industrial Sectors

Industrial enzymes and microbial solutions represent a less visible but increasingly important serving as a catalysts of the BioIndustrial ecosystem moving away from the use of harsh chemicals in the conversion process. These biological catalysts are used across a wide range of industries to improve efficiency, reduce chemical inputs, and lower energy consumption.

Enzyme technologies continued to be vastly deployed in sectors including **textiles, detergents, food processing, animal nutrition, beverage alcohol and biofuels**.

In the food and dairy industry, enzymes are used to enhance processing efficiency in brewing, baking, and dairy production. Similarly, the animal nutrition sector increasingly relies on feed enzymes to improve nutrient absorption and reduce feed costs.

These technologies are also important in fermentation-based industries such as biofuels and food biotechnology, where enzymes play a critical role in converting agricultural feedstocks into industrial products.

Although the enzymes and microorganisms market is smaller than pharmaceutical manufacturing or biofuels in absolute value, its applications illustrate the diffusion of biotechnology across traditional industrial systems. By enabling cleaner and more efficient production processes, enzymes are quietly reshaping manufacturing practices across multiple sectors, not only protecting the environment but also significantly increases the yield of any biotech product manufacturing.

Within India's BioEconomy, enzyme technologies therefore represent an important example of how **industrial biotechnology is penetrating everyday production systems**, contributing to the expansion of the BioIndustrial segment.

Industrial Enzymes Key Applications

- Textiles & fabric finishing
- Food & dairy processing
- Detergents & cleaning products
- Animal nutrition
- Biofuels & fermentation technologies

1.2 Ecosystem

1.2.1 Investment and Capital Landscape

Above all, investments continue to flow into innovative biotech companies. A $4.6 billion with disclosed funding in over 200 transactions have happened in the sectors in 2024 and 2025. These include strategic investments and exits in 2025 with 100 deals totaling $1.58 billion, reflecting sustained investor engagement despite a moderation in global venture capital activity. At the same time, 45 private equity exits with disclosed value exceeding $6.15 billion indicate growing investor confidence and increasing liquidity in the sector.

India's BioEconomy ecosystem continues to attract strong investor interest across healthcare, biotechnology, agritech, and emerging bioindustrial technologies. Investment activity remained concentrated in major innovation hubs such as Bangalore, Mumbai, Hyderabad, and Delhi NCR, supported by strong research institutions, biotechnology clusters, and vibrant startup ecosystems. Early-stage angel investors also continued to strengthen the innovation pipeline, particularly in biotechnology, diagnostics, and medical devices

Investment Highlights

- 208 deals
- $4.6 bn investment
- $1.58 bn in 2025
- 45 exits
- $6.15 bn disclosed exit value

1.2.2 Biotechnology Startup Ecosystem

India's biotechnology startup ecosystem continued to strengthen in **2025**, with the cumulative number of registered biotech startups rising to **11,855** from **10,075** in **2024**. The increase reflects sustained entrepreneurial activity across **therapeutics**, **diagnostics**, **agricultural biotechnology**, **industrial biotechnology**, and **digital life sciences**. In 2025 alone, **1,780 new biotech startups** were established, compared with **1,544 in 2024**, representing growth of roughly **15 percent**. Startup formation remained concentrated in leading innovation hubs such as **Maharashtra, Karnataka, and Telangana**, while **Delhi, Uttar Pradesh, Gujarat**, and **Tamil Nadu** also played important roles in nurturing new ventures. This steady pipeline of startups highlights the growing depth of India's life sciences innovation ecosystem, supported by research institutions, incubators, and expanding industry collaboration, and signals a **maturing environment for technology commercialization and scaling biotechnology innovation.**

Startup Highlights

- 11,855 total biotech startups
- 1,780 new startups in 2025
- 1,544 in 2024
- 15% growth

1.2.3 Policy Landscape Strengthening India's Bioeconomy

India's BioEconomy continues to benefit from a strengthening policy environment aimed at accelerating biotechnology innovation, expanding advanced biomanufacturing, and improving research commercialization. Recent national initiatives signal a strategic shift toward high-value biotechnology segments including biologics, advanced therapeutics, precision fermentation, and next-generation diagnostics.

A key development is the BioPharma SHAKTI programme, with an outlay of $1.2 Billion (₹10,000 crore) to enhance India's capabilities in next-generation biopharmaceuticals and expand clinical research infrastructure. Complementing this, the Research, Development and Innovation (RDI) Fund, valued at $11.6 Billion (₹1 lakh crore), will support deep-tech innovation across sectors including biotechnology.

Regulatory reforms—such as the 2025 Guidelines on Genetically Engineered Plants Containing Stacked Events and new DBT research commercialization guidelines—are expected to further accelerate innovation, technology transfer, and industry collaboration.

Policy Highlights

- $1.2 Billion BioPharma SHAKTI
- $11.6 Billion RDI Fund
- GE plant regulatory framework
- Strengthened research commercialization ecosystem

1.2.4 BIRAC – Supported Innovation Strengthening India's Biotechnology Ecosystem

Programmes supported by the Biotechnology Industry Research Assistance Council (BIRAC) continue to advance India's biotechnology innovation ecosystem through funding for startups, translational research, and technology commercialization. These initiatives—combining early-stage grants, industry–academia collaborations, and commercialization support—have helped bridge laboratory research to market-ready technologies.

Flagship programmes including the Biotechnology Ignition Grant (BIG), SBIRI, BIPP, and commercialization initiatives have strengthened the innovation pipeline across healthcare, agriculture, industrial biotechnology, and diagnostics. BIRAC's nationwide network of biotechnology incubation centres has further enabled academia–startup–industry partnerships, supporting the emergence of new enterprises and technologies.

Together, these efforts have contributed to stronger intellectual property generation, startup creation, and product development, reinforcing the foundations of India's BioEconomy.

BIRAC Impact Highlights

- 1000+ innovations supported
- 550+ cities reached
- 5000+ startups supported
- 1350+ IP filings
- 900+ products developed

1.2.5 India's Bioeconomy: Entering An Accelerated Growth Phase

The developments highlighted across biofuels, biopharmaceuticals, digital life sciences, and industrial biotechnology illustrate the expanding role of biotechnology across multiple sectors of the economy. Biofuels derived from industrial biotechnology are strengthening energy security. New biopharmaceutical therapies are creating rapidly expanding global markets. Digital platforms and global capability centres are linking India more closely with worldwide research and innovation networks. At the same time, industrial enzymes are improving efficiency across manufacturing systems ranging from textiles and food processing to bioenergy production.

Together, these trends point to a BioEconomy that increasingly operates as an integrated system rather than a collection of isolated sectors. Manufacturing-led segments continue to anchor scale, while services, digital capabilities, and advanced therapeutics are expanding rapidly within the broader ecosystem.

India has set an ambition of building a $300 billion BioEconomy by 2030, and the trajectory observed over the past five years suggests that this milestone is well within reach. If current growth trends continue, the BioEconomy could potentially cross the $300 billion threshold before the end of the decade.

Looking further ahead, India has an opportunity to aim at a long-term vision of building a $1 trillion BioEconomy by 2047. India's BioEconomy is therefore evolving from a specialized biotechnology sector into a broad-based bio-industrial and knowledge economy , with growing implications for economic growth, employment generation, and global leadership.

Growth Outlook

- $195.3B BioEconomy value
- 18% growth in 2025
- $300B target by 2030
- $1T vision by 2047
- expanding innovation ecosystem

Chapter 2

2 India BioEconomy at a Glance

2.1 Size and Growth Overview (2020–2025)

India's BioEconomy reached a value of **$195.3 billion in calendar year 2025**, compared to **$165.7 billion** in **2024**, reflecting a year-on-year growth of **18 per cent**. The nearly $29.6 billion in 2025 increase was one of the largest annual growth in the past five years.

The BioEconomy demonstrated sustained growth over the medium term. Between 2020 and 2025, the sector more than doubled in size, expanding from **$86.0 billion** in **2020** to **$195.3 billion** in **2025.** This represents a compounded annual growth rate (CAGR) of **17.8 per cent** over the five-year period, underscoring the increasing integration of biotechnology across manufacturing, agriculture, healthcare, industrial processing and research services.

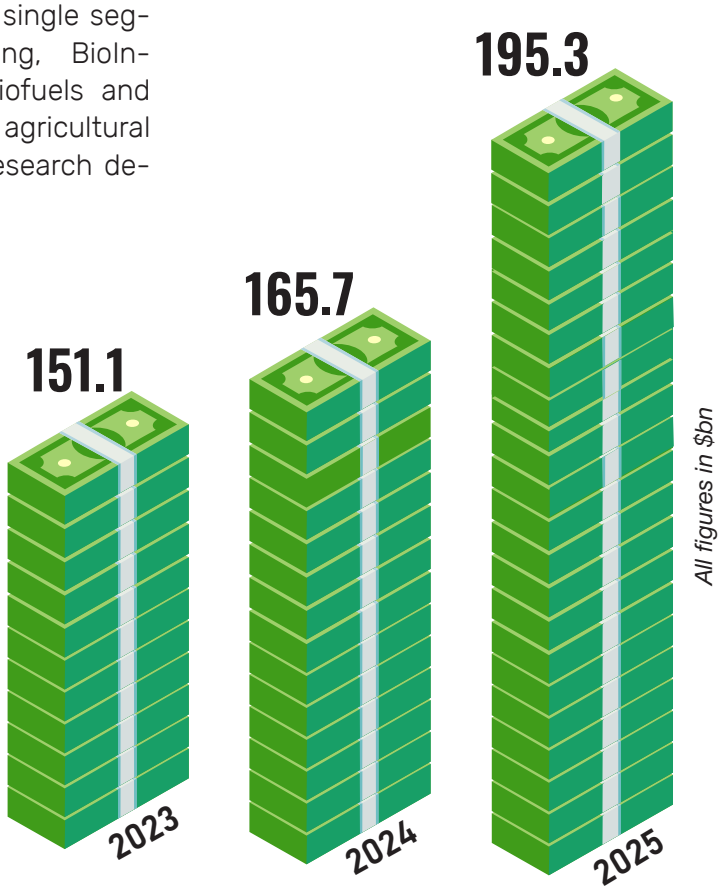
The growth was not limited to a single segment. BioPharma manufacturing, BioIndustrial production, including biofuels and fermentation-based outputs, agricultural biological inputs, and contract research development services all contributed to the upward trajectory. The services component of the BioEconomy continued to gain relative importance, reflecting a gradual shift towards higher value-added and research-intensive activities.

The 2025 figure also incorporates the inclusion of Fermented Food Ingredients, Nutraceuticals, and Food Supplements as a subsegment in BioIndustrial vertical, which contributed **$4.3 billion** to the overall total. Growth remained consistent across established verticals, reflecting steady momentum in the BioEconomy.

All figures presented in this report are based on calendar year estimates and are expressed in US dollar terms.

India's BioEconomy Growth 2023-2025

India's BioEconomy grew from **$165.7 billion** in **2024** to **$195.3 billion** in **2025**, reflecting **18%** year-on-year growth.



2.2 Historical Growth Trajectory (2020–2025)

The growth of India's BioEconomy over the past five years showed a sustained expansion across multiple segments of the life sciences and bio-led industry ecosystem.

The BioEconomy was valued at **$86.0 billion** in **2020,** rising to **$106.3 billion** in **2021**, representing a significant post-pandemic acceleration, driven by vaccine production, biopharmaceutical manufacturing scale-up, and heightened global demand for biotechnology-enabled solutions. The upward trajectory continued in 2022, when the sector expanded to **$137.2 billion**, marking one of the strongest annual growth phases in recent years.

Growth moderated in 2023, with the BioEconomy reaching **$151.1 billion**, reflecting normalization in pandemic-linked demand and adjustments in global supply chains. However, expansion resumed in 2024, with the sector increasing to **$165.7 billion**, supported by bio-industrial output, contract research services, and agricultural biological inputs.

In 2025, the BioEconomy reached **$195.3 billion**, entering a new acceleration phase while staying on its medium-term growth path. Over the period from 2020 to 2025, the sector recorded a **compounded annual growth rate (CAGR) of 17.8 per cent**, underscoring its increasing contribution to industrial output, research intensity, and biomanufacturing capacity in India.

Growth has shifted from pandemic stimulus to drivers like expanded manufacturing, services exports, and integration of biotechnology across industrial value chains.

2.3 Segment Composition and Structural Shift

The composition of India's BioEconomy in 2025 reflected both expansion of scale and gradual evolution across its major segments. In 2025, **BioIndustrial** remained the largest segment, valued at **$90.2 billion**, followed by **BioPharma** at **$64.5 billion**. **BioServices** accounted for **$26.0 billion**, while **BioAgri** contributed **$14.6 billion**.

Compared to 2024, the BioEconomy's structure reflected two changes. BioServices saw an absolute increase from contract research, clinical development, biotechnology-enabled solutions, and life sciences Global Capability Centers (GCCs) now better represented. The Fermented Food Ingredients, Nutraceuticals, and Food Supplements subsegment was newly identified and included in the BioIndustrial segment, capturing previously under-represented areas.

While BioIndustrial and BioPharma continued to account for the majority share of total value, the relative contribution of knowledge-intensive and service-driven segments increased gradually. This shift suggests a maturing ecosystem where manufacturing capacity, research services, agricultural biotechnology inputs, and healthcare solutions operate within an increasingly integrated value chain.

The segment-wise contribution in 2025 also highlights diversification in growth drivers. Incremental expansion was not concentrated in a single vertical; rather, multiple subsegments recorded measurable gains. The cumulative increase of **$29.6 billion** between 2024 and 2025 was distributed across industrial manufacturing, biopharmaceutical production, research services, agricultural biological inputs, and the newly incorporated industries. This structural broadening enhances resilience, reduces dependence on any one industry category, and strengthens the BioEconomy's role within India's broader industrial and innovation landscape.

2.4 Contribution to National GDP

India's nominal Gross Domestic Product (GDP) has been estimated at **₹355.25 lakh crore ($4.1 trillion) in calendar year 2025**. It was **₹316.98 lakh crore ($3.8 trillion) in calendar year 2024**. The BioEconomy's contribution to the national GDP has increased significantly to **4.8 per cent** in **2025** at a BioEconomy value of **$195.3 bn** against **4.4 per cent** in **2024**. BioEconomy's contribution to GDP in 2023 was 4.2 per cent. These numbers indicate a continuing growth phase of national BioEconomy.

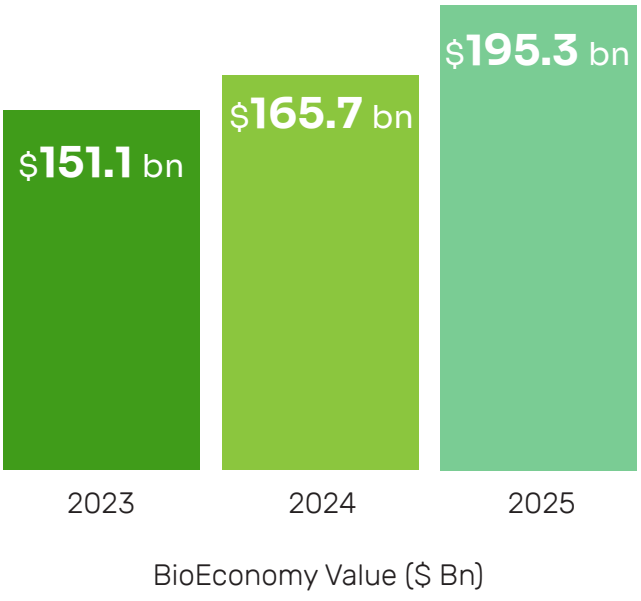
As such, its economic impact extends beyond a single industrial classification and intersects with manufacturing, services, and primary sector activities.

The gradual increase in GDP share over the past five years indicates that biotechnology and bio-based production are becoming more deeply embedded within India's economic structure. Sustained expansion in this segment has implications for industrial diversification, export competitiveness, and innovation-led growth.

(All GDP comparisons presented in this section are based on nominal values and current exchange rate conversions.)

Year	BioEconomy Value ($ Bn)	Nominal GDP ($ Tn)	Share of GDP (%)
2023	151.1	3.6	4.2
2024	165.7	3.8	4.4
2025	195.3	4.1	4.8

Note: GDP figures refer to nominal GDP at current prices (Financial Year). BioEconomy values refer to calendar year estimates. Percentages rounded to one decimal place.



BioEconomy Value ($ Bn)

2.5 Employment and Enterprise Base

The expansion of India's BioEconomy over the past five years has been accompanied by a steady increase in employment, across biotechnology-enabled manufacturing, research services, agricultural biological inputs, and health-related bio-products.

In 2025, core biotechnology enterprises are estimated to have employed **350,000–400,000 professionals,** compared to roughly **300,000 in 2024**. These roles include scientific researchers, manufacturing personnel, regulatory specialists, quality assurance professionals, and technical staff engaged in biopharmaceutical production, industrial biotechnology, and agricultural biotechnology operations.

Beyond core biotechnology firms, the broader life sciences and pharmaceutical ecosystem—including pharmaceutical manufacturing, clinical research, contract development and manufacturing services, and associated supply chains—harbored 3.0–3.5 million professionals in 2025, up from 2.5–3.0 million in 2024. This reflects growth in production capacity and services activities.

The academic and public research ecosystem, including universities, research laboratories, and publicly funded biotechnology institutes, supports an additional estimated **50,000–75,000 researchers and academic professionals**. This segment plays a foundational role in knowledge generation, translational research, and skill development for the broader BioEconomy.

In addition to direct employment, the BioEconomy supports indirect and induced employment through manufacturing supply chains, logistics networks, input providers, regulatory services, and distribution channels.

On the new startup registrations front, India's biotechnology ecosystem continues to expand. The total number of registered biotechnology startups is estimated to be in the range of **1,700 enterprises**, reflecting steady growth in innovation-led ventures across therapeutics, diagnostics, agricultural biotechnology, industrial enzymes, and digital bio-services. A detailed assessment of startup growth, funding patterns, and incubation infrastructure is presented in subsequent chapters.

The combined expansion of employment and enterprise activity indicates that the BioEconomy is evolving from a niche innovation sector into a broader industrial and services ecosystem with measurable workforce depth and institutional capacity.

In 2025, core biotechnology enterprises are estimated to have employed 350,000–400,000 professionals, compared to roughly 300,000 in 2024

2.6 Investment and Capital Formation

Investment inflows into the pharmaceutical and medical technology segments continued to support the expansion of India's BioEconomy in 2024 and 2025.

The foreign direct investment (FDI) inflows in the **Drugs and Pharmaceuticals** amounted to **$0.9 billion** in **FY 2024–25** (**₹7,500 crore**), following $1.1 billion in FY 2023–24 and a peak of roughly $2.0 billion in FY 2022–23. In FY 2025–26 (up to September 2025), inflows had already reached **$1.3 billion (₹10,948 crore)**, indicating the possibility of a recovery in annual investment levels.

The **Medical Technology (MedTech) segment** recorded a sustained increase in FDI over recent years. Inflows rose from $0.1 billion in FY 2020–21 to nearly **$0.6 billion** in **FY 2024–25** (**₹5,253 crore**). In FY 2025–26 (up to September 2025), it registered additional inflows of roughly $0.3 billion (₹2,245 crore). The upward trajectory reflects growing investor interest in domestic manufacturing of medical devices, diagnostics, and healthcare-linked technologies.

Taken together, annual FDI inflows into pharmaceuticals and medical technology have ranged broadly between **$1.0–2.5 billion** in recent years, depending on project approvals and sectoral cycles. These flows reinforce India's position as a globally integrated manufacturing and research destination within the life sciences value chain.

In parallel with private capital inflows, targeted policy interventions have strengthened domestic capacity formation. Under the **Production Linked Incentive (PLI) Scheme for Bulk Drugs**, realized investments exceeded **$0.5 billion (₹4,250 crore)** by December 2024, with 34 projects commissioned. Similarly, the **PLI Scheme for Medical Devices** supported investments and production expansion amounting to nearly **$0.7 billion in reported production value (₹5,889 crore)** across approved applicants.

The pharmaceutical bulk drugs segment also transitioned from a net import position in FY 2021–22 to a net export surplus in FY 2024–25, reflecting improved domestic capacity and value addition. Sales under the pharmaceutical PLI scheme crossed **$32 billion (₹2.66 lakh crore)** during its first three years, including exports valued at roughly **$20 billion (₹1.70 lakh crore)**. Reported domestic value addition in the sector reached **83.7 per cent** as of **March 2025**.

These trends indicate strengthening manufacturing depth, improved self-reliance in critical inputs, and continued integration of India's BioEconomy within global production networks.

Annual FDI inflows into pharmaceuticals and medical technology have ranged broadly between $1.0–2.5 billion in recent years. These flows reinforce India's position as a globally integrated manufacturing and research destination within the life sciences value chain

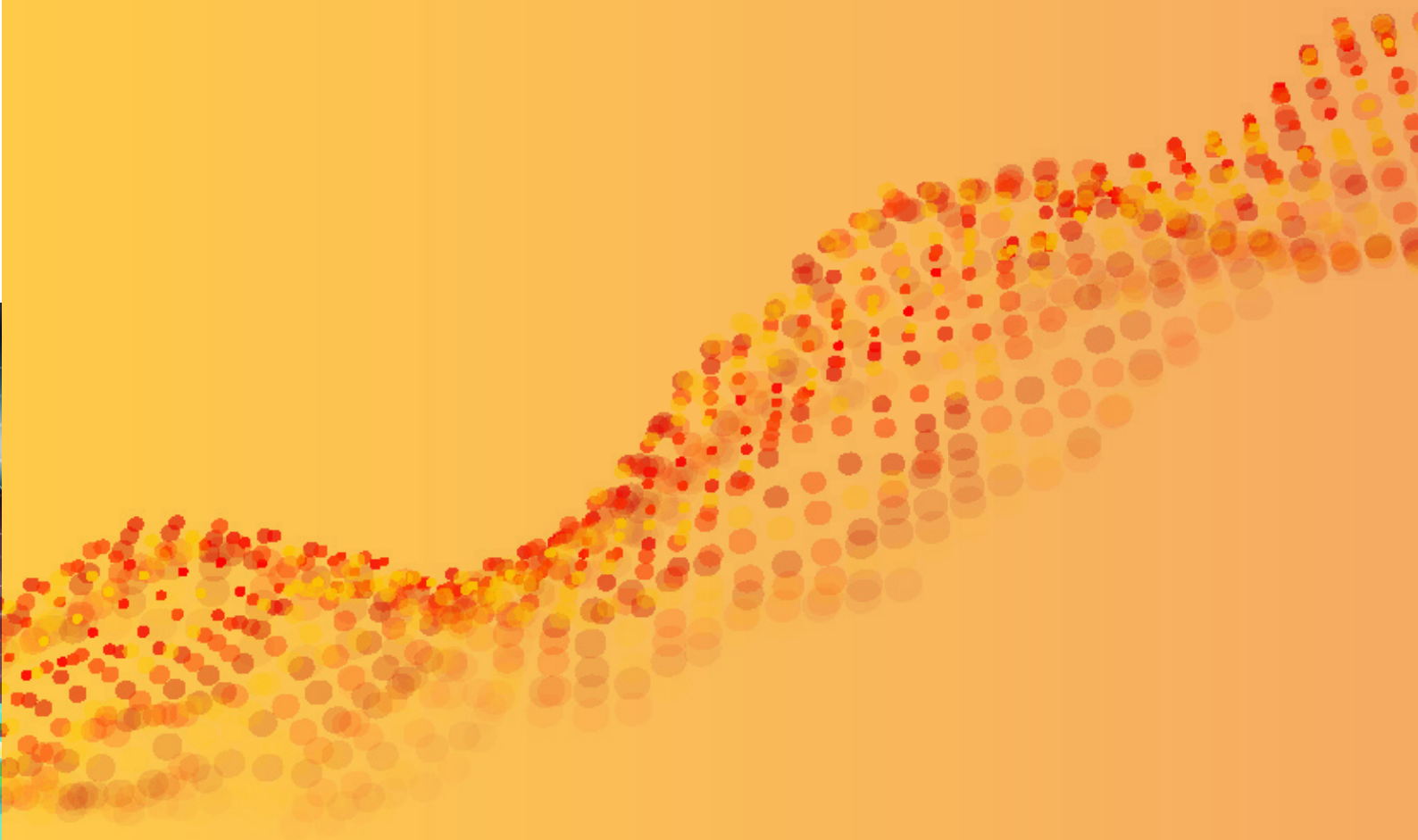
2.7 Beyond Cyclic Growth

The expansion of India's BioEconomy to **$195.3 billion** in 2025, representing nearly **4.8 per cent of national GDP**, indicates more than cyclical growth. The growth profile in 2025 was broad-based. Manufacturing-oriented segments such as BioIndustrial and BioPharma continued to anchor scale, while contribution of BioServices to the overall pie, signals a gradual shift toward higher value-added and knowledge-intensive activities.

Investment inflows, policy-linked incentives, improved domestic value addition, and strengthening of export performance beyond bulk drugs have collectively reinforced the production base of the sector. Employment growth across core biotechnology enterprises and the broader life sciences ecosystem underscores its rising contribution to India's industrial workforce.

The subsequent pages analyze the regional distribution, sector-specific performance, innovation ecosystem dynamics, and policy implications underlying this expansion.

REGIONAL ANALYSIS



Chapter 3

3 Regional Contribution to BioEconomy

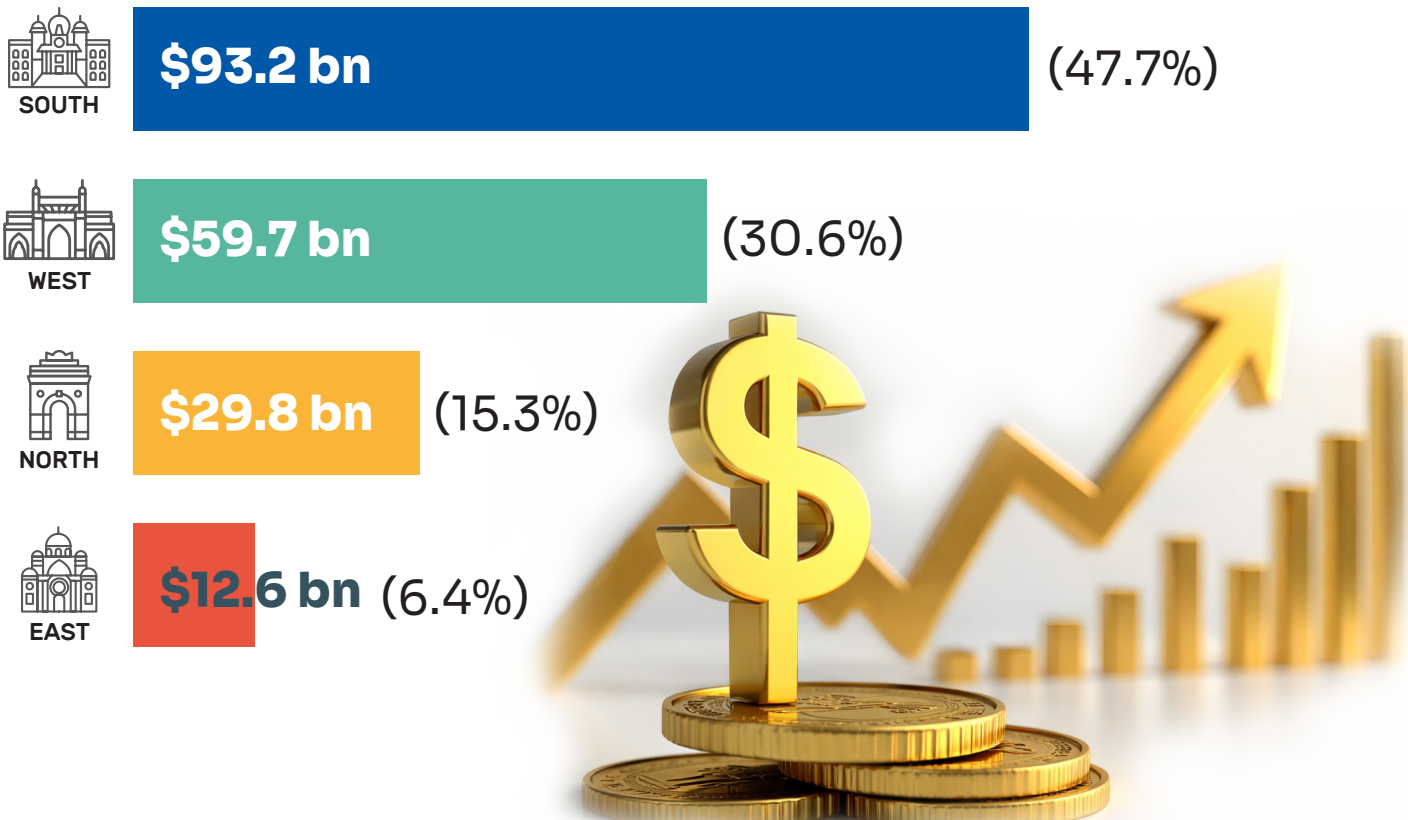
3.1 Regional Contribution

India's BioEconomy shows strong regional concentration, with economic activity clustered predominantly in the southern and western regions of the country.

In 2025, the **Southern region accounted for $93.2 billion**, representing nearly **47.7 per cent** of the national BioEconomy. The **Western region** contributed **$59.7 billion**, or **30.6 per cent** of the total BioEconomy. Together, these two regions represented over **78 per cent** of national BioEconomy output. The **Northern region** made up for **$29.8 billion (15.3 per cent)**, while the **Eastern region**, including the North East, contributed **$12.6 billion (6.4 per cent)**.

This distribution reflects the cumulative effects of long-term investments in biotechnology clusters, industrial ecosystems, research institutions, pharmaceutical manufacturing capacity, and services infrastructure concentrated primarily in the South and West.

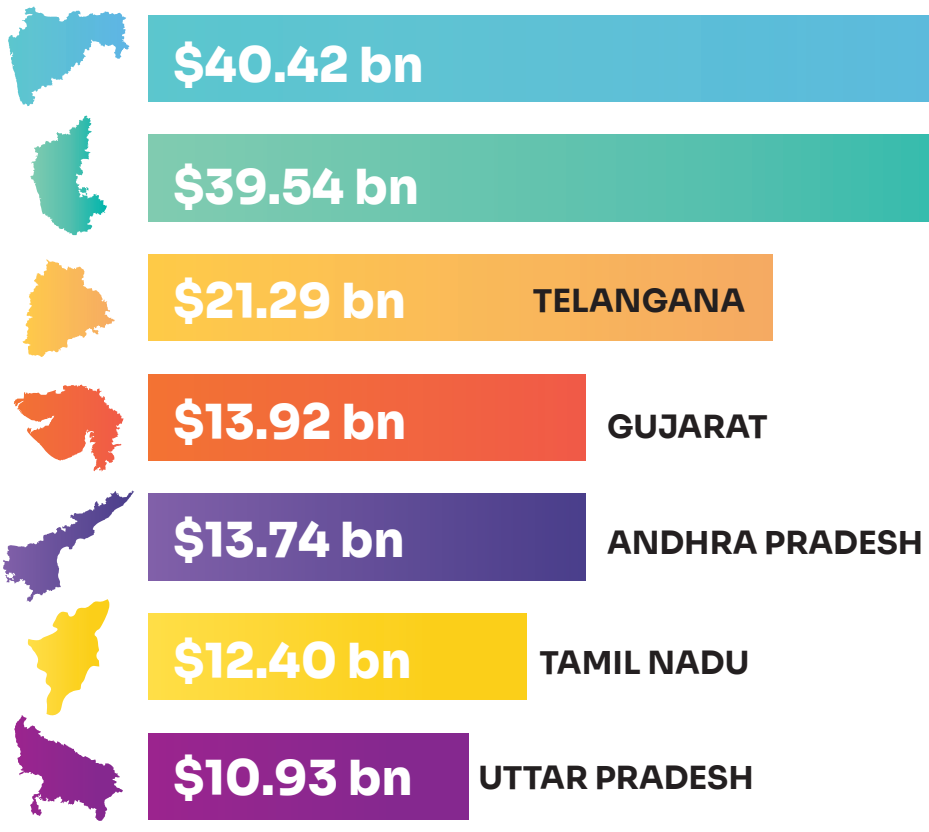
Regional contribution to BioEconomy 2026



3.2 Regional Concentration and Scale Thresholds

Seven states individually exceed the $10 billion BioEconomy threshold, together accounting for **$152.36 billion**, or **78 per cent** of national output. This concentration reflects the presence of established life sciences clusters, advanced manufacturing capacity, skilled workforce pools, and strong research infrastructure in select geographies. A threshold-based classification further reveals a tiered scale structure. **Three states exceed the $20 billion mark**, collectively contributing **$101.25 billion**, or more than **51 per cent** of national BioEconomy output. These Tier 1 states represent mature and diversified ecosystems combining pharmaceutical production, industrial biotechnology, research capability, and services depth. A second group of four states falls within the **$10–20 billion range**, contributing **$50.99 billion**. These Tier 2 states reinforce national scale through strong segment specialization and expanding industrial capacity. All remaining states together account for **$43.05 billion**, representing just over **22 per cent** of total BioEconomy. While individually smaller in scale, this group constitutes the widening base of India's BioEconomy and signals the gradual diffusion of biotechnology-enabled activity beyond the primary clusters.The tiered structure underscores a dual dynamic: concentration within mature industrial hubs alongside broadening geographic participation. This balance supports scale efficiency while strengthening resilience across the national landscape.

Top 7 States contributing to 78% of the BioEconomy in 2025



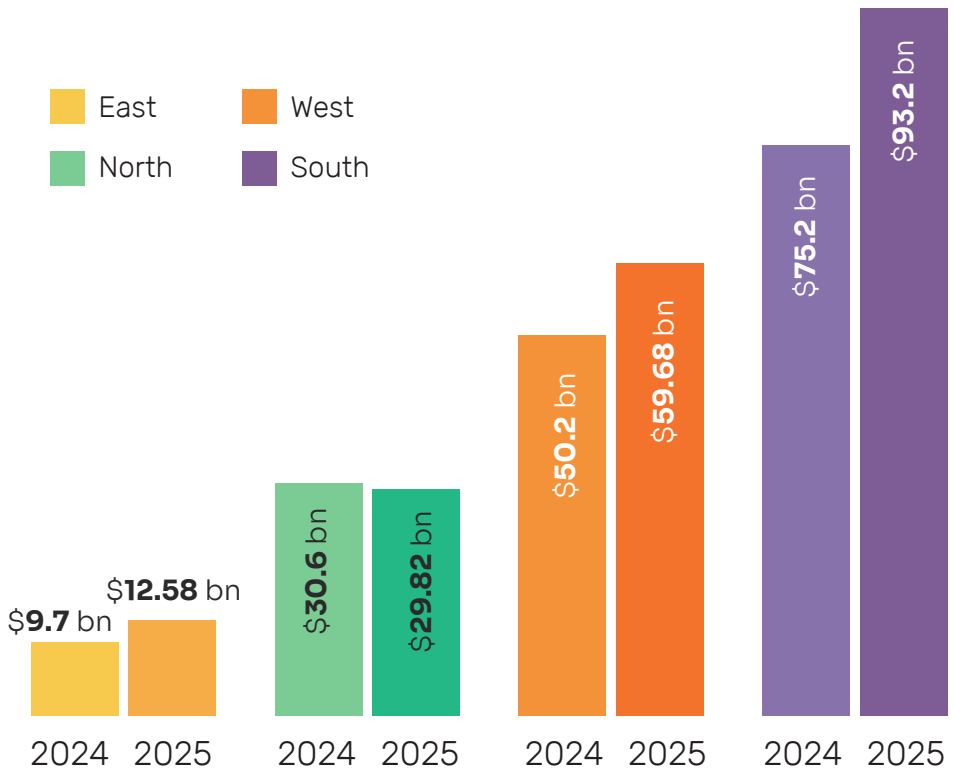
3.3 Regional Growth Momentum (2024–2025)

Between 2024 and 2025, India's BioEconomy expanded by **$29.6 billion**, rising from **$165.7 billion** to **$195.3 billion**. The expansion was regionally concentrated, with the **Southern and Western regions** accounting for the majority of the growth.

The **Southern region recorded the largest absolute increase**, growing from **$75.2 billion** in **2024** to **$93.2 billion** in **2025** — an increase of nearly **$18.0 billion**. This accounted for roughly **60 per cent of total national growth** during the year, reinforcing the South's position as the primary growth engine of the BioEconomy. The **Western region contributed $9.5 billion in value**, representing about **32 per cent of the national increase**. Its overall share remained broadly stable at 30–31 per cent of national output.

The **Eastern region expanded from $9.7 billion to $12.6 billion**, reflecting an increase of **$2.9 billion**. While smaller in absolute scale, this represents a proportionally significant expansion relative to its base. The **Northern region's** share of the national BioEconomy adjusted from **18.5%** in **2024** to **15.3%** in **2025**. The 2025 expansion therefore reflects increasing geographic concentration of high-value BioEconomy activity in the Southern and Western regions, alongside emerging but smaller gains in the Eastern region.

Regional Growth in India's BioEconomy 2025



3.4 Segment Orientation by Region

The regional distribution of India's Bio-Economy in 2025 reflects distinct segment strengths shaped by industrial depth, research infrastructure, agricultural linkages, and services ecosystems.

The **Southern region** exhibits the most diversified structure across all four segments. With **$43.4 billion in BioIndustrial output and $28.8 billion in BioPharma**, the region combines manufacturing scale with strong biopharmaceutical production capacity. In addition, BioServices contributes **$16.8 billion**, indicating significant research, contract development, and knowledge-intensive activity. Overall, the South represents a balanced manufacturing-and-services ecosystem within the national BioEconomy.

The **Western region** demonstrates a strong biopharmaceutical orientation, with **$26.9 billion in BioPharma** activity, complemented by **$19.0 billion in BioIndustrial** output. **BioAgri** contributes nearly **$8.0 billion**, reflecting agricultural biotechnology and biological input production. Compared to the South, the Western region has a relatively smaller services component, suggesting a manufacturing intensive profile with strong pharmaceutical depth.

The **Northern region** displays a more concentrated structure, with BioIndustrial output of **$18 billion** forming the largest share of its regional total. **BioPharma** contributes **$6.8 billion**, while BioAgri and BioServices represent smaller but notable components. The regional profile suggests industrial and agro-linked strengths, with comparatively lower representation in services-intensive segments.

The **Eastern region**, including the North East, remains smaller in absolute scale but shows a clear concentration in BioIndustrial activity, which accounts for the majority of its **$9.9 billion** regional total. BioServices are present but limited in scale. The structure indicates an emerging profile with manufacturing-led participation.

The 2025 region-wise segment distribution reflects both geographic clustering and diversification. While manufacturing-oriented segments—particularly BioIndustrial and BioPharma—anchor most regions, services-intensive and health-linked segments are more unevenly distributed.

Segment Contribution by Region (2025)

Region	BioAgri	BioIndustrial	BioPharma	BioServices	Total
South	4.2	43.42	28.8	16.78	**93.2**
West	7.98	18.91	26.89	5.9	**59.68**
North	2.33	18	6.76	2.73	**29.82**
East	0.07	9.91	2.04	0.56	**12.58**

All figures in $bn

3.5 Scale Clusters and Emerging Hubs

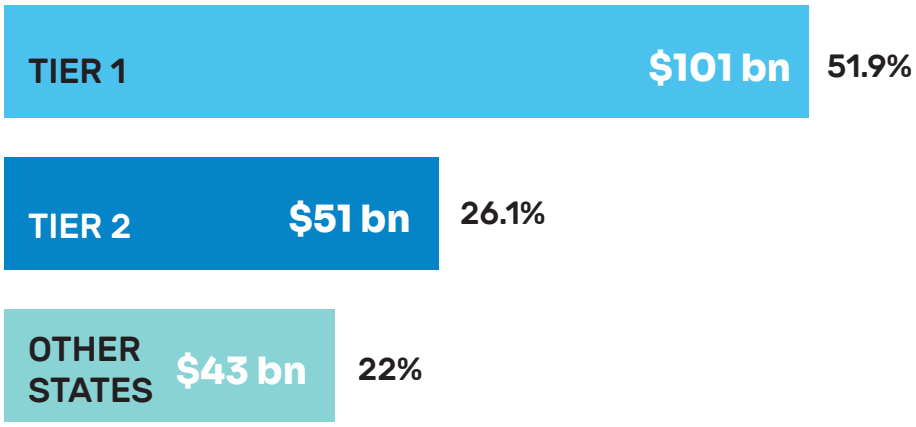
India's BioEconomy in 2025 reflects a tiered scale structure at the state level, indicating differentiated ecosystem maturity across geographies. A threshold-based classification highlights three distinct scale clusters.

Tier I states (**Maharashtra, Karnataka & Telangana**) individually exceed the $20 billion mark and represent the largest concentrations of BioEconomy activity. These states combine strong pharmaceutical manufacturing bases, industrial biotechnology capacity, established research institutions, and significant services ecosystems. Together, they account for a substantial portion of national output and serve as anchor nodes within India's life sciences landscape.

Tier II states (Gujarat, Andhra Pradesh, Tamil Nadu & Uttar Pradesh), falling broadly within the $10–20 billion range, demonstrate strong sectoral depth but comparatively narrower diversification. These states typically exhibit strengths in specific verticals such as pharmaceutical manufacturing, industrial biotechnology, or agricultural biologicals. Their contribution reinforces regional balance while expanding manufacturing and services capabilities beyond the primary clusters.

States below the $10 billion threshold collectively account for **$43.05 billion**, or about **22 per cent of national BioEconomy output**. While individually smaller in scale, this group represents an important expansion frontier. Emerging hubs within this category are witnessing incremental capacity creation, particularly in bioindustrial processing, agricultural biotechnology inputs, and selected research and services activities.

Tier based Bioeconomy (2025)



Source: ABLE

3.6 Geographic Concentration and Diffusion

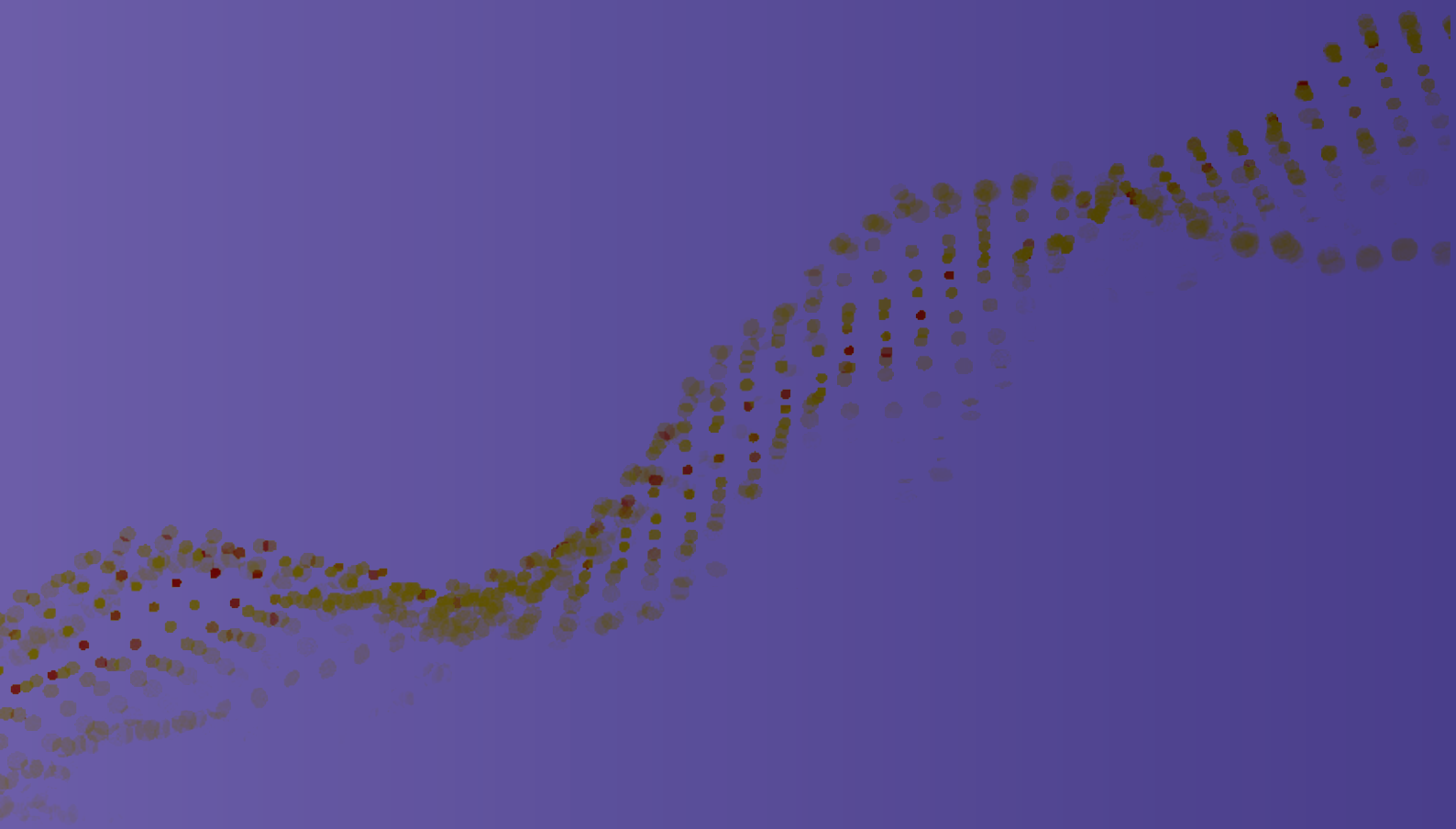
India's BioEconomy in 2025 indicates a dual structural dynamic: strong concentration within established industrial clusters alongside gradual geographic expansion. The Southern and Western regions continue to anchor national output, supported by accumulated manufacturing capacity, research depth, and integration with global value chains.

At the same time, incremental growth across additional states and regions signals widening participation within the national landscape. While smaller in absolute scale, activity in the Northern and Eastern regions contributes to structural diversification and long-term expansion potential. The increase observed in the Eastern region during 2025 points to emerging manufacturing capabilities and expanding industrial participation.Concentration within mature clusters supports scale efficiencies, innovation intensity, and export competitiveness. Broader diffusion, in turn, enhances systemic resilience, reduces dependence on a limited number of production centres, and enables the formation of new industrial ecosystems.

The inclusion of Fermented Food Ingredients, Nutraceuticals, and Food Supplements subsegment in 2025 expands the scope of definition of the BioEconomy without materially altering its geographic structure. Instead, it establishes the importance of diversified regions that integrate manufacturing, services, and health-linked bio-products within cohesive ecosystems.

The resulting national pattern balances scale with spread — a configuration that strengthens stability while sustaining growth momentum.

SEGMENT INSIGHTS



Chapter 4

4 Segment Structure and Growth

4.1 Segment Composition in 2025

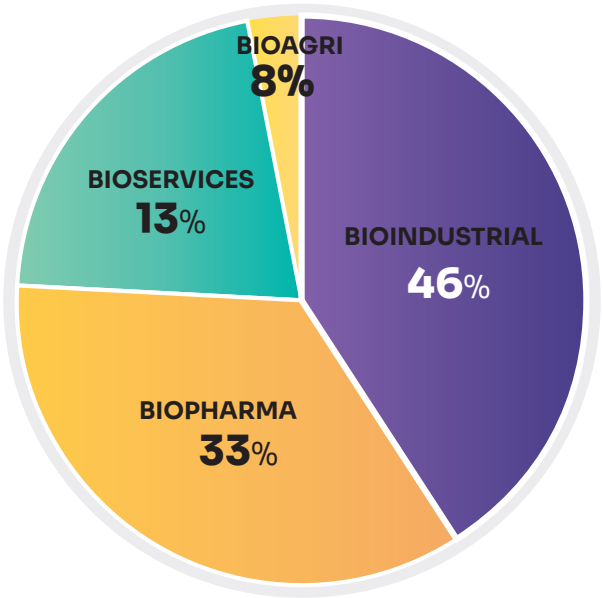
India's BioEconomy expanded to **$195.3 billion in 2025,** reflecting continued scale of consolidation across manufacturing, agricultural biotechnology, and knowledge-intensive services. The segment composition shows a diverse ecosystem rooted in BioIndustrial, BioPharma, and BioAgri operations. It draws growing support from knowledge areas like contract research (CROs), contract development and manufacturing (CDMOs), BioDigital, Life Science GCCs. This mix reflects balanced expansion across industrial, agricultural, pharmaceutical, and service-based activities.

BioIndustrial remained the largest component at **$90.2 billion**, accounting for approximately **46 per cent** of total BioEconomy value. The segment encompasses industrial biotechnology, biofuels, Fermented Food Ingredients, Nutraceuticals and Food Supplements, and other bio-based industrial applications that collectively form the production backbone of the ecosystem.

BioPharma followed at **$64.5 billion**, representing roughly **33 per cent** of total value. The segment continues to play a central role in export-oriented manufacturing, domestic therapeutic supply, biosimilars, vaccines, and biologics production.

BioServices contributed **$26.0 billion**, or approximately **13 per cent** of total value. This segment includes contract research, enterprise services, clinical research, digital integration, and related life sciences support functions.

BioAgri accounted for **$14.6 billion** (**7.5 per cent**), reflecting steady activity across agricultural biological inputs, crop biotechnology, and allied applications. Grouped together, manufacturing-oriented segments (BioIndustrial and BioPharma) continue to account for nearly three-quarters of total BioEconomy value, underscoring the centrality of productionbased scale within India's bio-based economy.



Segment wise growth 2023-25

4.2 Growth Dynamics: 2024–2025

Between 2024 and 2025, the **BioEconomy** expanded by approximately **$29.6 billion**, representing broad-based growth across segments.

BioIndustrial increased from **$78.2 billion** to **$90.2 billion**, registering **15 per cent** growth. The expansion reflects continued industrial biotechnology deployment and capacity augmentation across bio-based production streams.

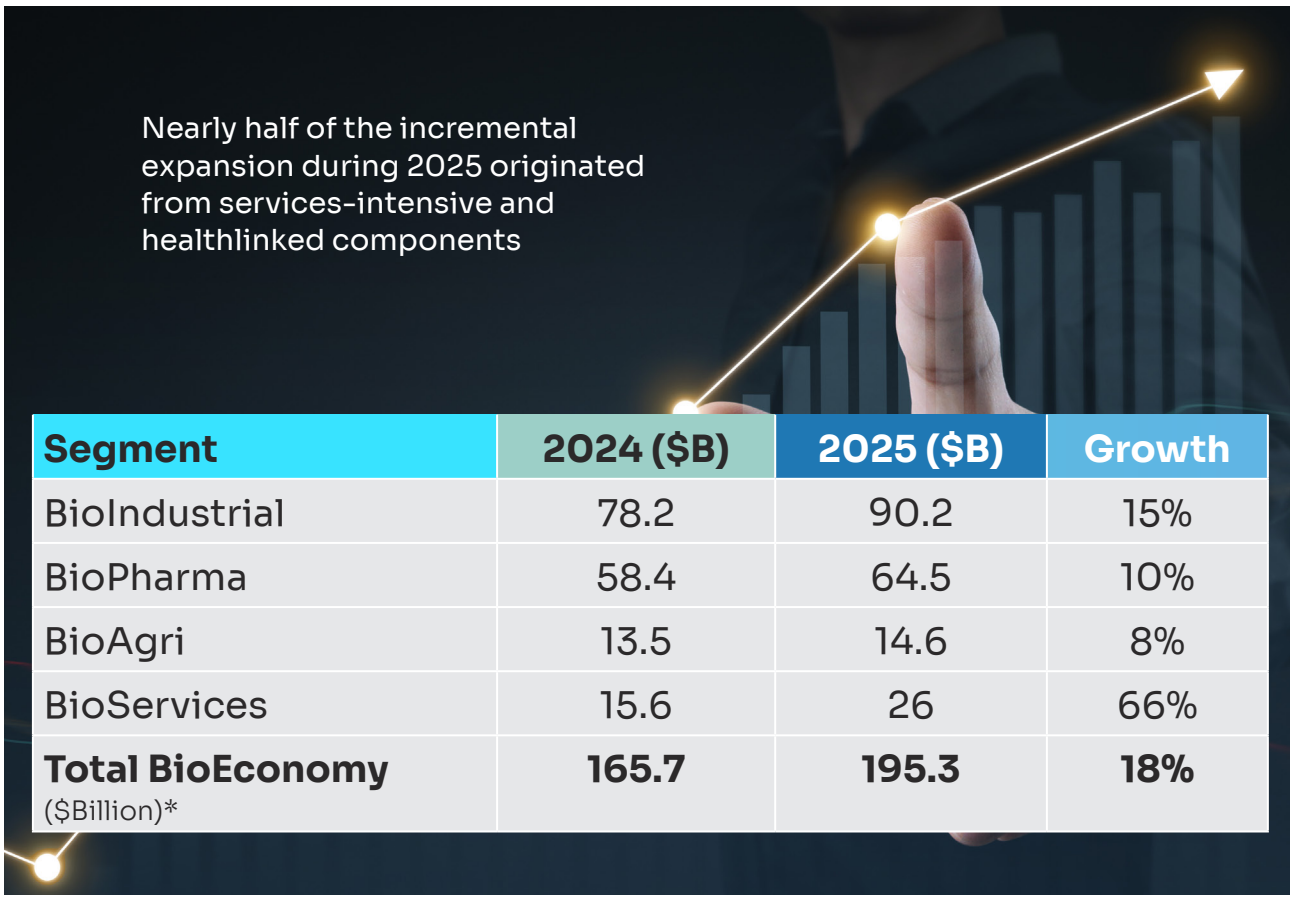
BioPharma grew from **$58.4 billion** to **$64.5 billion**, reflecting growth of roughly **10.4 per cent**. The segment maintained momentum across therapeutic manufacturing, export activity, and biologics capacity expansion.

BioAgri increased from **$13.5 billion** to **$14.6 billion**, registering growth of approximately **8 per cent**, reflecting steady demand in agricultural biological inputs and related segments.

BioServices recorded the most significant absolute expansion, rising from **$15.6 billion** to **$26.0 billion**. The increase reflects both genuine ecosystem scaling in research, enterprise-linked services, and digital life sciences integration, alongside strengthened measurement of services-intensive activity.

In terms of incremental contribution: **BioIndustrial** contributed approximately **41 per cent**. **BioServices** accounted for approximately **35 per cent** of the total increase. **BioPharma** contributed approximately **21 per cent**. **BioAgri** contributed approximately **3 per cent**.

Nearly half of the incremental expansion during 2025 originated from services-intensive and healthlinked components, signalling a deepening of value-chain complexity within the BioEconomy.



Segment	2024 ($B)	2025 ($B)	Growth
BioIndustrial	78.2	90.2	15%
BioPharma	58.4	64.5	10%
BioAgri	13.5	14.6	8%
BioServices	15.6	26	66%
Total BioEconomy ($Billion)*	**165.7**	**195.3**	**18%**

4.3 Structural Rebalancing

BioIndustrial and BioPharma remain the largest segments by scale. Services-linked activities also grew in 2025, supporting the BioEconomy's broadening base. Emerging areas like BioAgri and fermented products further strengthened this diverse foundation.

Out of the total BioEconomic value of $195.3 bn, BioIndustrial's held to its share from approximately **47 per cent in 2024** to **46 per cent in 2025**, while BioPharma's share moderated from **35 per cent to 33 per cent**. BioServices share rose from **9.4%** to **13.3%** driven by BioDigital services, AI-enabled solutions, GCCs, and research/capability functions. The compositional shift does not indicate weakening manufacturing performance. Rather, it reflects the addition of new layers of activity that enhance ecosystem depth. The rise of services-intensive components suggests that India's BioEconomy is evolving beyond production scale toward integrated value-chain participation.

4.4 Segment Positioning Within the BioEconomy

The segments profile of 2025 illustrates three structural pillars:

1. **Industrial Production Backbone** – anchored by BioIndustrial and BioPharma, providing scale, export orientation, and manufacturing strength.
2. **Knowledge and Enterprise Layer** – driven by BioServices, integrating research, global capability centres, digital platforms, and contract development.
3. **Diversification Layer** – introduced through Fermented Food Ingredients, Nutraceuticals, and Food Supplements, GCCs, etc. expanding the ecosystem toward preventive and consumerfacing bio-products.

This layered configuration enhances resilience and supports long-term expansion. Manufacturing provides stability and scale, services deepen integration with global value chains, and health-linked segments broaden domestic market orientation.

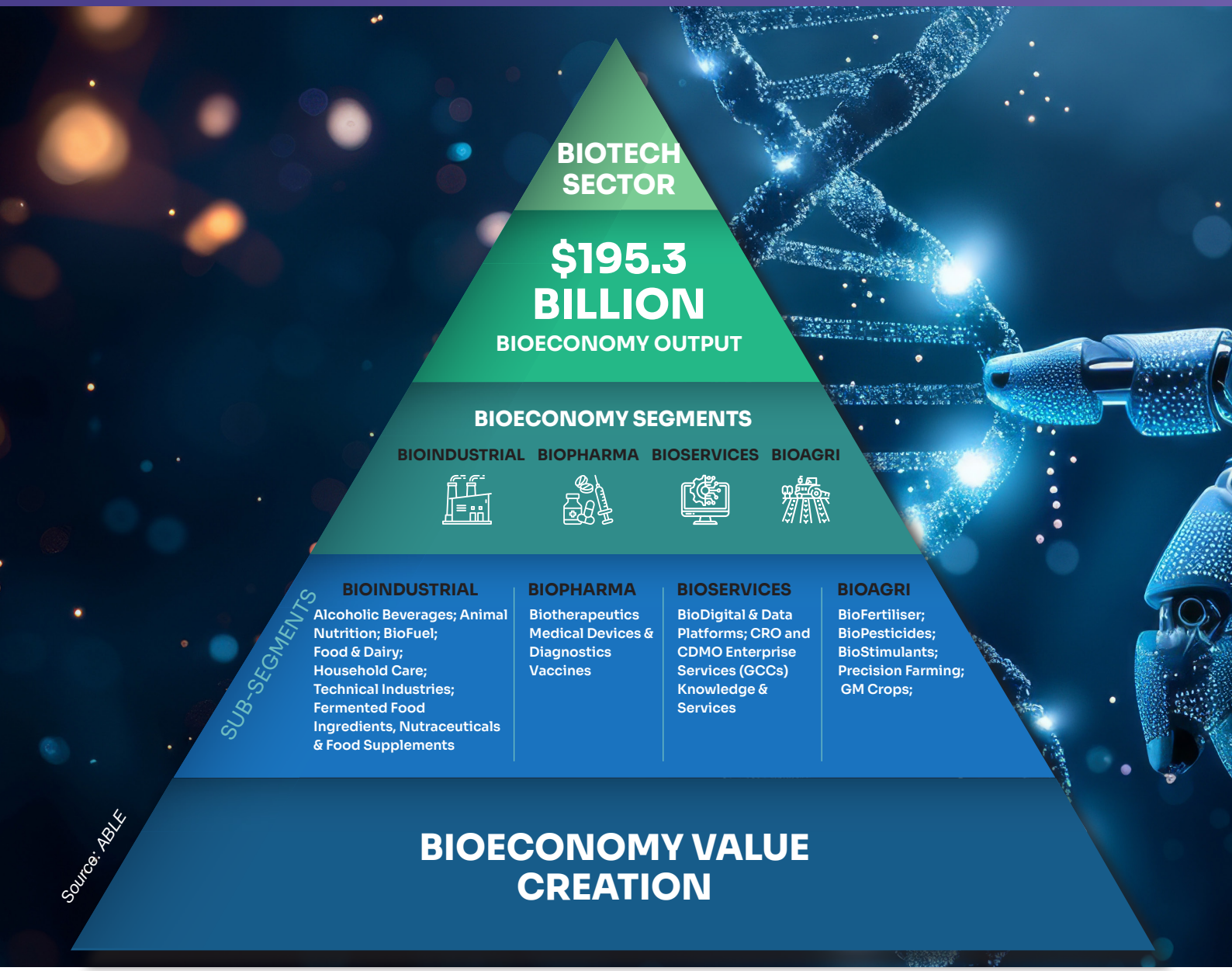
4.5 Geographic Anchoring of Segment Activity

Segments growth in 2025 remains closely aligned with established geographic clusters. BioIndustrial and BioPharma activity continues to be anchored in regions with mature manufacturing ecosystems, export infrastructure, and integrated supply chains. The Southern and Western regions, in particular, retain significant concentration of production-oriented capacity, reflecting accumulated industrial investment and technical depth.

BioServices activity demonstrates a metropolitan concentration pattern, driven by enterprise-linked functions, research services, digital platforms, and global capability operations. Major urban clusters continue to serve as nodes for knowledge-intensive life sciences activity, supporting both domestic firms and multinational corporations.

BioAgri activity exhibits comparatively broader geographic dispersion, reflecting the distributed nature of agricultural production systems and input markets. Overall, segments expansion in 2025 reflects continuity in geographic anchoring, with incremental broadening rather than structural relocation of activity.

BioEconomy Architecture Pyramid

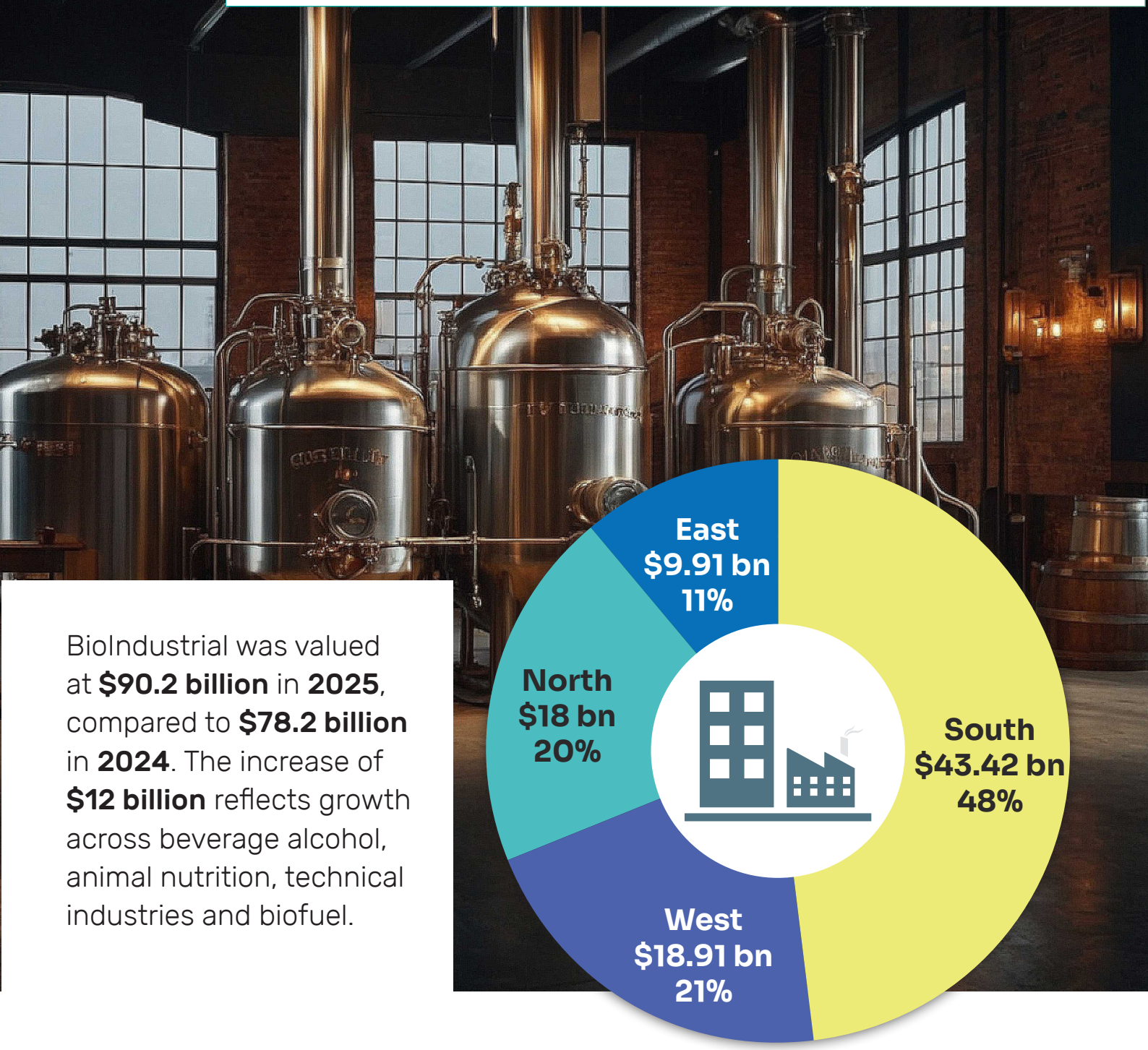


India's BioEconomy represents the economic value generated by biotechnology-enabled activities. The ecosystem is structured into four segments—BioIndustrial, BioPharma, BioServices, and BioAgri—each comprising multiple subsegments and industry categories that collectively contribute to national BioEconomy output.

Chapter 5

5 Subsegment Distribution

5.1 BioIndustrial



BioIndustrial was valued at **$90.2 billion** in **2025**, compared to **$78.2 billion** in **2024**. The increase of **$12 billion** reflects growth across beverage alcohol, animal nutrition, technical industries and biofuel.

Subsegment Industry Performance

Alcoholic Beverages remained the largest industry subsegment at **$25.8 billion**. **Spirits** increased from **$17.2 billion** in **2024** to **$18.3 billion** in **2025**. **Beer** rose from **$6.7 billion** to **$7 billion**. Growth was incremental and consumption-driven.

Animal Nutrition increased from **$20.50 billion** to **$23.04 billion**. **Aquaculture** expanded from **$6.89 billion** to **$8.61 billion**, while **Poultry feed** increased from **$13.61 billion** to **$14.43 billion**. This segment recorded one of the largest absolute increases within BioIndustrial.

Technical Industries remained stable at **$13.69 billion**. **Textiles** held at **$8.69 billion**. **Leather** and **Pulp and paper** segments recorded marginal increases.

BioFuel grew from **$9.36 billion** to **$11.79 billion**, driven by higher bioethanol output and blending expansion.

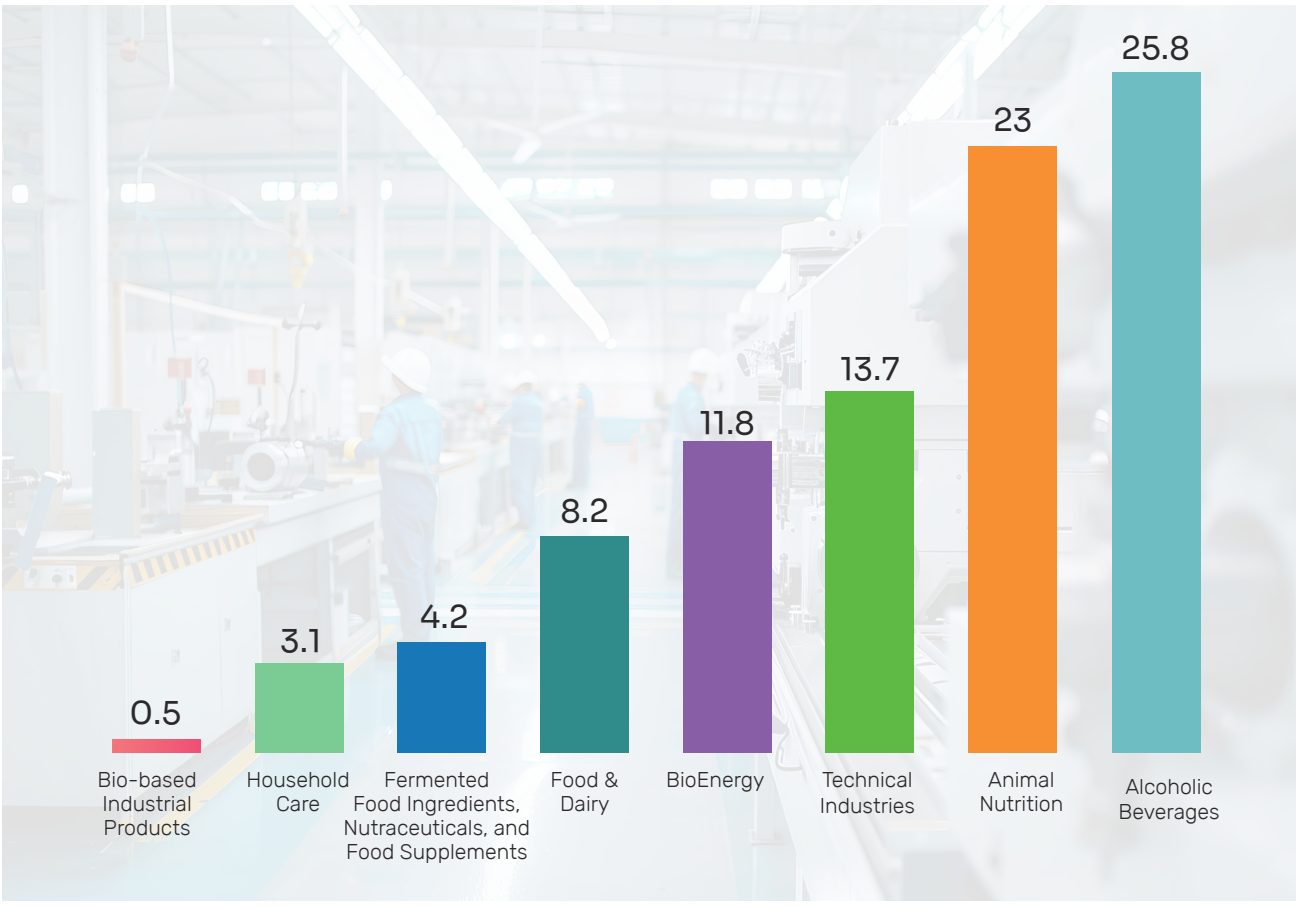
The newly added subsegment—**Fermented Food Ingredients, Nutraceuticals, and Food Supplements**—contributed **$4.2 billion**. Botanical extracts led this subsegment with a **70% share**, alongside categories like algal/omega-3 bioactives, fermented functional ingredients such as probiotics, bioactive peptides/proteins, and vitamins.

Food & Dairy increased from **$7.61 billion** to **$8.16 billion**, with moderate gains across processing applications.

Household Care rose from **$2.89 billion** to **$3.09 billion**.

Bio-based Industrial Products remained limited in scale at **$0.48 billion**.

BioIndustrial Subsegment Industry Distribution (2025)



Growth Concentration

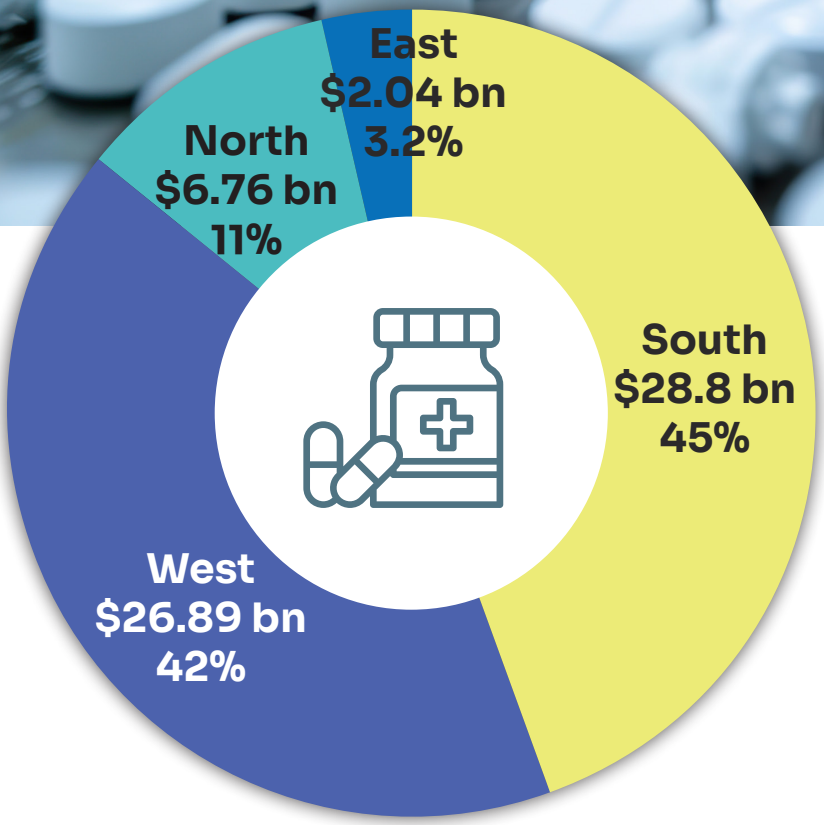
Animal Nutrition and **BioEnergy** accounted for a substantial portion of the **$7.8 billion** increase in **BioIndustrial**. **Alcoholic Beverages** contributed steady growth. **Technical Industries** remained stable. **Advanced biomaterials** and **bioplastics** continue to represent a small share of sector output.

Regional Orientation

BioIndustrial production remains concentrated in the **Southern** and **Western regions**, supported by fermentation capacity, Poultry feed manufacturing infrastructure, and biofuel processing facilities. Expansion in aquaculture and bioethanol production reinforced this concentration in 2025. Participation from **Northern states** continues in grain-linked and feed-related segments.

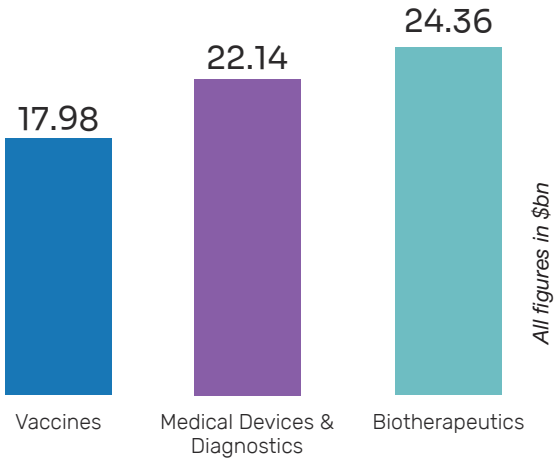
5.2 BioPharma

Subsegment Composition and Distribution



BioPharma was valued at **$64.5 billion** in **2025**, compared to **$58.4 billion** in **2024**. The segment expanded by **$6.1 billion**, reflecting growth across biologics, biosimilars, diagnostics, medical devices and vaccines.

BioPharma Subsegment Industry Distribution (2025)



Biotherapeutics increased from **$21.40 billion** in **2024** to **$24.36 billion** in **2025.** Biosimilars expanded from **$12.84 billion** to **$14.77 billion**, while biologics increased from **$8.56 billion** to **$9.59 billio**n. This segment recorded one of the stronger absolute gains within BioPharma.

Medical Devices and Diagnostics rose from **$20.20 billion** to **$22.14 billion**. **Diagnostics** increased from **$12.50 billion** to **$13.75 billion**, while **medical devices** grew from **$7.70 billion** to **$8.39 billion**. Growth was broad-based across testing, imaging, and device manufacturing.

Vaccines increased from **$16.80 billion** to **$17.98 billion**. The segment remains a significant component of BioPharma output, supported by established manufacturing capacity and export activity.

Growth Concentration

Of the $6.1 billion increase in BioPharma:

- Biotherapeutics contributed a substantial share, led by biosimilars.
- Medical Devices and Diagnostics recorded steady expansion.
- Vaccines continued to grow, though at a moderate pace relative to biosimilars.

Growth was distributed across therapeutic manufacturing and diagnostics, rather than concentrated in a single vertical.

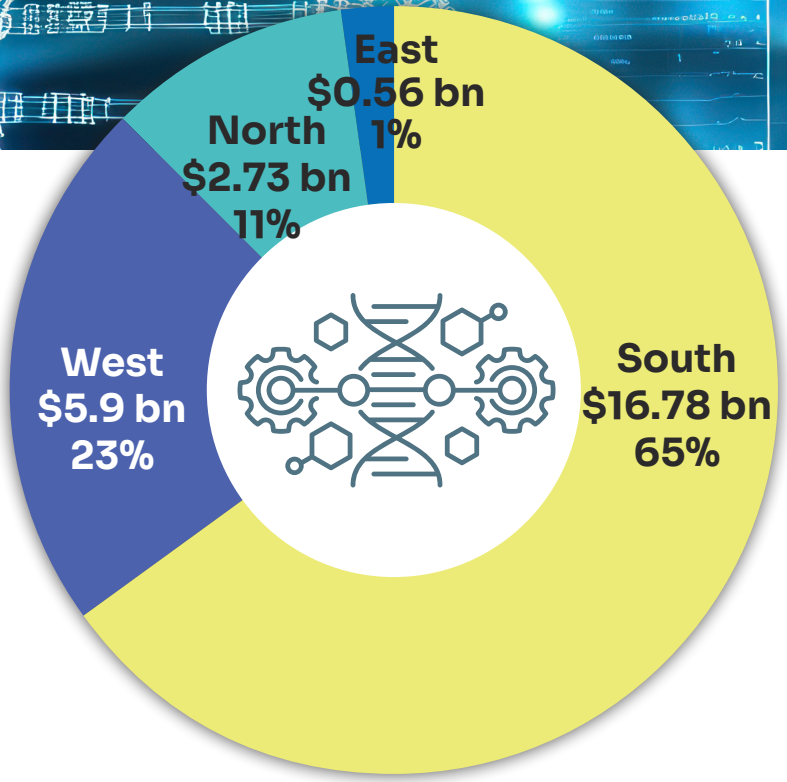
Regional Orientation

BioPharma activity remains concentrated in established life sciences clusters across the Southern and Western regions, where large-scale manufacturing facilities, regulatory infrastructure, and export-linked production are located. Telangana, Maharashtra, and Karnataka continue to anchor biologics and vaccine manufacturing capacity. Medical devices production demonstrates wider geographic dispersion, though core concentration remains within established industrial hubs.

BioPharma continues to represent a manufacturing-intensive, export-oriented pillar of India's BioEconomy, with growth led by biologics and diagnostics rather than conventional generics alone.

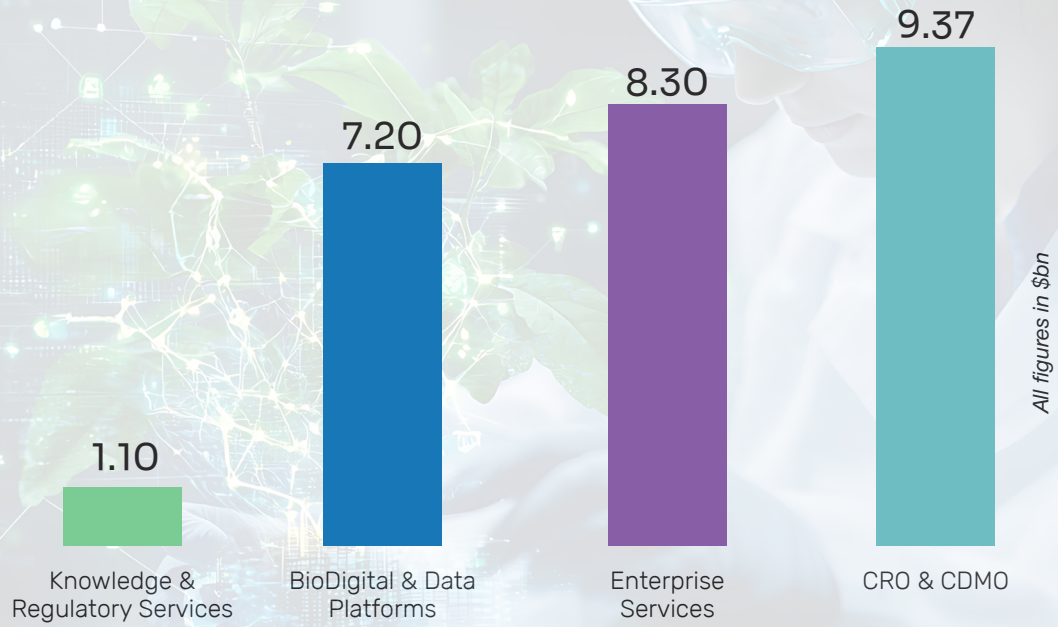
5.3 BioServices

Subsegment Composition and Distribution



BioServices BioEconomy was valued at **$26.0 billion** in 2025, compared to **$15.6 billion** in **2024**. The segment expanded by **$10.4 billion**, representing the largest absolute increase among all segments.

BioServices Subsegment Industry Distribution (2025)



	CRO and CDMO services increased from **$7.10 billion** in **2024** to **$9.37 billion** in **2025**. Growth was distributed across development and clinical services, discovery and translational services, and process support.
	BioDigital and **Data Platforms** expanded from **$4.00 billion** to **$8.30 billion**. This segment includes bioinformatics, data analytics, artificial intelligence applications, cloud integration, and digital platforms supporting life sciences operations.
	Enterprise Services, led by Life Sciences Global Capability Centres (GCCs), increased from **$3.50 billion** to **$7.20 billion**. India now hosts over 150 Life Sciences GCCs supporting global pharmaceutical, biotechnology, and medical device firms across research, regulatory, analytics, and enterprise functions.
	Knowledge and Regulatory Services increased from **$1.00 billion** to **$1.10 billion**.

Growth Concentration

Of the $10.4 billion increase in BioServices:

- BioDigital and Enterprise Services together accounted for a significant share of incremental expansion.
- GCC-linked activity and digital life sciences platforms were key contributors.
- CRO & CDMO services recorded steady expansion aligned with global outsourcing demand.

The growth pattern indicates strengthening integration of research, digital infrastructure, and enterprise-linked functions within the BioEconomy.

Regional Orientation

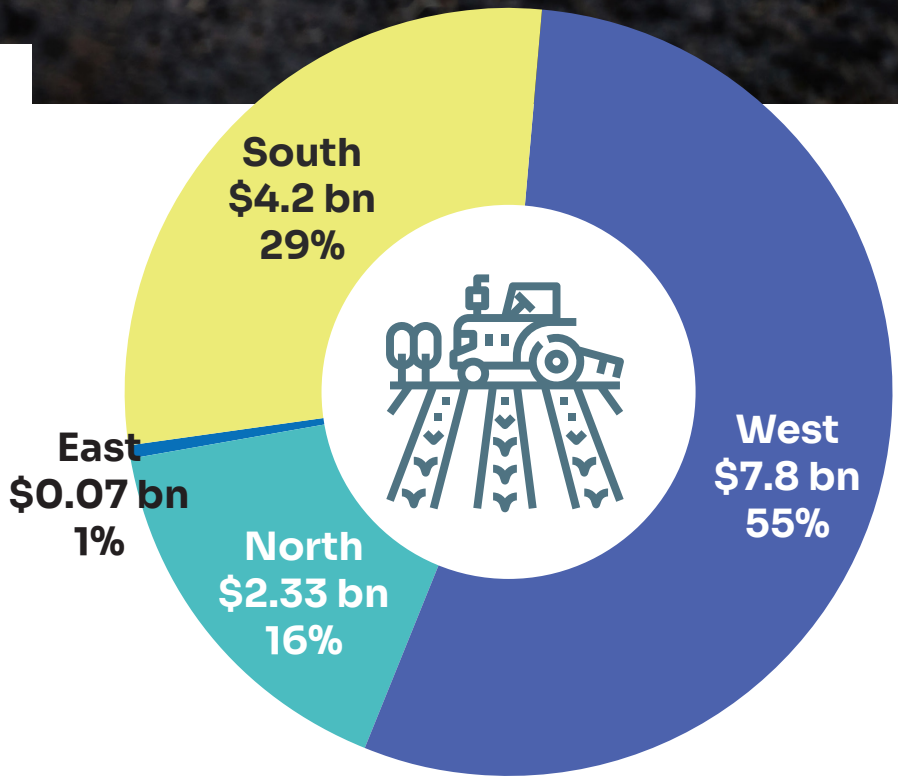
BioServices activity is concentrated in major metropolitan clusters across the Southern and Western regions, including established technology and life sciences hubs. Global Capability Centres and digital platforms are primarily located in urban centres with advanced talent pools and technology infrastructure. CRO and CDMO operations demonstrate proximity to pharmaceutical manufacturing clusters, reinforcing ecosystem integration.

BioServices represents the knowledge-intensive and globally integrated layer of India's Bio-Economy, with 2025 growth driven by digital platforms, enterprise operations, and contract development services.

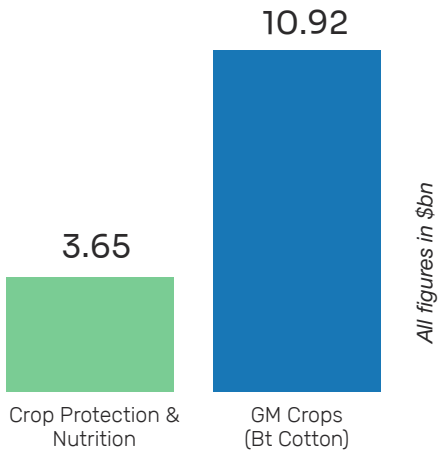
5.4 BioAgri

Subsegment Composition and Distribution

BioAgri was valued at **$14.6 billion** in **2025**, compared to **$13.5 billion** in **2024**. The segment expanded by **$1.1 billion**, reflecting moderate growth across crop protection inputs and genetically modified crop output.



BioAgri Subsegment Industry Distribution (2025)



GM Crops, represented by **Bt Cotton**, accounted for **$10.92 billion in 2025**, compared to $10.30 billion in 2024. This segment remains the dominant component of BioAgri, contributing nearly three-quarters of BioAgri's contribution.

Crop Protection and **Nutrition** increased from **$3.20 billion** in 2024 to **$3.65 billion** in 2025.
Within this segment: **Biofertilizers** rose from $1.44 billion to $1.61 billion.
Biopesticides increased from $0.96 billion to $1.10 billion.
Biostimulants expanded from $0.80 billion to $0.94 billion.
Growth was distributed across all three subsegments.

Growth Concentration

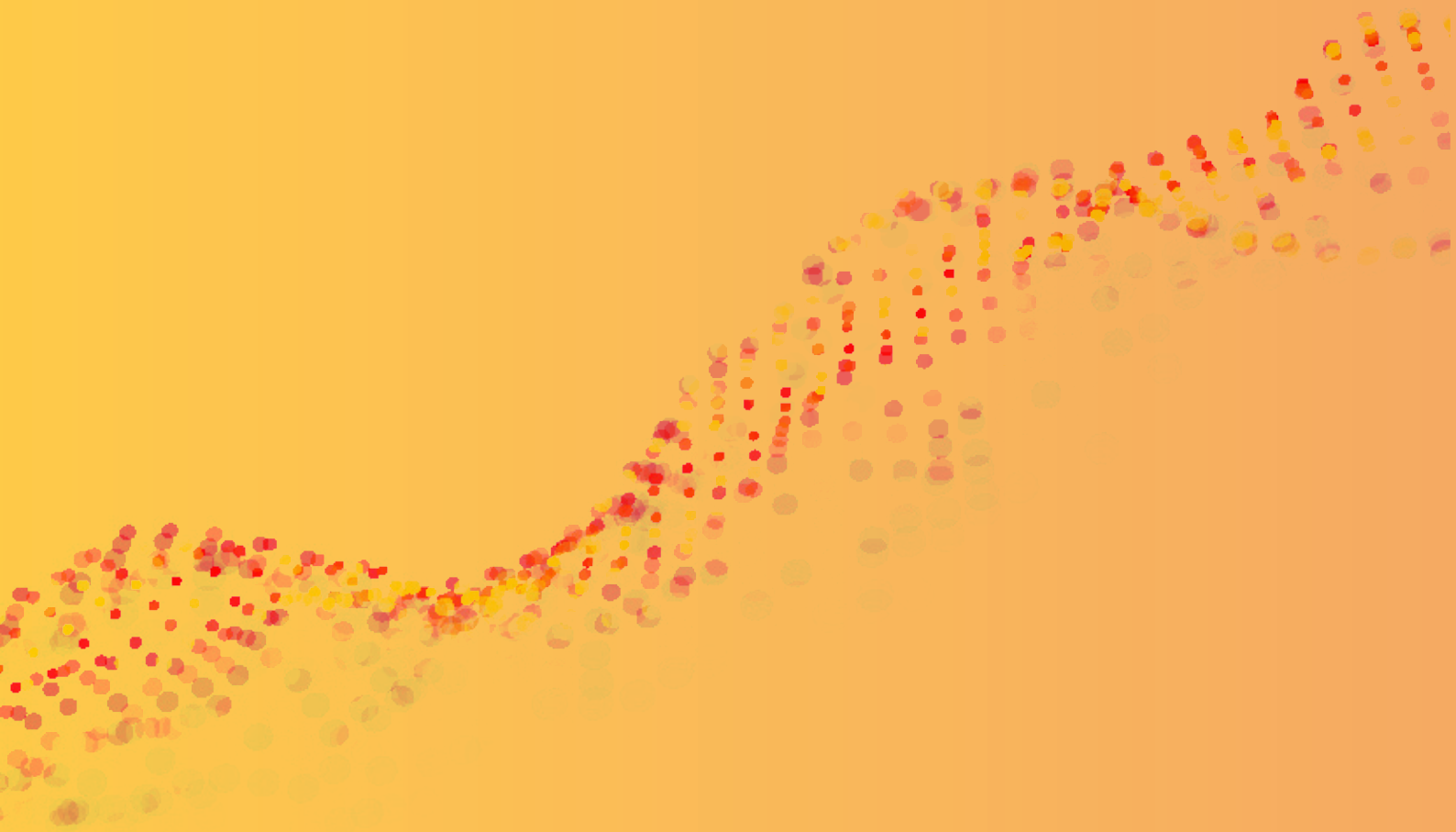
The $1.1 billion increase in BioAgri was driven primarily by incremental expansion in Bt Cotton output and steady gains in biological crop inputs. Growth rates in crop protection and nutrition outpaced the overall segment average, though Bt Cotton continues to anchor absolute scale.

Regional Orientation

BioAgri activity is more geographically dispersed than manufacturing-oriented segments. Bt Cotton production is concentrated in major cotton-growing states, while crop protection and nutrition inputs demonstrate wider distribution aligned with agricultural demand across multiple regions. The segment's footprint reflects crop patterns rather than industrial clustering.

BioAgri remains production-linked and crop-dependent, with growth driven by incremental expansion rather than structural shifts.

GROWTH DRIVERS



Chapter 6

6 Growth Drivers Overview

India's BioEconomy expansion in 2025 was shaped by activity across manufacturing, agriculture, digital services, and enterprise activities. The nearly $30 billion overall growth was distributed unevenly across segments.

Growth concentrated in areas like energy-linked industrial biotechnology, biologics manufacturing,digital life sciences platforms, and agricultural biological inputs, which together accounted for much of the incremental output.

BioIndustrial and BioPharma segments provided ongoing scale and stability. BioServices grew alongside this, supported by research services, data platforms, and global capability centers tied to biotechnology value chains. Agricultural biotechnology, though smaller, advanced steadily via biological crop inputs and genetically modified crops.

These patterns point to a diversifying BioEconomy that integrates industrial production, advanced therapeutics, knowledge services, and sustainable agriculture.

Segment	Primary Growth Drivers	Key Subsegments	Nature of Expansion
BioIndustrial 	Energy transition, biofuel blending targets, and protein demand in livestock and aquaculture	BioEnergy, Animal Nutrition	Expansion was driven by animal nutrition (aqua and poultry) and energy-linked bioethanol production
BioPharma 	Scaling of biologics and biosimilars manufacturing alongside diagnostic demand	Biotherapeutics, Medical Devices & Diagnostics	High-value therapeutic and diagnostic manufacturing
BioServices 	Digitalisation of life sciences operations and expansion of Global Capability Centres	BioDigital & Data Platforms, Enterprise Services, CRO/CDMO	Expansion in knowledge-intensive and globally integrated services
BioAgri 	Adoption of biological crop inputs and continued GM crop production	Crop Protection & Nutrition, GM Crops	Intensification of agricultural inputs and incremental crop-linked expansion

6.1 BioIndustrial Growth Drivers

In 2025, BioIndustrial growth was anchored in Animal Nutrition and BioEnergy. These categories contributed a large part of the increase in this segment, excluding newly profiled categories. Within Animal Nutrition, aqua and poultry drove expansion, while energy-linked growth reflected higher bioethanol production.

Animal Nutrition increased from $20.5 billion in 2024 to $23.0 billion in 2025, representing growth of 12 per cent. Expansion was driven by aqua industry, which rose from $6.89 billion to $8.61 billion, and poultry industry, which increased from $13.61 billion to $14.43 billion. The segment reflects sustained protein demand, industrial feed processing capacity, and continued integration of biotechnology into livestock and aquaculture.

BioEnergy expanded from $9.36 billion to $11.79 billion, representing growth of approximately 26 per cent, one of the highest rates within BioIndustrial. The increase was primarily associated with bioethanol production aligned with blending targets. Growth reflects both policy-linked demand and incremental production capacity additions during the year.

Alcoholic Beverages recorded steady expansion, rising from $24.20 billion to $25.76 billion. Growth in this industry segment remained consumption-driven and moderate relative to feed and energy applications. Technical Industries, including textiles and leather processing, remained largely stable, indicating maturity within these segments.

BioIndustrial growth in 2025 varied across segments, with energy-linked and feed-linked applications showing the clearest gains. Advanced bio-based materials, including bioplastics, remain small in scale relative to established production streams

Looking ahead, energy substitution targets, feed efficiency improvements, and deeper integration of agricultural residues into industrial systems are likely to continue influencing expansion within this pillar of the Bio-Economy.

6.2 Biologics, Biosimilars and Diagnostic Scale

BioPharma expanded from $58.4 billion in 2024 to $64.5 billion in 2025, representing 10 per cent growth. Expansion was distributed across biologics, biosimilars, diagnostics, and vaccines, with no single vertical accounting for all of the incremental value.

Biotherapeutics increased from $21.40 billion to $24.36 billion, representing growth of nearly 14 per cent. Biosimilars rose from $12.84 billion to $14.77 billion, while biologics increased from $8.56 billion to $9.59 billion. The growth reflects scaling of therapeutic manufacturing capacity and continued export orientation.

Medical Devices and Diagnostics increased from $20.20 billion to $22.14 billion, reflecting growth of approximately 10 per cent. Diagnostics rose from $12.50 billion to $13.75 billion, while medical devices increased from $7.70 billion to $8.39 billion. Expansion was broad-based, supported by domestic demand and export-linked production.

Vaccines increased from $16.80 billion to $17.98 billion, representing moderate but steady growth. The industry segment remains a significant contributor to BioPharma output, supported by established manufacturing infrastructure.

Growth in 2025 was led by **biosimilars** and **biologics** besides conventional therapeutic categories. The increasing weight of biologics within BioPharma indicates continued movement toward higher-value therapeutic manufacturing.

Policy frameworks supporting domestic manufacturing of bulk drugs and medical devices, along with production-linked incentives, provided stability to the sector. At the same time, export demand and regulatory compliance capabilities continue to shape the trajectory of advanced therapeutic segments.

The overall pattern indicates scaling within established manufacturing clusters rather than structural redistribution. Capacity augmentation in biologics and diagnostic production reinforced India's position within global pharmaceutical supply chains.

6.3 Digitalisation and Global Capability Centres

BioServices expanded from **$15.6 billion** in **2024** to **$26.0 billion** in **2025,** representing growth of approximately 66 per cent. This represented the largest absolute and percentage increase among the BioEconomy segments.

Expansion was concentrated in **Bio-Digital and Data Platforms** and **Enterprise Services**. BioDigital and Data Platforms increased from **$4.00 billion** to **$8.30 billion**. The segment includes bioinformatics, data analytics, artificial intelligence applications, cloud integration, and digital infrastructure supporting pharmaceutical and biotechnology operations.

Enterprise Services, led by Life Sciences Global Capability Centres (GCCs), increased to **$7.20 billion**. India now hosts more than 100 Life Sciences GCCs supporting global pharmaceutical, biotechnology, and medical device firms across research operations, regulatory management, analytics, supply chain functions, and enterprise platforms.

CRO and CDMO services expanded from **$7.10 billion** to **$9.37 billion**, reflecting steady outsourcing demand in development, clinical research, and process support functions.

The pattern of expansion indicates a structural strengthening of the knowledge-intensive layer of the BioEconomy. BioServices growth reflects deeper integration into global research, analytics, and enterprise value chains, rather than manufacturing-led expansion.

Policy initiatives supporting innovation, digital infrastructure, and global investment facilitation provided enabling conditions, though expansion was largely demand-driven and enterprise-linked.

The scale increase in digital and GCC-linked services suggests that the BioEconomy is no longer solely production-oriented. Knowledge, analytics, and enterprise capabilities now represent a rapidly expanding layer of value creation within the ecosystem.

In future, continued growth in biologics, complex therapeutics, and global regulatory compliance requirements is likely to sustain demand for digital and research-linked services.

6.4 Agricultural Biologicals & Input Intensification

BioAgri increased from $13.5 billion in 2024 to **$14.6 billion** in 2025, representing growth of 8 per cent. Expansion was moderate relative to other sectors but remained broad-based across both genetically modified crop output and biological inputs.

Bt Cotton increased from $10.30 billion to **$10.92 billion**. The segment continues to anchor BioAgri in absolute scale, accounting for the majority of sector output. Growth reflects incremental production gains rather than structural expansion into new crop categories.

Crop Protection and Nutrition increased from $3.20 billion to **$3.65 billion**, representing growth of approximately 14 per cent. Biofertilizers rose from $1.44 billion to $1.61 billion, biopesticides increased from $0.96 billion to $1.10 billion, and biostimulants expanded from $0.80 billion to $0.94 billion. Growth in biological inputs outpaced overall sector growth.

The pattern indicates gradual intensification of biological applications within agricultural systems. While GM crops remain dominant in scale, biological crop inputs are expanding at a faster rate.

Policy emphasis on sustainable agriculture, reduced chemical input intensity, and soil health management provides enabling conditions for biological crop protection and nutrition products.

BioAgri growth in 2025 reflects incremental input intensification rather than structural diversification. Expansion was gradual rather than abrupt, with biological inputs gaining share within a broadly stable crop-linked framework.

Shifts toward climate-resilient agriculture, soil health restoration, and productivity optimisation are likely to shape the medium-term growth trajectory of biological crop inputs.

6.5 Structural Rebalancing and Expansion

The 2025 expansion of India's BioEconomy was multifaceted across sectors. Growth was concentrated in energy-linked applications, biologics, digital platforms, and enterprise-linked services, while mature segments expanded at a steadier pace.

BioIndustrial growth was led by Animal Nutrition and BioEnergy, with bioethanol and feed-linked production contributing significantly to incremental output. In contrast, technical processing segments such as textiles and leather remained stable. This divergence indicates that energy substitution and protein-linked demand are currently stronger growth drivers than traditional industrial processing applications.

Within BioPharma, biosimilars and biologics expanded at a faster pace than vaccines and conventional manufacturing categories. Diagnostics and medical devices recorded steady gains, reinforcing diversification within therapeutic and diagnostic manufacturing.

BioServices recorded increases across all its industry categories. Digital platforms and Global Capability Centres expanded, increasing the weight of knowledge-intensive and enterprise-linked activity within the BioEconomy. This marks a measurable strengthening of the services layer relative to production-led segments.

BioAgri growth was moderate but steady, with biological crop inputs expanding faster than overall agricultural biotechnology output.

Collectively, these movements indicate a gradual rebalancing within the BioEconomy. Manufacturing remains the dominant pillar in absolute scale, but services, digital integration, and energy-linked applications are increasing their relative contribution to incremental growth.

The 2025 profiling reflects both continuity and transition: continuity in established industrial and pharmaceutical strength, and transition toward knowledge-intensive, energy-linked, and preventive health segments. The distribution of growth suggests increasing diversification within the BioEconomy's internal structure rather than a shift away from its manufacturing base.

The 2025 expansion of India's BioEconomy was multifaceted across sectors. Growth was concentrated in energy-linked applications, biologics, digital platforms, and enterprise-linked services, while mature segments expanded at a steadier pace.

Chapter 7

7 Intra-Year Growth Patterns

7.1 Quarterly Distribution of BioEconomy

Total BioEconomy value in 2025 was distributed relatively evenly across quarters. Aggregate quarterly BioEconomy was $48.13 billion in Q1, $49.84 billion in Q2, $48.03 billion in Q3, and $49.26 billion in Q4.

The difference between the highest and lowest quarter was approximately $1.6 billion, indicating limited volatility at the aggregate level. Q2 recorded the highest quarterly output, while Q3 reflected a modest dip before recovery in Q4.

The absence of sharp quarter-to-quarter swings indicates that 2025 growth was broad-based and sustained rather than concentrated in a single acceleration period.

In comparison, 2024 displayed a similarly stable pattern, with modest variation across quarters. The stability across both years indicates that expansion was not driven by short-term cyclical spikes but by underlying structural capacity.

Total BioEconomy value in 2025 was distributed relatively evenly across quarters. Aggregate quarterly BioEconomy was $48.13 billion in Q1, $49.84 billion in Q2, $48.03 billion in Q3, and $49.26 billion in Q4

7.2 Segment Quarterly Movement

Segment-level quarterly patterns in 2025 reveal differentiated intra-year behaviour across major components of the BioEconomy.

BioIndustrial remained highly stable across quarters. BioEconomy contribution ranged narrowly between $22.26 billion and $22.77 billion per quarter. The difference between the highest and lowest quarter was less than $0.05 billion, indicating minimal volatility. This stability reflects the mature and capacity-driven nature of industrial biotechnology production.

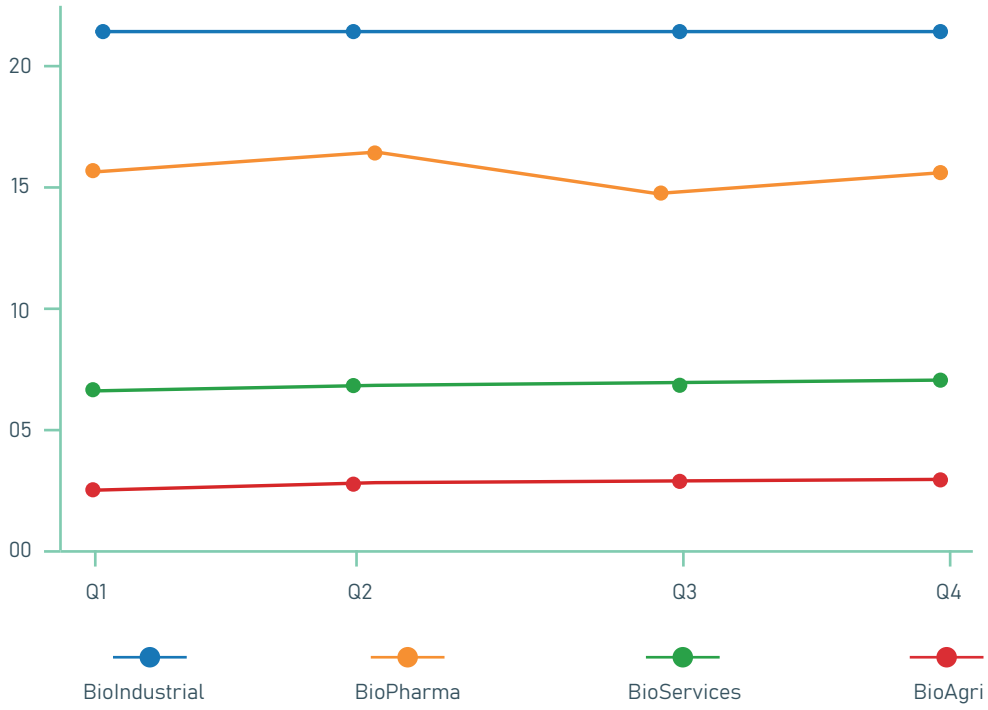
BioPharma exhibited moderate quarterly variation. BioEconomy increased from $16.18 billion in Q1 to $16.92 billion in Q2, moderated to $15.32 billion in Q3, and recovered to $16.05 billion in Q4. The Q3 dip represents the most visible intra-year movement among large segments, though overall annual growth remained intact.

BioServices demonstrated steady sequential expansion. The contribution increased from $6.30 billion in Q1 to $6.65 billion in Q4, with incremental increases each quarter. Unlike manufacturing-led segments, BioServices showed a progressive build-up rather than quarter-specific concentration.

BioAgri displayed moderate seasonal variation. Output declined slightly in Q1 relative to 2024 levels, then increased through Q4, reaching $3.80 billion in the final quarter. The pattern aligns with agricultural production cycles and input demand timing.

Overall, segment-wise quarterly data indicates that 2025 growth was distributed across the year. The only visible intra-year moderation occurred in BioPharma during Q3, while BioServices demonstrated consistent upward momentum.

Segments Quarterly Movement (2025)



7.3 First Half vs Second Half Dynamics

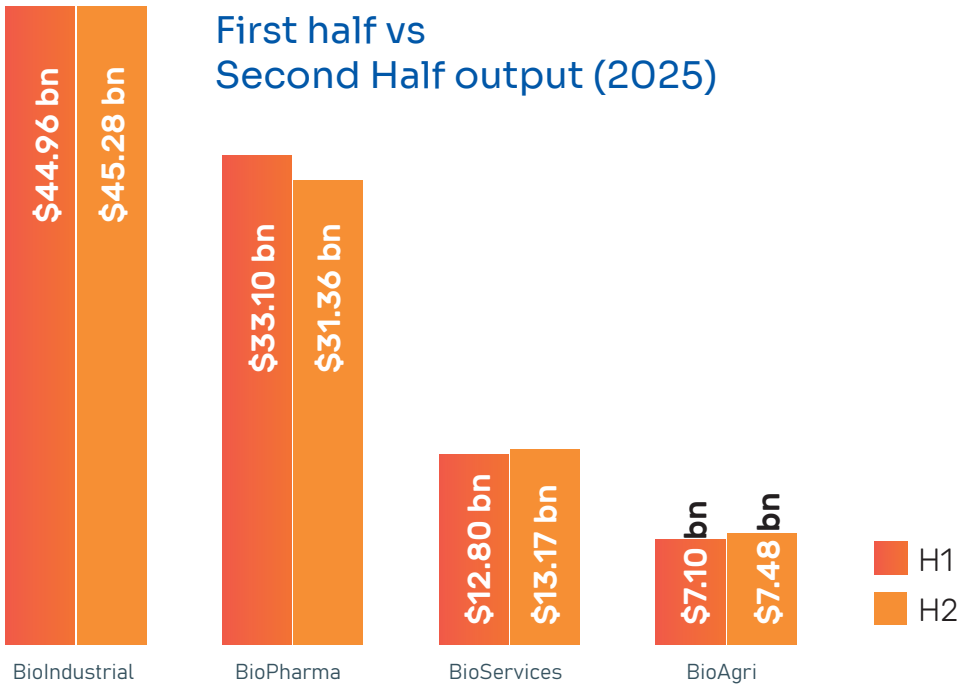
An examination of first-half (H1) and second-half (H2) performance provides additional insight into intra-year momentum.

For 2025	**H1 (Q1 + Q2)** total output was **$97.96 bn**	**H2 (Q3 + Q4)** total output was **$97.30 bn**	The difference between halves was less than $1.0 bn, confirming that annual growth was evenly distributed across the year.

At the segment level:

- **BioIndustrial** recorded **$44.96 billion** in **H1** and **$45.28 billion** in **H2**, reflecting near-identical distribution.
- **BioPharma** generated **$33.11 billion** in **H1** and **$31.36 billion** in **H2**. The moderation in H2 corresponds with the Q3 decline before partial recovery in Q4.
- **BioServices** increased from **$12.80 billion** in **H1** to **$13.17 billion** in **H2**, indicating continued acceleration in the latter half of the year.
- **BioAgri** rose from **$7.10 billion** in **H1** to **$7.48 billion** in **H2**, reflecting seasonal strengthening toward Q4.

The data indicates that 2025 growth occurred steadily throughout the year. Manufacturing-intensive segments remained evenly distributed, while services and agricultural segments showed mild second-half strengthening. This trend confirms that expansion was capacity-driven rather than dependent on year-end acceleration.



7.4 Intra-Year Concentration and Volatility

Quarter-to-quarter variation in 2025 was limited across most segments, indicating stability rather than volatility.

BioIndustrial exhibited the lowest intra-year variation among major segments. The difference between its highest quarterly output (**$22.77 billion**) and lowest quarterly yield (**$22.26 billion**) was less than **$0.51 billion**. This narrow range confirms high production stability and steady capacity utilisation.

BioPharma recorded the most visible intra-year movement among large segments. BioEconomy contribution ranged from **$15.32 billion** in **Q3** to **$16.92 billion** in **Q2**, representing a variation of **$1.60 billion**. The **Q3** moderation was followed by recovery in Q4, indicating temporary deceleration rather than structural contraction.

BioServices demonstrated gradual upward momentum with minimal volatility. Quarterly output increased consistently from $6.30 billion in Q1 to $6.65 billion in Q4. The total variation across the year was $0.35 billion, reflecting progressive scaling rather than cyclic fluctuation.

BioAgri exhibited moderate seasonal variation, with output increasing from $3.38 billion in Q1 to $3.80 billion in Q4. The variation of $0.42 billion aligns with agricultural production cycles and input demand timing.

Overall, intra-year concentration risk in 2025 was low. No single quarter disproportionately accounted for annual output in any major segment. Growth was distributed and sustained and expansion during the year was structurally anchored.

7.5 Intra-Year Structural Signals

The intra-year distribution of output in 2025 indicates a BioEconomy characterised by stability rather than volatility. Quarterly totals remained tightly clustered, and no segment exhibited sharp concentration in a single period.

Manufacturing-intensive segments, particularly **BioIndustrial**, demonstrated near-uniform quarterly output, reflecting steady capacity utilisation and production continuity. BioPharma displayed moderate quarterly variation, though without sustained deceleration.

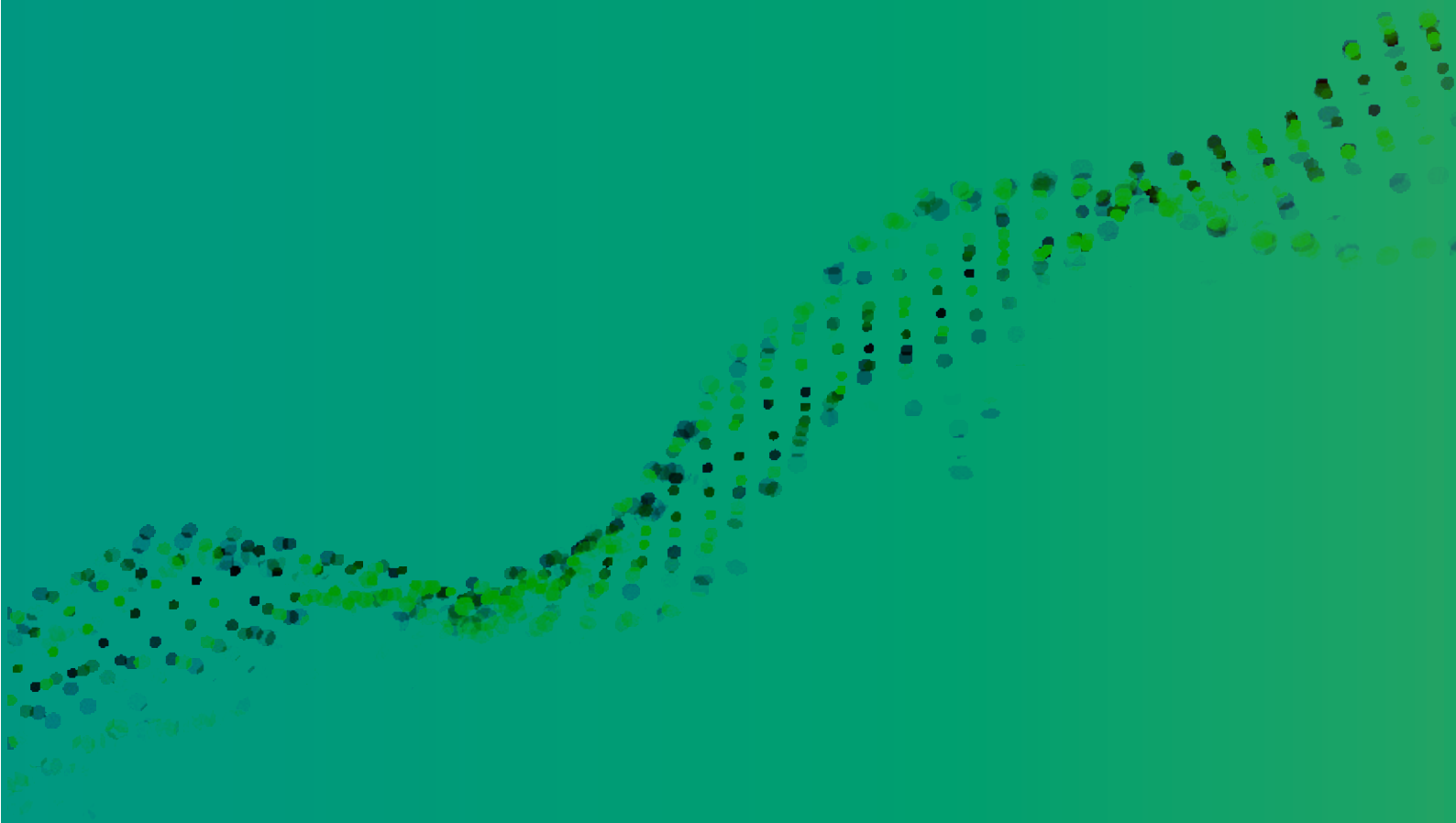
BioServices showed sequential quarterly increases, suggesting progressive expansion rather than episodic growth. The steady build-up across quarters aligns with enterprise-linked scaling and digital platform integration, which are less dependent on seasonal production cycles.

BioAgri exhibited mild second-half strengthening, consistent with agricultural cycles and consumer demand patterns.

The absence of back-loaded concentration in 2025 suggests that growth was not dependent on year-end acceleration, fiscal cycle effects, or short-term policy triggers. Instead, expansion appears to have been supported by stable industrial production, sustained demand, and incremental capacity scaling.

The temporal pattern shows that 2025 growth was broad-based and distributed across segments and quarters, indicating continuity rather than cyclical distortion.

INNOVATION AND STARTUPS

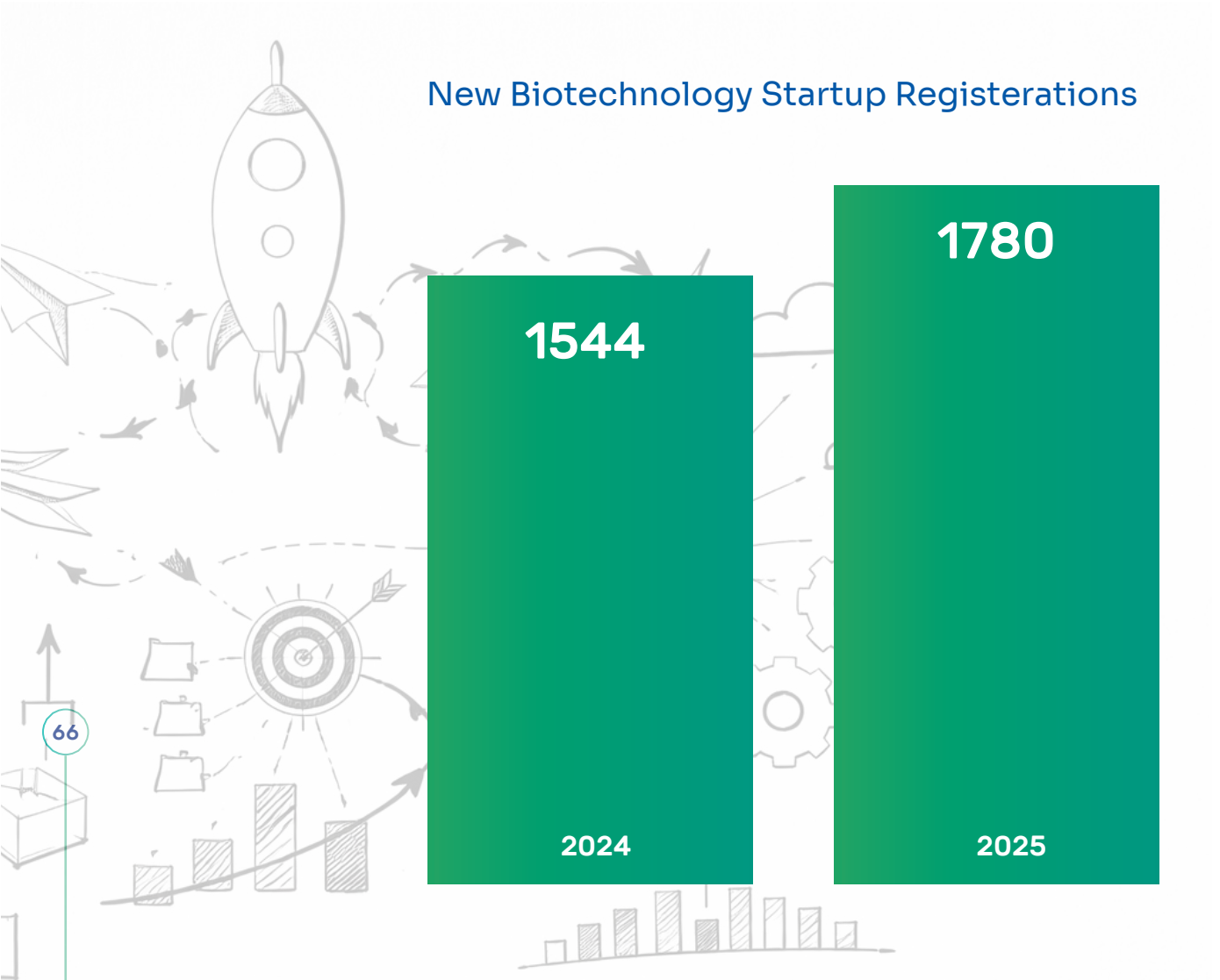


Chapter 8

8 Startup Ecosystem Dynamics

8.1 Startup Ecosystem Milestone

India's biotechnology startup ecosystem continued its expansion momentum in 2025, with the cumulative number of registered biotech startups reaching **11,855**. This represents a substantial increase from 10,075 startups recorded in 2024, reflecting sustained entrepreneurial activity across the country.



During 2025 alone, **1,780 new biotechnology startups** were registered, compared with **1,544 new registrations in 2024**, representing an increase of approximately **15 per cent**. The rise in new registrations indicates renewed momentum following the moderation observed in the previous year.

The expansion of the startup base over the past several years reflects a combination of factors, including improved access to incubation infrastructure, increased availability of early-stage funding, and the growing integration of biotechnology across healthcare, agriculture, industrial processes, and digital platforms.

The steady growth in the number of new enterprises also signals the strengthening of India's broader life sciences innovation ecosystem. Universities, research institutions, incubators, and industry partnerships continue to play an important role in translating scientific research into commercial ventures.

The addition of nearly **1,800 new startups** in 2025 demonstrates that entrepreneurial activity remains an important contributor to the evolution of India's BioEconomy. The expanding startup base also reflects the increasing diversification of biotechnology applications, ranging from therapeutics and diagnostics to agricultural biologicals, bio-based materials, and digital life sciences platforms.

As the number of biotechnology startups grows, the ecosystem is gradually transitioning from an early-stage innovation landscape toward a more mature environment that supports scaling, technology transfer, and commercial deployment.

8.2 New Startup Formation

The number of new biotechnology startups registered in India increased to **1,780 in 2025**, compared with 1,544 registrations in 2024, representing an increase of approximately 15 per cent.

The recovery in new startup formation in 2025 follows the moderation observed in 2024 and indicates renewed momentum in the biotechnology innovation ecosystem. The increase suggests continued entrepreneurial activity across multiple application areas including therapeutics, diagnostics, agricultural biotechnology, industrial biotechnology, and digital life sciences platforms.

Startup formation remains concentrated in a group of leading innovation states. **Maharashtra recorded the highest number of new registrations in 2025 with 235 startups**, followed by **Karnataka (218)** and **Telangana (190)**. Together, these three states accounted for a substantial share of the year's new biotech enterprises.

Other major contributors included **Delhi (160), Uttar Pradesh (154)**, **Gujarat (122)**, and **Tamil Nadu (112)**. These states collectively reflect the presence of strong research institutions, incubators, funding networks, and established biotechnology clusters.

A broader group of states also recorded steady startup formation during the year, including Haryana, Odisha, West Bengal, and Kerala. The distribution of registrations indicates that while established innovation hubs continue to dominate startup creation, entrepreneurial activity is gradually expanding across a wider geographic base.

The continued increase in startup formation highlights the growing role of entrepreneurship in translating scientific research and technological innovation into commercially viable enterprises. As the ecosystem matures, a larger proportion of startups are emerging from incubator networks, academic research programs, and industry partnerships.

8.3 Quarterly Startup Formation

Quarterly registration data for 2025 indicates sustained startup formation throughout the year without sharp fluctuations. In **Q1 2025**, **419 biotechnology startups** were registered. This was followed by **435 registrations** in **Q2**, reflecting a steady continuation of startup activity during the first half of the year.

Startup formation accelerated in **Q3**, with **469 new enterprises registered**, representing the highest quarterly addition during the year. The increase suggests continued entrepreneurial momentum and active participation from incubators, research institutions, and startup support programs.

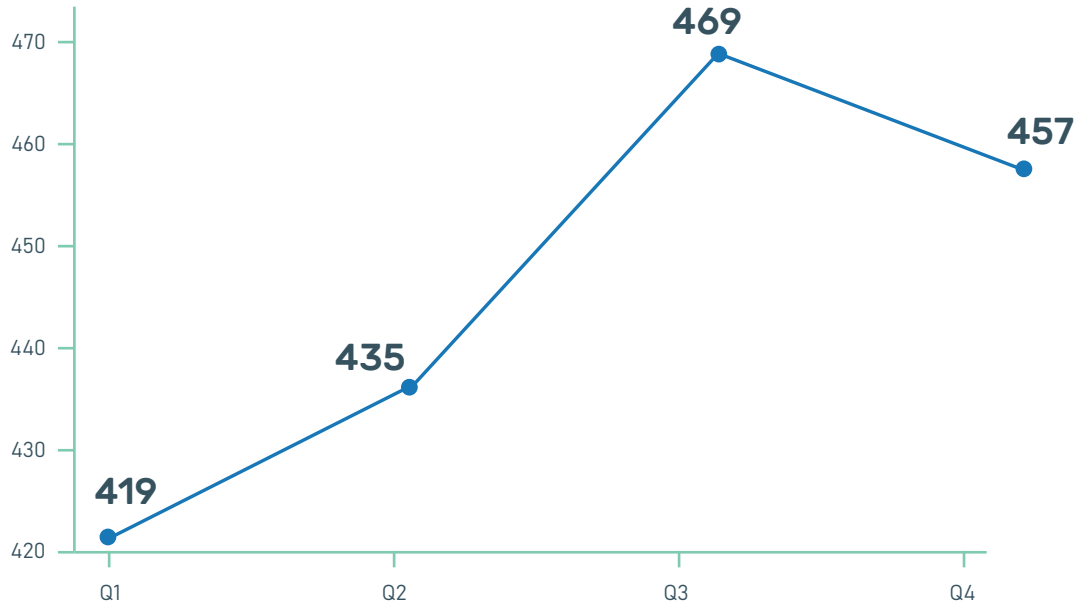
In **Q4**, **457 startups** were registered, maintaining the elevated level of activity observed during the second half of the year.

Overall, quarterly registrations in 2025 ranged between **419** and **469 startups**, indicating relatively consistent formation across the year. Unlike ecosystems where startup activity is heavily concentrated in a single period, India's biotechnology startup ecosystem demonstrated stable momentum throughout the year.

A comparison with the previous year highlights the improvement in startup formation. While 2024 recorded 1,544 new registrations, quarterly numbers during that year declined progressively after Q1. In contrast, 2025 displayed stronger and more evenly distributed quarterly formation, with higher registrations recorded in three out of four quarters.

The quarterly pattern suggests that startup creation in 2025 was not driven by a single surge but reflected sustained entrepreneurial activity supported by incubation networks, research commercialization initiatives, and expanding biotechnology applications.

Quarterly Biotechnology Startup Registerations (2025)



8.4 Regional Distribution of Startup Formation

The regional distribution of biotechnology start-up registrations in 2025 indicates that entrepreneurial activity remains concentrated in a few major innovation regions, while gradually expanding across the country.

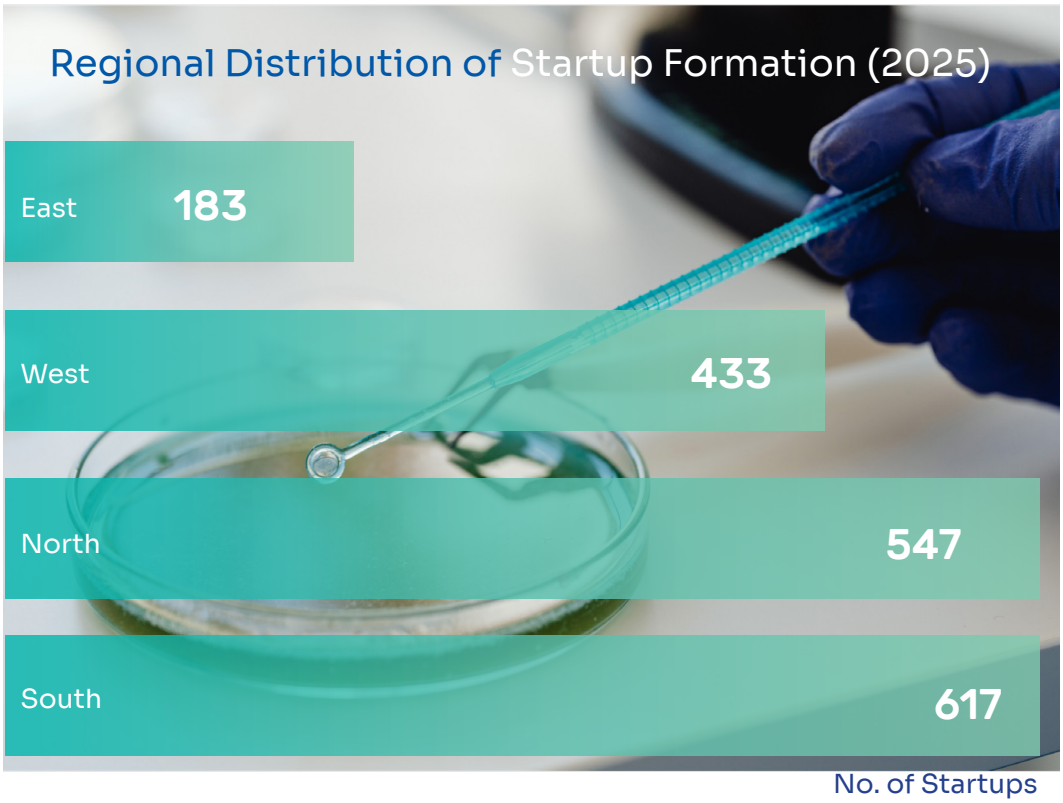
Southern India recorded the highest number of new biotech startups, with **617 registrations in 2025**, accounting for approximately **35 per cent** of the national total. The region's leadership reflects the strong presence of biotechnology clusters in **Karnataka, Telangana**, and **Tamil Nadu**, supported by established research institutions, incubation centres, and industry partnerships.

The Northern region followed with **547 new startups**, representing about **31 per cent** of total registrations. Startup formation in this region was driven primarily by **Delhi**, **Uttar Pradesh**, and Haryana, which collectively host a growing number of research institutions, technology parks, and startup incubators.

The **Western region** recorded **433 new startups**, accounting for roughly **24 per cent** of national registrations. **Maharashtra** and **Gujarat** were the primary contributors in this region, reflecting strong industrial and pharmaceutical ecosystems that support biotechnology entrepreneurship.

The **Eastern region** recorded **183 new startup registrations**, representing around **10 per cent** of the total. While the region currently contributes a smaller share of national startup formation, states such as **Odisha** and **West Bengal** are emerging as regional centres for biotechnology innovation.

Overall, the regional distribution indicates that while startup activity remains concentrated in established biotechnology clusters, entrepreneurial participation is gradually expanding across a wider geographic base.



8.5 Leading States in Startup Formation

Startup formation in 2025 remained concentrated in a group of leading innovation states that collectively account for a substantial share of national biotechnology entrepreneurship.

Maharashtra recorded the highest number of new biotech startups in **2025** with **235 registrations**, followed by **Karnataka** with **218 startups** and **Telangana** with **190 startups**. These three states together accounted for a significant portion of total new registrations during the year.

Other major contributors included **Delhi (160 startups)** and **Uttar Pradesh (154 startups)**. These states benefit from strong academic institutions, established incubator networks, and proximity to research laboratories and healthcare ecosystems.

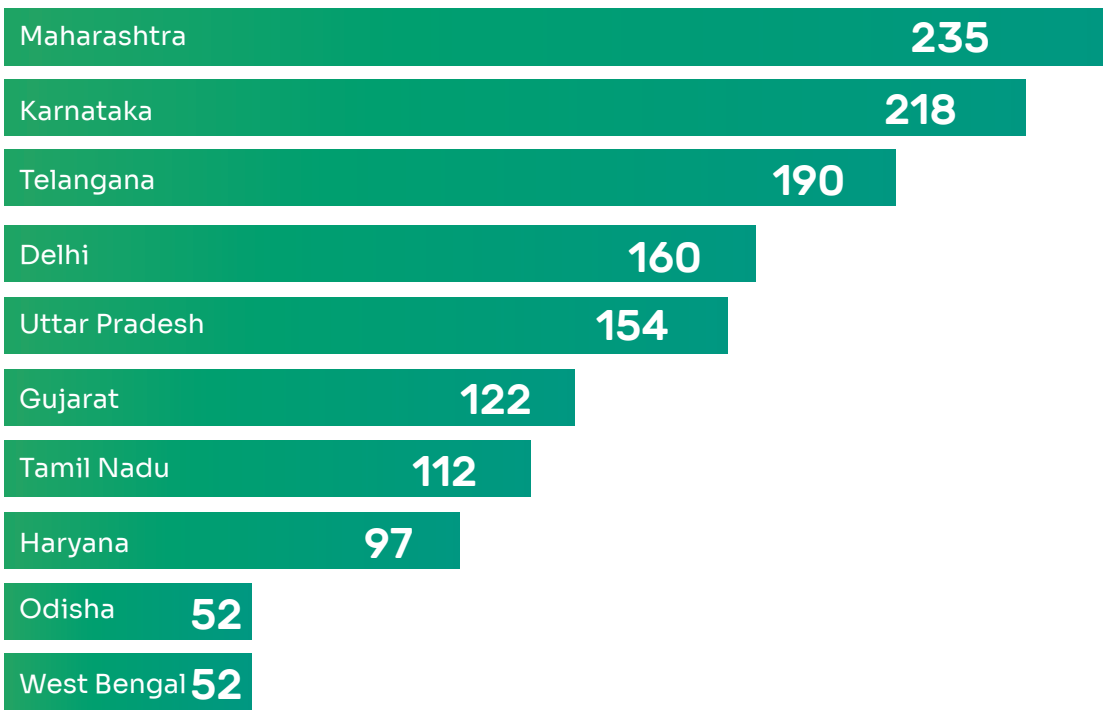
Gujarat (122 startups) and **Tamil Nadu (112 startups)** also recorded substantial startup formation, reflecting their growing biotechnology and pharmaceutical manufacturing bases.

A second tier of states recorded moderate but consistent startup activity, including **Haryana (97 startups)**, **Odisha (52 startups)**, and **West Bengal (52 startups)**. These states indicate expanding participation in biotechnology entrepreneurship beyond the traditional innovation hubs.

Collectively, the top ten states accounted for roughly three-quarters of all new biotechnology startups registered in 2025, highlighting the importance of regional innovation clusters in driving entrepreneurial activity.

At the same time, smaller contributions from a wider group of states demonstrate that the biotechnology startup ecosystem continues to broaden geographically, supported by national incubation programs, academic research networks, and state-level innovation initiatives.

Top States for Biotechnology Startup Formation (2025)



8.6 Ecosystem Maturity

The expansion of India's biotechnology start-up ecosystem in 2025 reflects continued momentum in entrepreneurial activity across the BioEconomy landscape. With **1,780 new start-ups** registered during the year, the cumulative number of biotechnology startups increased to **11,855**, reinforcing the role of startups as an important driver of innovation and technology commercialization.

Startup formation in 2025 showed **stable momentum throughout the year**, with relatively consistent quarterly registrations and no sharp concentration in any single period. This pattern indicates that entrepreneurial activity is supported by sustained ecosystem development rather than short-term fluctuations.

The geographic distribution of startups continues to be shaped by established biotechnology clusters. **Southern and Northern regions together accounted for nearly two-thirds of new registrations**, reflecting the concentration of research institutions, incubation facilities, and innovation infrastructure in these regions.

At the state level, a small group of leading innovation hubs continues to anchor startup formation. Maharashtra, Karnataka, Telangana, Delhi, and Uttar Pradesh together contributed a substantial share of new enterprises. These states benefit from strong academic ecosystems, industry presence, and startup support programs.

At the same time, the presence of new startups across a wider set of states indicates gradual geographic expansion of biotechnology entrepreneurship. Emerging contributions from additional regions suggest that incubation programs, research networks, and policy initiatives are supporting broader participation in the innovation ecosystem.

Overall, the startup landscape in 2025 reflects a **maturing biotechnology ecosystem**, where sustained enterprise creation, expanding incubation infrastructure, and increasing research commercialization continue to support the growth of India's BioEconomy.

Chapter 9

Strengthening India's Biotechnology Innovation Ecosystem

बाइरैक
इग्नाइट इनोवेट इंक्यूबैट

birac®
Ignite Innovate Incubate

BIRAC's strategic funding mechanisms have been instrumental in advancing research and translating innovations into market-ready products across the biotechnology sector.

BIRAC Innovation Impact Snapshot

Indicator	Value
Beneficiaries Supported	15 lakh+
Cities covered	550+
Aspirational districts reached	38
Startups supported	5000+
IP filings	1350+
Products & technologies developed	900+

BIRAC Innovation Pipeline

Stage	Key Programmes
Idea / Proof of Concept	**BIG**
Product Development	**SBIRI, BIPP**
Academic Research	**ETA, PACE**
Commercialization	**PCP**
Growth Stage Equity Support	**SEED, LEAP**

9.1 Early Stage Innovation Support: Biotechnology Ignition Grant (BIG)

BIRAC's flagship early-stage programme, the **Biotechnology Ignition Grant (BIG)**, has strengthened the base of India's innovation pyramid by nurturing high-risk, high-impact biotech ideas and enabling their transition into startup ventures. The programme has supported over **1000 biotech innovations** from more than **550 cities** across India, including **38 aspirational districts**, demonstrating a strong pan-India reach.

Through catalytic initial funding and mentoring support, BIG helps de-risk deep-tech biotechnology innovations, enabling innovators to validate ideas, develop proof-of-concepts, and translate research into credible technologies and ventures.

To date, over **200 innovative products and technologies** have emerged from BIG-supported ideas, while over **900 IP filings** have been facilitated. Nearly **150 startups** have collectively raised more than **₹3500 crore** ($415 million) in follow-on funding, highlighting BIG's significant contribution to strengthening India's biotechnology innovation ecosystem.

BIG Programme Outcomes

Innovations supported	Cities Covered	Follow-on Funding Raised	Startups Funded
1000+	**550+**	**3500+ Crore**	**350+** (2025)

9.2 Proof of Concept to Late Stage Support

i4 (Intensifying the Impact of Industrial Innovation)

Moving beyond early-stage support, BIRAC has strengthened the biotech innovation pipeline and product/technology development through the flagship **i4 (Intensifying the Impact of Industrial Innovation) initiative**, that focusses on strengthening R&D capabilities of start-ups/companies/LLPs through two schemes: Small Business Innovation Research Initiative (SBIRI) and Biotechnology Industry Partnership Program (BIPP). SBIRI and BIPP schemes have catalysed high-risk biotech innovation by de-risking R&D, enabling industry–academia partnerships, supporting commercialization, and creating globally competitive, indigenous technologies that strengthen India's bioeconomy and **Atmanirbhar Bharat vision**. Since inception, SBIRI scheme has supported **350+ projects** involving **450+ beneficiaries**. The support has resulted in filing of **50+ patents** and the development or commercialization of **90+ products and technologies**. BIPP scheme has provided support to **300+ beneficiaries**, resulting in filing of **40+ IPs and development/ commercialization** of **100+ products**.

Together, SBIRI and BIPP schemes have transformed scientific potential into scalable enterprises, reinforcing India's innovation leadership and accelerating the journey towards a resilient, self-reliant bioeconomy.

SBIRI/ BIPP Programme Outcomes

Programme	Projects	Beneficiaries	Outcomes
SBIRI	**350+**	**450+**	**90+** products/ technologies
BIPP	**250+**	**300+**	**100+** products/ technologies

Product Commercialization Program (PCP) Fund

The Product Commercialization Program (PCP) Fund, launched in 2018, is designed to accelerate the market entry of high-potential biotechnology products and technologies developed by Indian start-ups. By providing targeted financial support for scale-up, and commercialization, PCP enables start-ups to bridge the critical gap between product development and market deployment. To date, multiple technologies across healthcare, medical devices have been supported under PCP, several of which have reached commercialization and begun generating returns. Return of BIRAC contribution will happen by recipients remitting following the conclusion of the project duration,

Promoting Academic Research Conversion to Enterprise (PACE)

The Promoting Academic Research Conversion to Enterprise (PACE) scheme of BIRAC is designed to bridge the critical gap between academic research and commercialization. It supports researchers and innovators in academic institutions to translate promising technologies into viable products in collaboration with industry. PACE has strengthened academia–industry linkages by enabling researchers to move beyond publications toward product development. Since its inception, 190+ projects have been supported under the scheme involving 310+ beneficiaries resulting in filing of 25+ patents and about 10 products/technologies reaching TRL7-9.

PACE Programme Outcomes

Projects supported	Beneficiaries	Patents filed	Technologies reaching TRL 7–9
190+	310+	25+	10+

Early Translation Accelerator (ETA)

The Early Translation Accelerator (ETA) initiative aims to bridge the gap between laboratory discoveries and industry-ready technologies by strengthening early-stage translational research. Recognizing that many promising academic discoveries fail to reach commercialization due to limited validation and industry engagement, ETA facilitates structured collaboration between academia and industry. These centres provide a framework for proof-of-concept validation, intellectual property generation, and industry engagement, thereby accelerating the transition of academic innovations toward technology transfer and commercialization.

9.3 Ecosystem Maturity

Preclinical Models for Drug Discovery

To strengthen India's drug discovery ecosystem, BIRAC launched a focused initiative to support the development of advanced preclinical models for drug discovery and therapeutic research. The program supports the establishment of robust in vitro and in vivo model systems for screening new drugs, vaccines, and novel chemical entities.

Projects supported under this initiative include cutting-edge platforms such as organoids, organ-on-chip technologies, genetically engineered animal models, and alternative model organisms. These models are being applied to a range of disease areas including cancer, rare diseases, neurodegenerative disorders, and metabolic conditions.

Program on Synthetic Biology

Synthetic Biology Program was launched in 2018 to foster collaborative R&D and commercialization, and to coordinate a national mission aimed at advancing a bio-based economy. Two calls for proposals have been announced which led to supporting a total of 11 projects. These projects focus on developing products such as rose oxide, sandalwood sesquiterpenes and biobutanol production. The projects have resulted in development of PoC. Patents have been filed for a some of the technologies. Strategies for further supporting the developed outcomes as well as the promotion of research in this area is under process.

Program on Guar Gum

Recognizing the industrial and biomedical potential of guar gum, BIRAC launched a targeted program to support the development of value-added technologies and products based on guar gum

The initiative has supported innovations across sectors including biodegradable plastics, biomedical materials, advanced sealants, building materials, and nutraceutical formulations. By promoting the use of guar-based biopolymers and derivatives, the program contributes to sustainable materials innovation while enhancing the economic value of an important agricultural commodity.

Agri-Related Initiatives

BIRAC has implemented several strategic programs aimed at promoting biotechnology-driven innovation in agriculture and strengthening the agri-biotech ecosystem. These initiatives focus on improving crop productivity, enhancing nutritional value, increasing climate resilience, and translating agricultural technologies into solutions that benefit farmers and rural economies.

BIRAC has supported international technology transfer collaborations, including the biofortified and disease-resistant banana program developed in partnership with the Queensland University of Technology, Australia. The program focuses on developing banana varieties enriched with provitamin A and iron, while simultaneously enhancing resistance to major crop diseases.

In addition, BIRAC has supported collaborative research programs aimed at developing heat-tolerant and climate-resilient wheat varieties for the Indo-Gangetic plains, using modern genomics, molecular breeding, and physiological approaches to address emerging climate challenges.

Further to strengthen agricultural innovation, BIRAC partnered with IKP Knowledge Park and launched the Agri-technology Translation Grand Challenge, which identifies scalable agricultural technologies capable of increasing farmers' income. Selected start-ups are supported for field validation and product development, enabling the deployment of technologies such as post-harvest management systems, precision agriculture tools, bio-fertilizers, and sustainable pest management solutions.

Another key initiative is the Secondary Agriculture Entrepreneurial Network (SAEN), which supports start-ups and industry partnerships to develop value-added agri-food technologies and accelerate the translation of innovations from primary agriculture to secondary processing and commercialization. Some of the products include tomato juice-based beverage licensed to an industry; Coloured wheat rich in anthocyanins, phenolics and minerals approved by FSSAI; BioNEST, Punjab University supported projects have focussed on the development of protein and fibre rich beverage, a device for the selection and segregation of normal functional seeds from diseased and broken seeds, etc.

9.4 Growth Stage – Equity Support (SEED & LEAP)

BIRAC's equity support initiatives—the Sustainable Entrepreneurship and Enterprise Development (SEED) Fund and the Launching Entrepreneurial Driven Affordable Products (LEAP) Fund—aim to strengthen the growth stage of India's biotechnology innovation pipeline by providing critical risk capital and enabling start-ups to scale promising technologies. Launched in 2016, the SEED Fund acts as the first institutional equity exposure for biotech startups that have reached the proof-of-concept stage, providing up to ₹30 lakhs to help them build credibility and prepare for larger investment rounds.

To date, SEED has supported 153 biotech start-ups with an investment of ₹45 crore ($5 million), enabling them to collectively attract over ₹1,162 crore ($140 million) in follow-on funding and achieve a portfolio valuation exceeding ₹7,589 crore ($900 million) across 127 startups, with nine successful exits reflecting growing portfolio maturity.

SEED Fund Outcomes

Metric	Value
Startups supported	**153**
Investment deployed	**₹45 crore ($5 mn)**
Follow-on funding raised	**₹1,162 crore ($140 mn)**
Portfolio valuation	**₹7,589 crore ($900 mn)**
Successful exits	**9**

Complementing this, the LEAP Fund, launched in 2018, provides equity support of up to ₹1 crore to accelerate product validation, scale-up, and commercialization of innovative biotech solutions. So far, 62 biotech startups have been supported with an investment of ₹40 crore ($5 million), catalysing over ₹893 crore ($106 million) in follow-on funding, while 59 startups have achieved a cumulative valuation of ₹4,632 crore ($550 million), including four successful exits.

Together, these initiatives play a vital role in bridging the scale-up funding gap, attracting private capital, and accelerating the commercialization of high-impact biotechnology innovations in India.

LEAP Fund Outcomes

Metric	Value
Startups supported	**62**
Investment deployed	**₹40 crore ($5 mn)**
Follow-on funding catalysed	**₹893 crore ($106 mn)**
Portfolio valuation	**₹4,632 crore ($550 mn)**
Successful exits	**4**

9.5 Incubation and Mentorship Ecosystem

BIRAC has established a robust nationwide incubation ecosystem to nurture biotechnology entrepreneurship and accelerate technology translation. Through **a network of 94 biotechnology incubation centres**, BIRAC supports innovators across the startup life cycle by providing access to infrastructure, mentoring, funding linkages, and commercialization support.

This incubation ecosystem has enabled the **support of over 3,000+ startups**, **entrepreneurs, and students**, fostering a vibrant pipeline of biotechnology innovations emerging from academic institutions, research organizations, and early-stage enterprises. The supported ecosystem has also contributed significantly to knowledge creation and intellectual property generation, with more than **1,300+ intellectual property filings emerging from incubated innovations**.

Importantly, these efforts have translated into tangible technological outcomes, with over **800+ products and technologies developed**, contributing to the growth of India's biotechnology startup ecosystem and strengthening the country's bioeconomy.

9.6 IP and Technology Management (IPTEM)

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

Additionally, the group also provides strategic IP advisory services to Start-ups, supporting them in building and strengthening their intellectual property portfolios. One such initiative is the BIRAC IP & Law Clinic Connect, a monthly program designed to guide Start-ups and researchers on intellectual property and technology transfer related matters. The program is virtually organized on the Second Friday of every month.

9.7 Innovate for Sustainable Development

The Innovate for Sustainable Development Division at BIRAC promotes research and innovation that address key environmental challenges and focuses on emerging areas such as green hydrogen, waste management solutions developed in collaboration with municipal bodies, and applications of synthetic biology for sustainable production and resource efficiency. Through targeted funding programs and partnerships, the division supports technologies that convert waste into value, enable clean energy solutions, and develop bio-based alternatives. These efforts help align biotechnology innovation with sustainable development priorities while contributing to India's growing bioeconomy.

9.8 Make in India Biotechnology Programme Management Unit

Programme Focus: Ecosystem coordination, investment intelligence, and global engagement for India's biotechnology sector.

The Make in India Biotechnology Programme Management Unit (MII PMU), led by the Department of Biotechnology (DBT) and supported by BIRAC since 2015, serves as a strategic facilitation and coordination platform for India's biotechnology sector. The PMU supports policy advocacy, ecosystem intelligence, stakeholder consultations, and strategic inputs aimed at strengthening the biotechnology innovation ecosystem in alignment with national priorities and global sector developments.

Working in coordination with DBT, BIRAC, DPIIT, and Invest India, the PMU undertakes ecosystem research and stakeholder consultations to identify challenges faced by biotechnology companies, startups, and entrepreneurs. These insights contribute to evidence-based policy inputs and sectoral recommendations for strengthening innovation, scaling biotechnology manufacturing, and improving ease of doing business in the sector.

The PMU anchors the Biotech Fund of Funds – AcE Fund, which catalyzes private investment into biotechnology startups and emerging companies. It also played a key role in conceptualizing and steering Global Bio-India (GBI), which has evolved into India's flagship international biotechnology convergence platform for showcasing innovation, facilitating investment dialogue, and enabling global partnerships.

Through consultative processes and inter-agency engagement, the PMU has contributed inputs to several policy discussions related to biomanufacturing capacity, innovation infrastructure, startup ecosystem strengthening, and regulatory facilitation. **Key developments supported through these processes include the BioE3 Policy and Bio-RIDE Scheme, abolition of angel tax for startups (Union Budget 2024), custom duty rollback on biotech reagents, extension of startup eligibility to 20 years with turnover threshold of ₹300 crore ($35 million) for deep-tech startups, and revised DSIR recognition norms enabling tax benefits for startups**.

In addition, under DBT's mandate, the PMU hosts the Project Development Cell (PDC) for the biotechnology sector, supporting identification of investment opportunities, development of sectoral project pipelines, and facilitation of domestic and foreign investment in biotechnology manufacturing and innovation infrastructure.

Role of MII in Bringing Together the Biotechnology Ecosystem

The **MII PMU facilitates national and international platforms** that bring together innovators, industry leaders, investors, policymakers, and researchers to strengthen collaboration across the biotechnology ecosystem.

Global Bio-India (GBI) serves as India's flagship international biotechnology event, showcasing the country's innovation ecosystem and enabling global partnerships. Other engagement platforms include the Biotech Start-up Expo, Startup Conclave at IISF, and Innovators Meet and Foundation Day, which provide opportunities for knowledge exchange, networking, and showcasing biotechnology innovations.

In March 2025, the **BioSaarthi Global Mentorship Programme** was launched to support biotechnology startups through mentorship for product development, regulatory readiness, global partnerships, and international market access.

Digital platforms supporting the ecosystem include the **BIRAC 3i Portal** for application and grant management, the **Technology Portal** for technology sourcing and partnerships, the **Biotech Innovation Showcase Portal featuring 850+ technologies and products** from BIRAC-supported startups, and the **Facility Network e-Portal** providing access to equipment and facilities across **BioNEST incubation centres.**

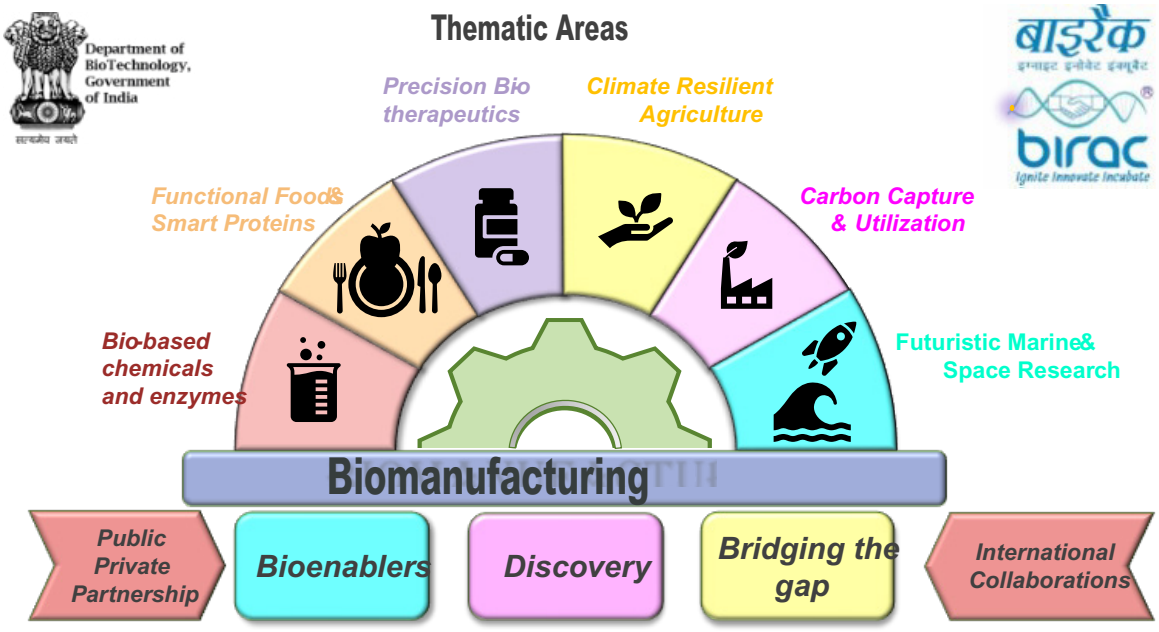
"Strategic coordination, investment catalysis, and global engagement are central to strengthening India's biotechnology innovation ecosystem under the Make in India initiative."

9.9 BioE3 Policy and Biomanufacturing Initiatives

BioE3: Fostering High Performance Biomanufacturing

BioE3 Policy was launched in August 2024. Department of Biotechnology (DBT) has formulated an initiative for the implementation of BioE3 Policy (Biotechnology for Economy, Environment & Employment) for fostering high performance biomanufacturing and to enable start-ups, SMEs, industries and academia with access to shared infrastructure/facilities and resources for pilot & precommercial scale biomanufacturing of viable commercial bio-based products.

BioE3 Policy for a green, clean, prosperous, and self-reliant India, will empower Indian institutions and industries to engage in transformative innovation through Public-Private Partnership (PPP) and international collaborations. Biomanufacturing leverages engineering microbial, plant, animal and human cells with increasing precision and control to produce commercially important products. In addition to enabling India's emissions reduction goals, Biomanufacturing will also have a transformative impact across diverse sectors of health, agriculture, food, pharmaceuticals, chemicals, materials, biofuels, etc. 'Fostering High Performance Biomanufacturing' stimulates and intensifies technology development.



Biomanufacturing Initiative

The following are the verticals considered under this initiative a) Biobased chemicals and enzymes b) Functional foods and smart proteins c) Precision biotherapeutics d) Climate change and resilient agriculture e) Carbon capture and utilization f) Futuristic marine and space biomanufacturing g) Bio-enablers including Bio-artificial intelligence (AI) hubs and Bio-foundries/ Biomanufacturing hubs i.e., High performance biomanufacturing platforms

Bio-enablers consisting of sophisticated instrumentations, technology platforms such as data acquisition and analysis capabilities along with artificial intelligence (AI) and machine learning (ML), omics and biomaterial libraries translate knowledge into scaled up applications, and wide spread socio-economic impact. Further, they augment discovery and translational research across the six sectorial verticals selected under the program. The Bio-AI Hubs will enable discovery research across the sectors, while the Bio-foundries/Biomanufacturing Hubs will support facilities for pilot scale and pre-commercial scale research.

The following are the achievements so far,

Network of 21 Bio-enablers: 08 Bio-foundries and 13 Biomanufacturing Hubs has been created across the country catering to different thematic areas of biomanufacturing.

Webinar Series Launch: 16 webinars have been jointly conducted by DBT and BIRAC so far under different thematic verticals under biomanufacturing initiative.

Launch of calls under thematic areas: The following Joint DBT-BIRAC Calls have been launched under the following categories viz. Discovery & Application-oriented Integrated Network Research; Bridging the Gaps for Scale-up

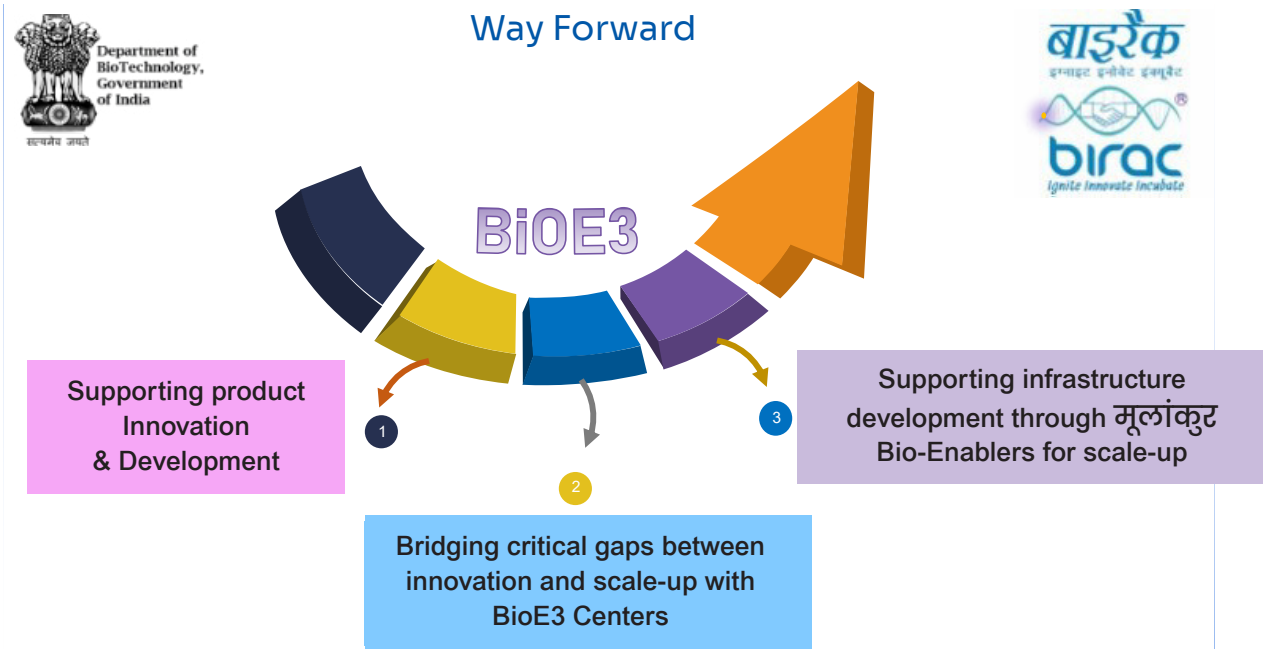
- Call I: "मूलांकुर" BioEnabler Hubs: Biofoundry & Biomanufacturing Hubs
- **Precision Biotherapeutics:** Cell & Gene Therapy
- Smart Proteins
- Carbon Capture & its Utilization
- Climate Resilient Agriculture

- Enzymes
- Precision Biotherapeutics - mRNA therapeutics
- Precision Biotherapeutics- monoclonal antibodies
- Bio-AI
- Call II: "मूलांकुर" Bioenablers: Biofoundries and Biomanufacturing hubs
- Functional Foods
- Bio-Based Chemicals, Biopolymers and Active Pharmaceutical Ingredients (APIs)
- Futuristic Marine research

Other initiatives under BioE3:

BioE3 Centres: A national stakeholder consultation organized by BIRAC in June 2025 identified critical gaps in India's biomanufacturing ecosystem, notably the lack of pilot-scale infrastructure, regulatory-grade facilities, skilled human resources, and integrated public–private partnership (PPP) models.

The consultation strongly recommended the creation of BioE3 Centres—next-generation incubation and biomanufacturing hubs to bridge these gaps and accelerate innovation from lab to market.



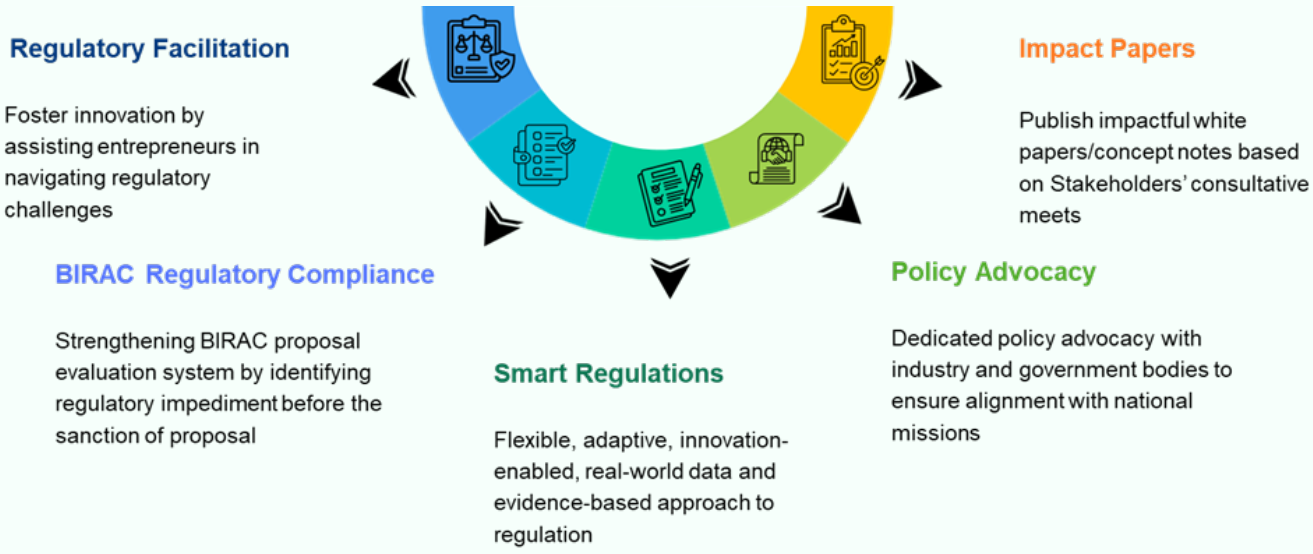
Implementation of Biomanufacturing through different verticals

Regulatory Facilitation for Startups and Innovators

The Regulatory Affairs & Policy Advocacy (RAPA) division of BIRAC strengthens regulatory facilitation for biotechnology innovators through initiatives such as FIRST HUB which is a Single Window Facilitation Platform, where key organisations including CDSCO, ICMR, FSSAI, BIS and DBT assist startups on regulatory pathways.

Over 85 FIRST HUB meetings have addressed 1,100+ regulatory queries from innovators. For advanced regulatory facilitation, REFINE (Regulatory Facilitation for Innovators and Entrepreneurs) provides customised support on regulatory documentation, application processes, regulatory risk assessment, success metrics and licensing requirements.

RAPA has established five key verticals-



For regulatory preparedness, RAPA has conducted numerous capacity-building workshops and webinars. Further strengthening this initiative, RAPA is organising the National Regulatory Professionals Development Programme, a pioneering industry-led masterclass series designed to enhance regulatory, quality, and safety capabilities throughout the product lifecycle.

RAPA also promotes policy reforms through stakeholder dialogues via BioManthan, which is the Global Regulatory Knowledge Exchange Forum for Emerging Technologies. This collaborative platform brings together innovators, academia, regulatory agencies, and industry stakeholders from national and international bodies to collectively address regulatory gaps, share best practices, and strengthen regulatory frameworks for emerging technologies. The division has conducted stakeholder consultations on cell and gene therapy products, complex in-vitro models, quantum computing in biotechnology, and strengthening India's Clinical Trial Regulations, resulting in white papers that highlight regulatory gaps and provide recommendations.

Chapter 10

Investment Landscape in India's BioEconomy Startups

10.1 Overview

India's BioEconomy ecosystem continues to attract sustained investor interest across healthcare, life sciences, agri-biotechnology, and emerging bioindustrial technologies. Between January 2024 and December 2025, the sector witnessed a broad mix of venture capital, private equity, debt financing, and buyout transactions, reflecting increasing investor confidence in bio-based innovation and scalable life sciences platforms.

Analysis of over 200 investment transactions during the period indicates a total disclosed funding value of approximately $4.61 billion. Investment activity was dominated by healthcare and life sciences companies, which accounted for the majority of capital deployment, followed by agri-business ventures focused on food systems, agritech solutions, and supply chain modernization.

The funding landscape highlights the maturation of India's BioEconomy ecosystem, characterized by the emergence of large institutional investments, growing participation of global investors, and continued expansion of early-stage biotech innovation.

Large transactions such as H**ealthium Medtech ($840 million)**, **Advanta Enterprises ($350 million)**, I**nventia Healthcare ($225 million)**, and **Meril Life Sciences ($200 million)** demonstrate increasing investor appetite for scalable healthcare technologies and life sciences manufacturing capabilities in India.

10.2 Funding Trends

Year	Deals	Funding ($ mn)	Average Deal Size ($mn)
2024	108	3,028.8	30.9
2025	100	1,583.3	17.2
Total	**208**	**4,612.1**	—

While the number of deals remained relatively stable across the two years, **total capital deployment declined in 2025**, largely due to the absence of large buyout transactions that characterized the previous year.

Key Trend

Investment value declined by approximately 48 percent between 2024 and 2025, reflecting broader global venture capital moderation. However, the consistent deal count suggests continued expansion of the startup pipeline, particularly in early and growth-stage companies.

10.3 Sector-Wise Funding Distribution

Investment activity is highly concentrated in **healthcare and life sciences**, which together account for **nearly four-fifths** of total capital invested in the BioEconomy startup ecosystem.

Sector	Deals	Funding ($ Mn)	Share
Healthcare & Life Sciences	143	$3,668	79.5%
Agri-business	53	$919	19.9%
BioIndustrial	5	$13	0.3%
IT-enabled Bio Platforms	7	$12	0.3%

Healthcare & Life Sciences

The healthcare sector attracted the majority of investments, driven by strong investor interest in:

1 Medical devices manufacturing
2 Pharmaceutical platforms
3 Diagnostic technologies
4 Biotechnology innovation
5 Digital health and preventive healthcare solutions

Major investments were directed toward companies developing **diagnostic platforms**, **surgical technologies**, **biopharmaceutical manufacturing capabilities,** and **specialty healthcare services**.

Agri-Business

The agri-business sector emerged as the second-largest investment category. Funding activity in this segment focused primarily on:

1 Food and dairy supply chains
2 Agri-logistics and farm-to-market platforms
3 Agritech solutions improving farm productivity
4 Food processing and value-added agricultural products

The growth of this sector reflects rising investor interest in food security, supply chain efficiency, and sustainable agriculture technologies.

BioIndustrial

Although still emerging, investments in bioindustrial technologies signal early momentum in areas such as:

1 insect protein production
2 enzyme and probiotic biotechnology
3 sustainable animal feed technologies

These sectors are expected to become increasingly important components of the bio-based economy as industrial biotechnology matures.

10.4 Stage-Wise Investment Distribution

The distribution of investments across funding stages illustrates the evolution of India's BioEconomy startup ecosystem from early innovation to large-scale commercialization.

Stage	Deals	Funding ($ Mn)
Late Stage	52	1,682
Buyouts / Private Equity	10	1,557
Growth Stage	77	1,157
Early Stage	65	164
PIPE Transactions	4	53

Key Observations

1. **Late-stage investments and buyouts account for a significant share of capital deployed**, indicating increasing maturity of life sciences companies in India.
2. **Early-stage investments account for a large number of deals but smaller capital amounts**, reflecting the research-intensive nature of biotechnology innovation.
3. Growth-stage financing continues to play a critical role in enabling startups to transition from product development to commercialization and scale.

10.5 Regional Distribution of Investments

Investment activity across India's BioEconomy ecosystem is concentrated in a few major innovation hubs with strong research institutions and startup ecosystems.

Region	Deals	Funding ($Million)
South India	103	2,366
West India	52	1,343
North India	44	867
Overseas	4	33
East India	3	2

Key Observations

1. South India leads the BioEconomy investment landscape, driven by major innovation hubs in Bangalore, Hyderabad, and Chennai. These cities host a large concentration of biotechnology companies, research institutions, and venture capital investors.
2. Western India, particularly Mumbai and Pune, also plays an important role due to the presence of pharmaceutical manufacturing clusters and private equity investors.

10.6 Startup Investment Hubs

A city-level analysis reveals that a small number of metropolitan regions account for the majority of startup funding activity.

City	Deals	Funding ($ Mn)
Bangalore	63	1,472
Mumbai	22	736
Hyderabad	16	387
Delhi	15	363
Gurugram	14	325

Key Observations

Bangalore emerges as India's leading BioEconomy startup hub, particularly in sectors such as biotechnology, medical devices, diagnostics, and digital health platforms. The city benefits from a strong ecosystem comprising research institutes, global venture capital funds, and a vibrant start-up culture.

10.7 Largest Investment Deals

Several large investment transactions significantly influenced the overall funding landscape during the period.

Rank	Company	Sector	Funding ($mn)
1	**Healthium Medtech**	Medical Devices	**840**
2	**Advanta Enterprises**	Agricultural Seeds	**350**
3	**Inventia Healthcare**	Pharmaceuticals	**225**
4	**Meril Life Sciences**	Medical Devices	**200**
5	**Felix Pharma**	Pharmaceuticals	**175**
6	**Matrix Pharma**	Pharmaceuticals	**173**
7	**Tirupati Medicare**	CRO Services	**123**
8	**Maiva Pharma**	Pharmaceuticals	**120**
9	**Neuberg Diagnostic**s	Diagnostics	**109**
10	**Centre for Sight**	Specialty Clinics	**100**

These large transactions highlight the strong investor interest in scalable healthcare manufacturing platforms, pharmaceutical production capabilities, and medical technology innovation.

10.8 Comparison of Investment Activity: 2024 vs 25

Metric	2024	2025	Change
Deals	**108**	**100**	Slight decline
Funding	**$3.03 Billion**	**$1.58 Billion**	-48%
Average Deal Size	**$30.9 Million**	**$17.2 Million**	Decline
Largest Deal	**Healthium Medtech ($840M)**	**Meril Life Sciences ($200M)**	Lower megadeals

Key Observations

1. **Decline in Mega Deals**
   The reduction in overall funding during 2025 is primarily attributable to fewer large buyout transactions compared with 2024.
2. **Strong Startup Pipeline**
   Despite lower capital deployment, the number of deals remained high, indicating a continued flow of startup formation and innovation across biotechnology and healthcare sectors.
3. **Expansion of Emerging Biotech Segments**

Recent investments suggest growing momentum in areas such as:

- cell and gene therapies
- oncology diagnostics
- precision medicine
- digital health technologies

10.9 Key Investment Trends

Growth of Healthcare Innovation

Healthcare technologies remain the largest destination for capital, particularly in diagnostics, medical devices, and pharmaceutical manufacturing.

Expansion of Agri-Tech and Food Systems

Investments in agri-business are increasingly focused on improving supply chains, farm productivity, and food processing technologies.

Emergence of BioIndustrial Technologies

Early investments in bioindustrial startups signal growing interest in sustainable materials, industrial biotechnology, and circular bioeconomy solutions.

Rise of Regional Innovation Hubs

Cities such as Bangalore, Hyderabad, Mumbai, and Delhi NCR continue to dominate investment activity, reflecting the importance of strong research and startup ecosystems.

10.10 Outlook

India's BioEconomy investment landscape is expected to continue expanding as biotechnology innovation accelerates and global demand for healthcare technologies grows. Increasing collaboration between research institutions, startups, investors, and industry stakeholders will further strengthen the country's position as a global hub for bio-based innovation.

While short-term fluctuations in venture capital funding may occur, the long-term trajectory of the BioEconomy remains strongly positive, supported by rising healthcare demand, advances in biotechnology, and increasing global investor participation.

Methodology Note:
Investment data presented in this section has been compiled and analyzed by ABLE's Research Team using transaction data from Venture Intelligence, Tracxn, and publicly reported deal announcements from leading business news publications. The dataset covers investment transactions in BioEconomy-related companies between January 2024 and December 2025, including venture capital, private equity, debt financing, and buyout transactions.

10.11 Early-Stage Innovation Capital in India's BioEconomy

While venture capital and private equity investments have played a central role in scaling India's BioEconomy startups, **angel investors and early-stage capital networks form the upstream layer of the innovation pipeline**, supporting founders during the earliest stages of technology development.

Between 2024 and 2025, angel investors backed a diverse cohort of emerging startups across biotechnology, healthcare technologies, agritech, and digital health platforms. These early-stage investments, though relatively modest in ticket size, play a critical role in enabling startups to progress from **research and proof-of-concept stages toward commercialization**.

A significant share of these investments has been directed toward science-led innovation, particularly in areas such as biotechnology platforms, medical devices, diagnostics technologies, and next-generation agritech solutions. These sectors often require longer development cycles and higher technical risk, making early-stage capital particularly important in enabling founders to translate scientific research into commercially viable technologies.

The geographic distribution of angel-backed startups broadly mirrors the broader BioEconomy investment ecosystem, with **Bangalore, Mumbai, Delhi NCR, Hyderabad, and Chennai** emerging as leading hubs for early-stage innovation. The presence of strong research institutions, biotechnology clusters, startup accelerators, and investor networks in these cities continues to support the formation of new BioEconomy ventures.

Another notable trend is the increasing presence of **deep-tech biotechnology startups**, particularly in areas such as synthetic biology, cell and gene therapies, advanced diagnostics, and precision medicine. These developments signal growing confidence among early-stage investors in India's ability to generate globally competitive bio-innovation platforms originating from domestic research ecosystems.

Angel investments also function as an important **precursor to institutional funding**, with a number of startups subsequently progressing to seed, Series A, and growth-stage financing from venture capital and private equity investors. In this sense, early-stage capital represents the **entry point in the broader investment lifecycle of the BioEconomy**, enabling the discovery and development of technologies that can later scale into larger commercial ventures.

The presence of a strong angel investment pipeline indicates that **India's BioEconomy ecosystem is increasingly developing a full capital continuum—from early-stage innovation financing to growth capital and investor liquidity**.

10.12 Private Equity Exit Landscape in India's BioEconomy (2024–2025)

Overview

Private equity exits are a critical indicator of the maturity and liquidity of a sector's investment ecosystem. Analysis of exit transactions in India's BioEconomy between January 2024 and December 2025 indicates continued investor interest and the presence of viable exit pathways for life sciences and healthcare companies.

During the period, 45 private equity exit transactions were recorded across BioEconomy-related sectors, with a combined disclosed exit value of approximately $6.15 billion. The average exit transaction size stood at around $170 million, reflecting the presence of several large secondary transactions and public market exits.

The exit landscape demonstrates increasing investor confidence in India's bioeconomy companies, particularly in healthcare technologies and pharmaceutical platforms.

Key Exit Metrics

Indicator	Value
Total exits	**45**
Total exit value	**$6.15 Billion**
Average exit size	**$170 Million**
Dominant sector	**Healthcare & Life Sciences**

10.13 Sector-Wise Exit Distribution

Private equity exits were heavily concentrated in healthcare and life sciences companies, reflecting the scale and maturity of this segment within India's bioeconomy.

Sector	Number of Exits	Exit Value ($M)
Healthcare & Life Sciences	**33**	**6,100**
Agri-business	**3**	**45**

Healthcare-related exits accounted for over **99% of the total disclosed exit value,** indicating strong liquidity in pharmaceutical, medical device, and healthcare services companies.

Key Exit Pathways

The exits during the period occurred through a mix of channels, including:

Strategic Acquisitions
Several transactions involved acquisitions by larger healthcare companies seeking to expand their product portfolios or geographic reach.

Secondary Private Equity Transactions
In a number of cases, existing investors exited through secondary sales to other private equity funds, reflecting sustained investor interest in scaling healthcare platforms.

Public Market Liquidity
Publicly listed companies also facilitated partial exits through block deals and secondary share sales, particularly in pharmaceutical and healthcare services companies.

Notable Exit Transactions

Several large exits shaped the overall exit landscape, including transactions involving companies such as:

- **Shilpa Medicare**
- **Krsnaa Diagnostics**
- **Entero Healthcare Solutions**
- **Poly Medicure**
- **Country Delight**

These exits reflect strong investor appetite for companies operating in:

- pharmaceutical manufacturing
- diagnostics services
- medical devices
- healthcare distribution platforms

10.14 Exit Trends

Strong Liquidity in Healthcare Platforms

Healthcare companies continue to attract both strategic and financial buyers due to their strong growth prospects and export potential.

Increasing Role of Secondary Transactions

A number of exits occurred through secondary private equity deals, indicating that investors remain willing to acquire stakes in mature life sciences companies.

Growing Investor Confidence in BioEconomy Companies

The scale of exit transactions suggests that India's bioeconomy startups are increasingly reaching maturity levels attractive to global investors and strategic buyers.

Implications for the BioEconomy Ecosystem

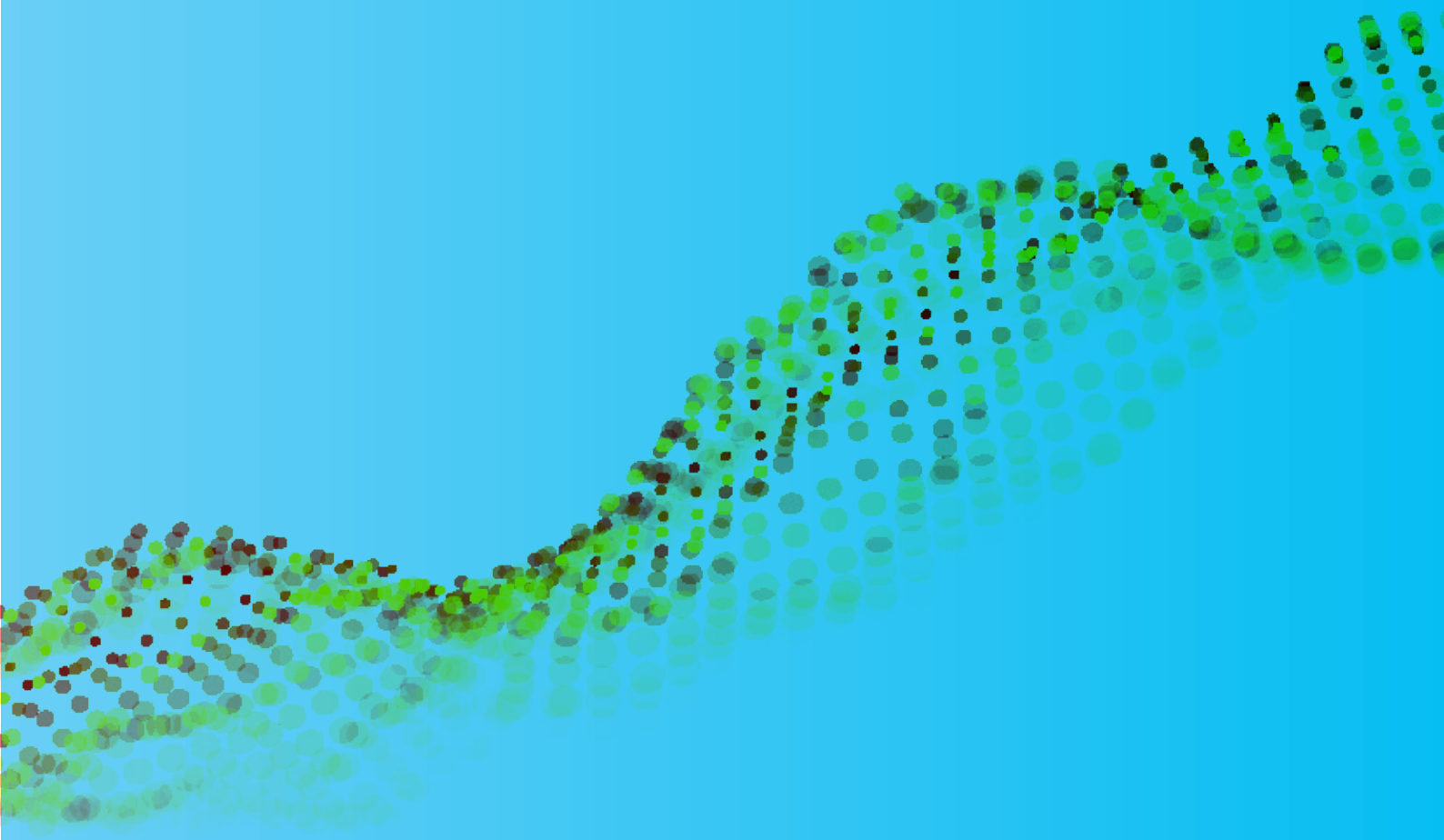
The exit environment provides an important signal for future investment activity. Successful exits encourage new capital inflows into early-stage startups and reinforce investor confidence in the sector.

The strong exit activity observed in healthcare and life sciences indicates that India's bioeconomy ecosystem is progressing toward a full investment lifecycle, encompassing start-up formation, growth-stage financing, and investor exits.

As biotechnology innovation accelerates and healthcare demand continues to grow, exit opportunities in the bioeconomy sector are expected to expand further in the coming years.

Source: ABLE Research analysis based on data from Venture Intelligence, Tracxn, and leading business news publications.

POLICY, PRODUCTS INNOVATION & OUTLOOK



Chapter 11

Policy Landscape Strengthening India's BioEconomy

India's BioEconomy continues to benefit from a supportive policy ecosystem that is increasingly focused on strengthening advanced biomanufacturing, accelerating innovation, and expanding regulatory capacity. Recent policy developments at both the national and state levels signal a strategic shift toward high-value biotechnology segments such as biologics, advanced therapeutics, precision fermentation, and next-generation diagnostics. These initiatives aim to position India as a global hub for biotechnology innovation while strengthening domestic capabilities in research, manufacturing, and commercialization.

11.1 National Initiatives

BioPharma SHAKTI Programme

The Government of India announced the BioPharma SHAKTI (Strategy for Healthcare Advancement through Knowledge, Technology and Innovation) programme in the Union Budget 2026–27 with an outlay of ₹10,000 crore ($1.1 billion) over five years. The initiative aims to position India as a global hub for next-generation biopharmaceuticals, building upon the country's established leadership in vaccines and biosimilars.

The programme represents a strategic shift from the traditional focus on generic medicines to strengthening capabilities in biosimilars, biologics, and advanced therapeutics, particularly to address the rising burden of non-communicable diseases such as diabetes, cancer, and autoimmune disorders.

Key components of the programme include:

- **Scale up** of biopharmaceutical manufacturing capacity
- Development of **global-grade regulatory systems**
- Establishment of additional **National Institutes of Pharmaceutical Education and Research (NIPER) institutions**
- Creation of a **nationwide clinical trial ecosystem**

A major objective of the programme is to establish 1,000 accredited clinical trial sites across India, which will significantly strengthen the country's clinical research capabilities and accelerate drug development timelines. These measures are expected to enhance India's competitiveness in the global biologics market while improving access to advanced therapies at affordable costs.

Guidelines on Genetically Engineered Plants with Stacked Events

The Department of Biotechnology (DBT) has notified the **Guidelines on Genetically Engineered Plants Containing Stacked Events, 2025**, establishing a regulatory framework for the biosafety assessment of genetically engineered plants containing multiple transgenic traits.

Advances in biotechnology have led to the development of **Genetically Engineered (GE) plants**, with stacked events, offering significant potential for agricultural innovation. The guidelines introduced by the **Review Committee on Genetic Manipulation (RCGM)** provide a structured approach for evaluating these crops, ensuring biosafety while enabling innovation.

These guidelines provide a framework for organizations developing stacked GE plants in India, aligning with international standards and promoting innovation. By clarifying approval processes and biosafety requirements, the guidelines aim to support research institutions, biotechnology companies, and agricultural innovators working in plant biotechnology.

Research, Development and Innovation (RDI) Funding Architecture

A major development in India's research ecosystem is the launch of the Research, Development and Innovation (RDI) Fund, a ₹1 lakh crore ($12 billion+) initiative aimed at strengthening deep-tech innovation and enabling large-scale technology development.

The RDI Fund was formally launched by the Prime Minister Shri Narendra Modi on 3 November 2025, as part of the broader national vision of Viksit Bharat 2047, which aims to transform India into a leading global innovation-driven economy.

The fund operates under the Department of Science and Technology (DST) and the Anu-

sandhan National Research Foundation (ANRF), with the objective of catalysing private sector participation in research and development. It supports Eligible Technology Entities, including startups, research institutions, and industry players, undertaking transformative R&D and advanced manufacturing initiatives.

The RDI Fund is designed to address a long-standing gap in India's innovation ecosystem by providing large-scale risk capital for deep technology development, including biotechnology, advanced materials, artificial intelligence, and other emerging technology domains.

Role of BIRAC in the RDI Fund

Within the biotechnology ecosystem, the **Biotechnology Industry Research Assistance Council (BIRAC)** serves as an **implementing partner and Second-Level Fund Manager** under the RDI Fund framework.

BIRAC is responsible for channeling RDI funding toward biotechnology and allied sectors, supporting innovation across a wide range of domains including:

- BioPharmaceuticals and advanced therapeutics
- Agricultural biotechnology
- Industrial biotechnology and bio-manufacturing
- Diagnostics and medical technologies
- Bioinformatics and digital health

Through this mechanism, BIRAC will support **research-driven startups, industry-led R&D programmes, and collaborative technology development initiatives**, helping accelerate the translation of scientific research into commercially viable biotechnology products.

The integration of BIRAC within the RDI Fund framework further strengthens India's innovation pipeline, linking public research institutions, startups, and industry stakeholders.

Scientific Entrepreneurship and Research Commercialization Guidelines

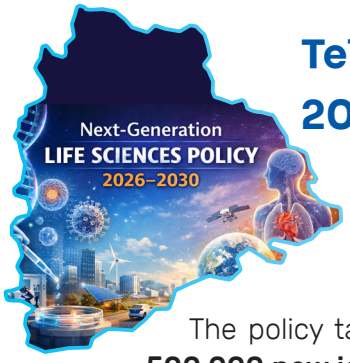
In January 2025, the Department of Biotechnology notified the **Operational Guidelines for Implementing Scientific Entrepreneurship and Research Commercialization at iBRIC institutions**. These guidelines are designed to strengthen the commercialization of scientific research emerging from publicly funded laboratories.

The guidelines include mechanisms that allow scientists working in DBT-supported institutions to participate in entrepreneurial ventures while continuing their research roles. Key provisions include:

- Defined approval processes for commercialization activities
- Guidelines on the time allocation scientists can dedicate to entrepreneurial initiatives
- Revenue-sharing mechanisms between institutions and researchers

These measures are expected to accelerate **technology transfer**, **startup formation, and industry collaboration**, helping translate laboratory research into commercially viable biotechnology products and services.

11.2 Biotech State Policies



Telangana Next-Gen Life Sciences Policy 2026–2030

At the state level, Telangana has announced the **Next-Generation Life Sciences Policy 2026–2030**, which aims to position the state among the **top five global biotechnology and life sciences hubs by 2030**.

The policy targets **$22 billion** (₹2 lakh crore) in investments and aims to generate **500,000 new jobs** over the next decade. The new policy emphasizes innovation-driven growth across the life sciences ecosystem.

Key Focus Areas

The policy prioritizes several emerging biotechnology domains, including:

- Biologics and advanced therapeutics
- Cell and gene therapies
- Precision fermentation
- Advanced diagnostics and medical technologies

Infrastructure Expansion

Telangana plans to strengthen its life sciences infrastructure through:

- Expansion of Genome Valley, one of India's largest biotechnology clusters
- Development of new medical device parks
- Establishment of a Green Pharma City integrating sustainable manufacturing with agricultural ecosystems

Investment and Innovation Support

To accelerate innovation and industry growth, the policy proposes:

- GST reimbursements and fiscal incentives for biotechnology companies
- A potential dedicated life sciences innovation fund
- Support mechanisms for startups and research-driven enterprises

Announced at the World Economic Forum 2026, the policy reinforces Hyderabad's role as a major global hub for pharmaceutical and biotechnology research and development.

Outlook

India's biotechnology policy landscape is increasingly driven towards enabling innovation-led growth across the BioEconomy. National initiatives aim to strengthen biopharmaceutical research and manufacturing, while making regulatory reforms address advancements in agricultural biotechnology and research commercialization.

At the same time, progressive state policies are reinforcing regional innovation clusters and expanding infrastructure for biotechnology R&D and manufacturing. These initiatives are expected to strengthen India's position in the biotechnology domain and accelerate the growth of the country's BioEconomy across healthcare, agriculture, industrial biotechnology, and BioServices.

Major Biotechnology Policy Announcements (2025–2026)

India's biotechnology sector has witnessed several major policy announcements aimed at strengthening innovation, research commercialization, and advanced biomanufacturing capabilities.

Policy Initiative	Lead Institution	Objective
RDI Fund (₹1 lakh crore)	DST / ANRF	Catalyse deep-tech R&D and innovation through public–private investment
BIRAC RDI Implementation	BIRAC	Channel RDI funding to biotechnology startups and innovation programmes
BioPharma SHAKTI Programme	Government of India	Strengthen biologics and biosimilars manufacturing and clinical trial capacity
GE Stacked Events Guidelines (2025)	DBT / RCGM	Establish biosafety framework for genetically engineered crops with stacked traits
Scientific Entrepreneurship Guidelines	DBT / iBRIC	Enable commercialization of research from public laboratories

Emerging Focus Areas in India's Biotechnology Policy

Recent policies prioritize high-impact innovation domains aligned with global biotechnology trends.

Advanced Therapeutics	BioIndustrial Innovation	Agricultural Biotechnology	Digital and Data-driven Biology
Biologics Biosimilars Cell and gene therapies GE Stacked Events Guidelines (2025)	Precision fermentation Bio-based materials and chemicals Sustainable bio-manufacturing	Genetically engineered crops Stacked trait technologies Climate-resilient agriculture	Bioinformatics AI-driven drug discovery Digital health platforms

These emerging focus areas highlight India's shift from a **volume-driven pharma manufacturing model towards innovation-led biotechnology development.**

Chapter 12

12 Innovation Snapshot

Selected Bio-based Product Introductions in India

During 2025, India's biotechnology landscape witnessed a range of new product introductions and technological advancements spanning biopharmaceuticals, vaccines, diagnostics, medical technologies, agricultural biologicals, and biomanufacturing platforms. These developments point to the increasing capability of the country's biotechnology ecosystem and the expanding role of bio-based solutions across healthcare, agriculture, and industrial applications.

The examples presented in this section represent a **curated set of verified product introductions and technology developments reported during 2025**. Rather than offering an exhaustive inventory, the list highlights areas where innovation activity has been particularly visible and commercially significant.

One notable trend is the **advancement of biologic and metabolic therapies,** particularly treatments addressing diabetes and obesity. The introduction of next-generation biologic medicines targeting lifestyle-related conditions signals both rising healthcare demand and the increasing role of advanced biologics within India's pharmaceutical landscape.

Progress is also evident in **diagnostic technologies**, where indigenous molecular diagnostic platforms are enabling decentralized testing and expanding point-of-care capabilities. These solutions support earlier disease detection and facilitate deployment in primary healthcare settings, strengthening the reach of diagnostic services.

India's **vaccine ecosystem** continues to remain a central pillar of the bioeconomy. Domestic manufacturers are advancing new vaccine candidates and expanding development capabilities, supporting both national immunisation priorities and global public health needs.

In agriculture, the **BioAgri segment** is seeing wider adoption of microbial biofertilisers, biostimulants, and plant-health solutions designed to enhance soil fertility and crop productivity. These biological inputs are gaining traction as more sustainable alternatives to conventional chemical fertilisers and pesticides.

Alongside these developments, **biomanufacturing infrastructure and digital biotechnology platforms** are strengthening the broader life sciences ecosystem. Advances in biologics manufacturing, contract research services, and data-driven biotechnology tools are supporting research, pharmaceutical development, and innovation across multiple segments of the Bio-Economy.

Together, these developments reflect the growing technological maturity of India's bio-based economy, with biotechnology applications increasingly integrated across healthcare, agriculture, and industrial systems.

12.1 Key Innovation Signals from Selected Product Introductions (2025)

The selected product introductions and technology developments during 2025 highlight several emerging trends shaping India's evolving bio-based economy:

1. **Rise of advanced biologic therapies**
New treatments for diabetes and obesity reflect increasing demand for next-generation biologic medicines targeting lifestyle-related diseases.

2. **Expansion of indigenous diagnostic capabilities**
Molecular diagnostic platforms developed by Indian companies are strengthening domestic capacity in point-of-care diagnostics and decentralized disease screening.

3. **Growing adoption of sustainable agricultural inputs**
The increasing availability of microbial biofertilisers and biostimulants reflects a shift toward biological crop inputs that enhance soil health while reducing reliance on synthetic chemicals.

4. **Strengthening biotechnology infrastructure**
Investments in digital life sciences platforms and biologics manufacturing facilities signal the continued maturation of India's biotechnology ecosystem, supporting research, drug development, and biomanufacturing.

Selected Product Launches in India (2025)

Segment	Company	Product / Technology	Description
Bio pharmaceuticals	**Eli Lilly**	Mounjaro (tirzepatide)	Once-weekly GLP-1/GIP receptor agonist introduced in India for treatment of type-2 diabetes and obesity, improving glycaemic control and supporting weight reduction.
Bio pharmaceuticals	**Novo Nordisk**	Wegovy (semaglutide)	GLP-1 receptor agonist therapy introduced for obesity management, helping regulate appetite and blood glucose levels.
Bio pharmaceuticals	**Sun Pharmaceutical Industries**	Ilumya (tildrakizumab)	Monoclonal antibody therapy targeting the IL-23 pathway for treatment of moderate-to-severe plaque psoriasis.
Vaccines	**Bharat Biotech**	Hillchol Oral Cholera Vaccine	Oral cholera vaccine candidate based on Hikojima strain technology aimed at addressing global shortages of affordable cholera vaccines.

Vaccines	**Bharat Biotech**	Shigella Vaccine Candidate (GMMA platform)	Vaccine candidate licensed for further clinical development targeting shigellosis, a major cause of diarrhoeal disease in children.
Diagnostics	**Molbio Diagnostics**	Truenat HPV Molecular Diagnostic Test	Portable PCR-based diagnostic test designed to detect high-risk human papillomavirus associated with cervical cancer in decentralized healthcare settings.
Diagnostics	**PrecisionRNA**	CANTEL MicroRNA Breast Cancer Test	Non-invasive blood test detecting circulating microRNA biomarkers linked to breast cancer for early screening applications.
Medical Devices	**Samsung**	BodyTom Mobile CT Scanner	Portable CT imaging system designed for bedside imaging in emergency and intensive care settings.
BioAgri – Biostimulants	**IFFCO**	DharAmrut Bio-Stimulant	Bio-stimulant formulation containing amino acids and micronutrients designed to enhance plant metabolism and crop productivity.
BioAgri – Biofertilisers	**Rallis India**	NuCode Biofertiliser Platform	Portfolio of microbial biofertilisers and plant growth stimulants aimed at improving soil fertility and crop yields.
BioAgri – Biostimulants	**UPL**	GoActiv Seaweed-based Biostimulant	Seaweed-derived formulation designed to improve nutrient uptake and plant resilience under environmental stress.
BioAgri – Biofertilisers	**Coromandel International**	Gromor Drive Biofertiliser	Microbial biofertiliser designed to enhance nutrient efficiency and crop productivity.
BioAgri – Biofertilisers	**IPL Biologicals**	Bacto-Life Biofertiliser	Microbial formulation supporting nitrogen fixation and improved soil fertility.
BioServices / Digital Platforms	**Indus Valley Group**	Atomesus AI Platform	Artificial intelligence platform designed for large-scale data processing and analytics across healthcare, research, and life sciences applications.
Biomanufacturing Platforms	**Aragen Life Sciences**	GMP Biologics Manufacturing Platform	Contract development and manufacturing platform supporting monoclonal antibody development and biologics production using single-use bioreactor technology.

*Note: The products and technologies listed above represent **a select set of verified introductions and developments reported during 2025**. The table is illustrative rather than exhaustive, and other product launches or technology introductions during the year may not be included.*

12.2 Additional Product Launches (2024–2025)

In addition to the product introductions reported during 2025, several notable bio-based innovations and technology deployments have emerged across India over the past two years. These developments span biopharmaceuticals, diagnostics, medical technologies, agricultural biotechnology, digital health platforms, and industrial biotechnology applications.

The examples below illustrate the breadth of innovation across India's life sciences ecosystem—from advanced vaccines, biosimilars, and cell therapies to molecular diagnostics, sustainable agricultural inputs, biotechnology-enabled materials, and digital healthcare technologies. Many of these developments also emphasize affordability, domestic manufacturing, and scalable solutions tailored to India's healthcare and agricultural needs.

Selected Bio-based Innovations in India (2024–2025)

BioPharmaceuticals & Vaccines

Product	Company / Institution	Description
Cadiflu Tetra Vaccine	**Cadila Pharmaceuticals**	Quadrivalent influenza vaccine using nanoparticle technology providing broad seasonal protection.
Glycoconjugate Salmonella Vaccine	**ICMR ⇨ Biological E**	Glycoconjugate vaccine candidate targeting typhoid and paratyphoid infections.
HILLCHOL Oral Cholera Vaccine	**Bharat Biotech**	Oral cholera vaccine developed to address global vaccine shortages and support endemic regions.
Multistage Malaria Vaccine	**ICMR ⇨ Multiple Licensees**	Vaccine candidate targeting multiple parasite stages to improve malaria prevention.
Nafithromycin	**Wockhardt / BIRAC**	Indigenous antibiotic developed to address antimicrobial resistance in respiratory infections.
PneumoShield 14 Vaccine	**Abbott**	Pneumococcal conjugate vaccine offering expanded strain coverage for pediatric protection.
Pertuzumab Biosimilar (Pertuza / Perzea)	**Enzene ⇨ Alkem / Hetero**	Biosimilar therapy for HER2-positive breast cancer improving treatment affordability.

Cell & Gene Therapy

Product	Company / Institution	Description
CAR-T Cell Therapy	**ImmunoACT & Amrita Hospital**	Cell-based therapy for treatment-resistant blood cancers developed within India.
Qartemi CAR-T Therapy	**Immuneel Therapeutics**	Indigenous CAR-T therapy designed to improve affordability of advanced cancer treatments.

Diagnostics & Genomics

Product	Company / Institution	Description
AFuPEPLISA Aspergillus Diagnostic Kit	**ICMR ⇨ Medsource Ozone**	Immunodiagnostic test used to detect invasive aspergillosis in immunocompromised patients.
ddSEQ RNA-Seq Kit	**Bio-Rad**	Single-cell gene expression analysis platform used in oncology and immunology research.
Dengue & Chikungunya ELISA Kits	**ICMR ⇨ Multiple Licensees**	Indigenous diagnostic kits supporting detection of vector-borne diseases.
Geniee Genomics Platform	**Neuberg Diagnostics**	Consumer genomics platform delivering personalized health insights.
Monkeypox LAMP Diagnostic Assay	**ICMR ⇨ SmartQR**	Field-deployable molecular diagnostic for rapid outbreak detection.
QuantiPlus MTB FAST Kit	**Huwel Lifesciences**	Open-platform molecular diagnostic for tuberculosis compatible with RT-PCR infrastructure.
RT-LAMP Nipah Virus Assay	**ICMR ⇨ SmartQR**	Rapid molecular diagnostic enabling detection of Nipah virus in resource-limited settings.

Medical Devices & MedTech

Product	Company / Institution	Description
BehaveNeu Cognitive System	**BehaveNeu**	Neurofeedback-based system supporting behavioral therapy and cognitive training.
GL 22 Blood Glucose Monitor	**Beurer India**	Locally manufactured glucose monitoring device designed for diabetes management.
InSpace Shoulder Implant	**Stryker**	Biodegradable implant used in minimally invasive treatment of rotator cuff injuries.
P-Scope Peritoneal Endoscope	**OUI Medical**	Single-use endoscope enabling minimally invasive diagnostic procedures.
Percept RC Neurostimulator	**Medtronic**	Deep brain stimulation device enabling real-time brain signal monitoring.

Digital Health & Healthcare Technology

Product	Company / Institution	Description
BharatBox Healthcare Metaverse	**BharatBox & GOQii**	Digital healthcare ecosystem combining wellness tracking and immersive engagement.
Caritas Drone Medical Delivery System	**Skye Air Mobility & CARiTAS**	Drone-enabled medical logistics platform improving access to remote healthcare delivery.
EMON-25 Cold Chain Monitoring	**Blackfrog Technologies**	Temperature monitoring solution designed to protect vaccines and biologics during transport.
HEDIS Gen-AI Solution	**CitiusTech**	AI-enabled healthcare quality management platform for payer and provider networks.
LifeCircuit Emergency Ecosystem	**LifeCircuit**	AR/VR-based CPR training and geolocated emergency response system.

Agricultural Biotechnology (BioAgri)

Product	Company / Institution	Description
Agenor Bio-Fungicide	**IPL Biologicals & Punjab Agricultural University**	Trichoderma-based biological fungicide developed for management of Bakane disease in rice.
Milk-O-Mak Adulteration Detection Kit	**BIOSOUK Life Sciences**	Paper microfluidic device detecting multiple milk adulterants without laboratory testing.
Shashthi IVF Media	**Indian Immunologicals Ltd. & NDDB**	Locally produced IVF media supporting cattle breeding and dairy productivity.

Industrial Biotechnology & Bio-based Materials

Product	Company / Institution	Description
Agropak Circular Packaging	**Agropak**	Biodegradable packaging materials produced from coconut and bamboo residues.
Microleer Bio-Leather	**Microleer Biopolymers**	Fermentation-derived leather alternative produced from agricultural waste streams.
Vegan Hyaluronic Acid	**Cosmos Bio**	Synthetic biology platform producing cosmetic-grade hyaluronic acid without animal sources.

Food Biotechnology & Functional Products

Product	Company / Institution	Description
Jeedi Cashew Functional Beverages	**Kamireddy Agro Foods**	Phyto-active beverages developed from cashew processing waste streams.
OATEY Millet Milk	**Plant Essentials**	Millet-based plant beverage supporting alternative dairy products and millet value chains.

Public Health & Vector Control		
Product	**Company / Institution**	**Description**
MozziQuit Mosquito Trap	**MozziQuit Solutions**	Low-cost mosquito trap designed to reduce vector breeding and disease transmission.

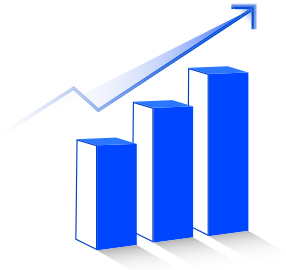
Assistive & Wellness Technologies		
Product	**Company / Institution**	**Description**
DriverPlus Mobility System	**TrueAssist Technology**	Joystick driving control system enabling mobility independence for persons with disabilities.
HQ Smart Bottle	**Rosette Smart Life**	Bluetooth-enabled hydration monitoring device supporting wellness tracking.

Note: The examples presented above represent a select set of innovations reported during 2024–2025 and are intended to illustrate emerging technology trends across India's bio-based economy. The list is illustrative rather than exhaustive.

Chapter 13

13 The Role of MSMEs in India's BioEconomy

11,855
companies in 2026



50–70
companies in 2014

India's BioEconomy has achieved remarkable growth, becoming a vibrant and diverse sector comprising over **11,855 companies** as of **2026,** ranging from large corporations to micro startups. This represents exponential growth from just **50-70 companies** in **2014,** demonstrating India's rapid transformation into a global biotechnology powerhouse. The sector's value has surged from **$10 billion** in 2014 to **$195.3 billion** in **2025**, marking a 19**-fold increase** over the past decade. The BioPharma and ethanol sectors remain particularly strong, with a robust manufacturing base complemented by a growing ecosystem focused on innovative platforms, research services, diagnostics, and medical devices.

13.1 The Backbone

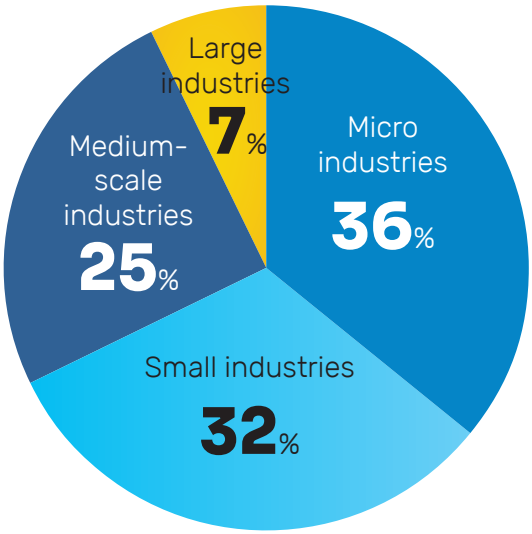
Micro, Small, and Medium Enterprises (MSMEs) form the backbone of India's bioeconomy sector, constituting approximately **90-91%** of all biotech companies, highlighting their crucial role in the broader BioEconomy ecosystem.

Definition of MSMEs
MSMEs are categorized based on their annual turnover

Micro Companies	Small Companies	Medium Enterprises	Large Enterprises
Turnovers under **$0.6 mn (₹5 cr)**	Turnovers under **$0.6-6 mn (₹5 -50cr)**	Between **$6-30mn (₹50-250cr)**	Turnovers under **$30 mn (₹250cr)**

13.2 Sector Distribution & Geographic Concentration

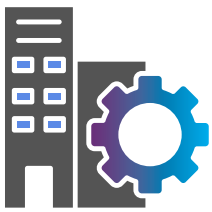
A detailed analysis of India's BioEconomy reveals the following distribution:



Large industries are primarily concentrated in major industrial hubs including **Mumbai**, **Pune, Bengaluru, Hyderabad, NCR (National Capital Region), and Chennai**.

These cities have emerged as biotech clusters with advanced infrastructure, research institutions, and access to skilled talent.

Sectoral Manufacturing



The sectoral manufacturing and capital deployment data underscore the central role of Pharma, Medicinal Chemical and Botanical Products and Food Products in India's manufacturing base. The pharma now accounts for approximately **36.6%** of all factories in India, **21.1%** of capital deployed, and **1-2%** of employment. Food products contribute about **19.0%** of factories, **18.8%** of capital, and **10-11%** of workforce, reflecting intensified investment in these supply-chain-critical segments. It is estimated that India has over **227,175** factories with total capital employed to be around **$10 billion**.

Future Prospects and Growth Trajectory

MSMEs remain the backbone of India's BioEconomy with strong growth prospects. India's BioEconomy is projected to grow at **13-17% annually** through **2030**.

Chapter 14

14 Outlook: Scaling India's BioEconomy

India's BioEconomy has undergone a remarkable transformation from ecosystem development to large-scale industrial growth, expanding from $10 billion in 2014 to $195.3 billion by 2025. Contributing nearly 4 per cent to the national GDP, it has become a key pillar of India's growth story. The sector spans biopharmaceuticals, vaccines, industrial biotechnology, contract research services, and agricultural innovations, demonstrating strong potential for further GDP expansion. Driven by scientific capability, entrepreneurial momentum, and global demand for sustainable solutions, India's BioEconomy now stands at the threshold of its next growth phase—transforming innovation capacity into large scale economic and technological impact in a wide range of industries.

14.1 Progress Toward the 2030 BioEconomy Target

India has set an ambitious target of building a $300 billion BioEconomy by 2030. With the sector currently valued at $195.3 billion, the country has already achieved nearly 60% of the 2030 milestone.

If the current growth momentum continues the 2030 target will happen in time. However, it will require sustained expansion across multiple segments. Sectoral projections indicate the following contributions by 2030.

Contributions across the following key areas by 2030:

Sector	2030 Projection
BioIndustrial	**$130 billion**
BioPharma	**$100 billion**
BioServices	**$45 billion**
BioAgri	**$25 billion**

Table : Projected sectoral contributions to India's BioEconomy by 2030

Among these, BioIndustrial and BioPharma are expected to remain the largest contributors, driven by biomanufacturing, fermentation-based chemicals, vaccines, biosimilars and precision therapeutics. BioIT and research services will expand rapidly through digital biology, genomics and global capability centres, while BioAgri will benefit from advances in gene-edited crops, biological inputs and climate-resilient agriculture.

Achieving the 2030 target will depend heavily on the success of the BioE3 Policy framework, which seeks to accelerate industrial biotechnology and biomanufacturing capabilities across the country.

14.2 The Role of BioE3 and Biomanufacturing Infrastructure

The recent **BioE3 Policy** marks a significant shift toward building a **bioindustrial economy**. The policy focuses on six strategic sectors:

- Bio-based chemicals, enzymes and biopolymers
- Smart proteins and functional foods
- Precision biotherapeutics and advanced medicines
- Climate-resilient agriculture
- Carbon capture and utilization
- Marine and space biotechnology

Central to this strategy is the creation of biofoundries, Bio-AI hubs, and biomanufacturing platforms through the national **MoolankurBio-Enabler Network**. This infrastructure will enable startups and industry to scale technologies from laboratory discovery to industrial production. The launch of India's first National Biofoundry Network, involving six institutions, is expected to significantly strengthen the country's capabilities in synthetic biology, precision fermentation, and next-generation biomaterials.

These infrastructure investments aim to reduce scale-up barriers for biotechnology innovation and support the emergence of globally competitive biotechnology companies. The first round of DBT-BIRAC joint calls under the BioE3 Policy received over 2,000 proposals, with approximately 40 per cent of selected projects led by startups and industry through public-private partnership (PPP) models.

14.3 Shaping the Global Biological Age

The coming decades will witness a profound transformation in the global economy as biology becomes a central platform technology across industries. Advances in biotechnology are likely to reshape manufacturing, healthcare, agriculture and environmental management at a scale comparable to the digital revolution.

With decisive and mission-driven execution, India has the opportunity not merely to participate in this transformation, but to help shape the global rules, markets and platforms of the biological age. If the current momentum is sustained, the country could emerge among the world's top three biotechnology powers, combining scientific capability, industrial scale and entrepreneurial innovation.

The next phase of India's BioEconomy will therefore depend on sustained investments in research, infrastructure, talent development and global partnerships—ensuring that biotechnology becomes a central driver of economic growth, technological leadership and sustainable development in the decades ahead.

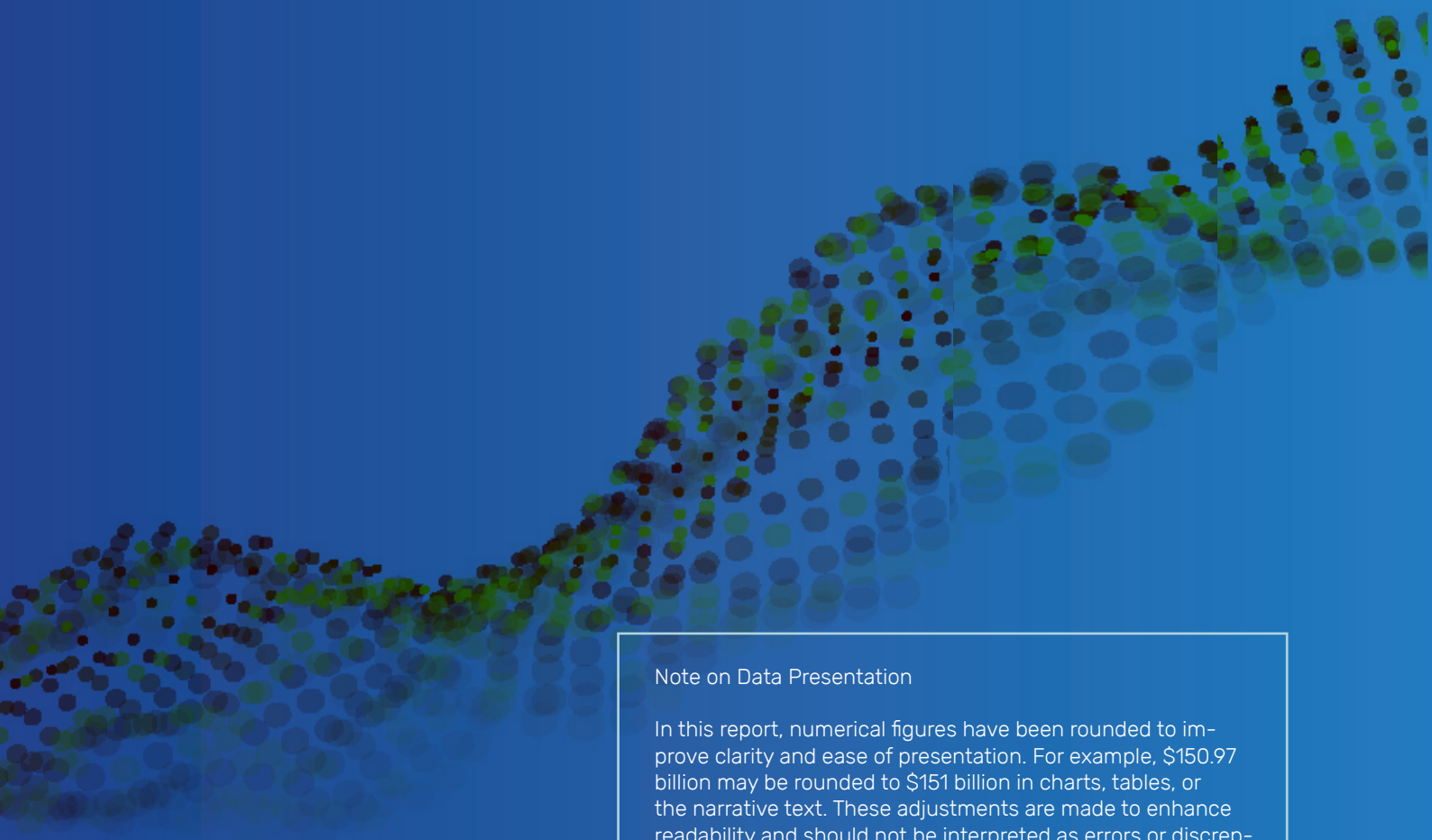
14.4 Convergence with Artificial Intelligence and Digital Biology

The next frontier of biotechnology will be defined by deep convergence with artificial intelligence, robotics, computational biology, and biosensor networks. Worldwide, advances in biologics, cell and gene therapies, synthetic biology, and climate-smart agriculture are increasingly enabled by AI-driven discovery tools and automated bioengineering platforms.

Future growth trajectories for India's BioEconomy assume the widespread integration of AI-native biology, computational modelling, and data-driven biosystems engineering. These technologies are expected to significantly shorten drug discovery cycles, reduce the cost of scale-up, and enable more precise biological design.

The BioE3 Policy also places strong emphasis on building digital and computational infrastructure as foundational public goods. AI-enabled drug discovery, automated Design–Build–Test–Learn (DBTL) cycles, robotic biofoundries, and digital twins for bioprocessing are expected to become central to next-generation biotechnology development. The establishment of Bio-AI hubs recognizes the strategic convergence of biotechnology and artificial intelligence.

DEFINITION AND METHODOLOGY



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.

DEFINITION AND METHODOLOGY OF INDIA'S BIOECONOMY

India BioEconomy Report (IBER)

The **India BioEconomy Report (IBER)** is the national assessment of India's bio-based economy, published annually by the **Department of Biotechnology (DBT), Government of India**, in partnership with the **Biotechnology Industry Research Assistance Council (BIRAC)** and the **Association of Biotechnology Led Enterprises (ABLE)**.

The report provides a structured assessment of the size, composition, and growth trajectory of India's BioEconomy, drawing upon a wide range of industry, policy, and market information. By consolidating insights across biotechnology-enabled industries, the report serves as a reference for policymakers, industry stakeholders, researchers, and investors.

Over successive editions, IBER has developed a consistent analytical framework to estimate the economic value generated by biotechnology-driven industries, enabling the evolution of India's BioEconomy to be tracked over time.

Definition and Scope of the BioEconomy

The **BioEconomy** refers to economic activity derived from the sustainable and **circular use of renewable biological resources**, including crops, forests, animals, fish, and microorganisms, to produce food, feed, energy, materials, and services.

It encompasses the production, processing, distribution, and utilization of **bio-based goods and services enabled by biotechnology and related life science innovations** across industries such as healthcare, agriculture, industrial manufacturing, energy, and environmental applications.

For the purpose of the India BioEconomy Report, biotechnology-enabled economic activity is organized into **four major segments**:

- **BioIndustrial** – industrial biotechnology applications such as biofuels, fermentation-based products, bio-based chemicals, enzymes, and biomaterials used across multiple manufacturing industries including food processing, alcoholic beverages, animal nutrition, textiles, pulp and paper, and household care.
- **BioPharma** – biotechnology applications in healthcare including biologics, biosimilars, vaccines, diagnostics, and medical technologies.
- **BioServices** – biotechnology-enabled services including contract research, clinical development, bioinformatics, digital biology platforms, and life sciences global capability centers.
- **BioAgri** – agricultural biotechnology including crop protection biologicals, biofertilizers, biopesticides, biostimulants, and biotechnology-enabled crop technologies.

The segments are presented in order of their estimated contribution to India's BioEconomy in 2025.

In this report, the BioEconomy represents the aggregate economic value generated across these biotechnology-enabled segments, reflecting the broader contribution of biological resources and biotechnology innovation to economic activity.

BioEconomy Classification Framework

To systematically assess biotechnology-enabled economic activity, the India BioEconomy Report adopts a multi-level classification framework. This framework enables diverse biotechnology applications across industries to be mapped and analyzed within a common structure.

The classification used in this report consists of three levels:

Level	Description
Segment	Broad domains of biotechnology-enabled economic activity
Sub segment	Major application areas or industry groupings within each segment
Industry Category	Specific product markets or industries where biotechnology is applied

Within this framework, each BioEconomy segment contains multiple subsegments representing key biotechnology application domains, while industry categories represent specific markets or product groups where biotechnology plays a role in production or value creation.

This structure allows biotechnology applications ranging from agricultural biologicals and vaccines to fermented ingredients, industrial biotechnology, and research services to be assessed within a consistent analytical framework.

The classification framework is designed specifically for the analytical purposes of this report and may not correspond directly to conventional industrial classification systems.

Methodology: The Triangulation Approach

The estimation of India's BioEconomy value is based on a triangulation approach, combining multiple sources of information and analytical perspectives to develop a comprehensive assessment of biotechnology-enabled economic activity.

The methodology broadly incorporates the following analytical elements:

Segment Contribution Assessment
Economic activity across biotechnology-enabled segments, subsegments, and industry categories is assessed through analysis of industry reports, publicly available financial information, government statistics, and relevant market studies.

Value Chain and Industry Linkages
The analysis also considers the broader ecosystem of biotechnology applications, including upstream and downstream linkages across manufacturing, services, and research activities, to reflect the wider economic role of biotechnology.

Innovation and Ecosystem Indicators
Indicators such as research activity, startup formation, technology development, and industry participation provide additional context for understanding the evolving biotechnology landscape in India.

The analysis is undertaken by the ABLE research team, drawing upon publicly available information, industry insights, and sectoral knowledge. The resulting estimates are reviewed through consultations with industry participants and subject matter experts, followed by internal review to ensure alignment with the overall BioEconomy framework used in the report.

Given the diversity of biotechnology applications and evolving industry structures, the estimates presented in this report should be interpreted as indicative measures of the scale and growth of India's BioEconomy, rather than precise measurements of individual industry revenues.

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, Bio-pharma, 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.

The creation of this report was made possible through the collaborative efforts of ABLE and BIRAC.

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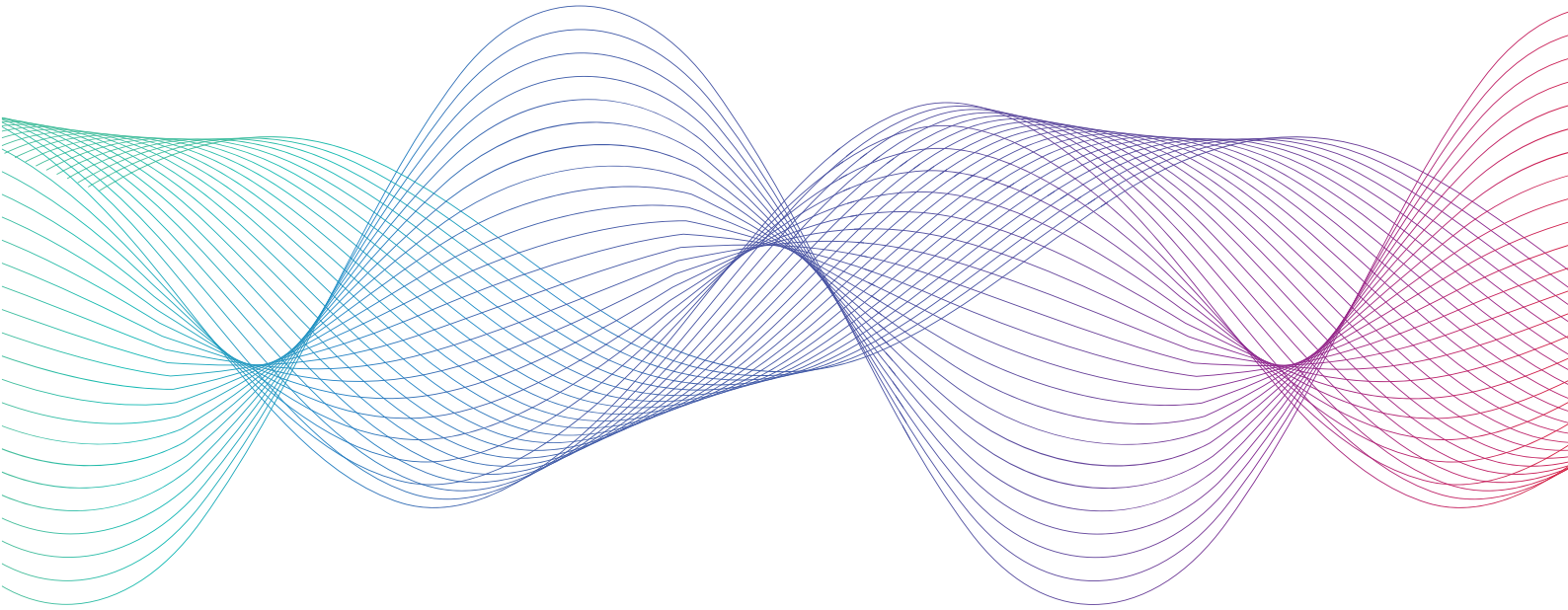

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