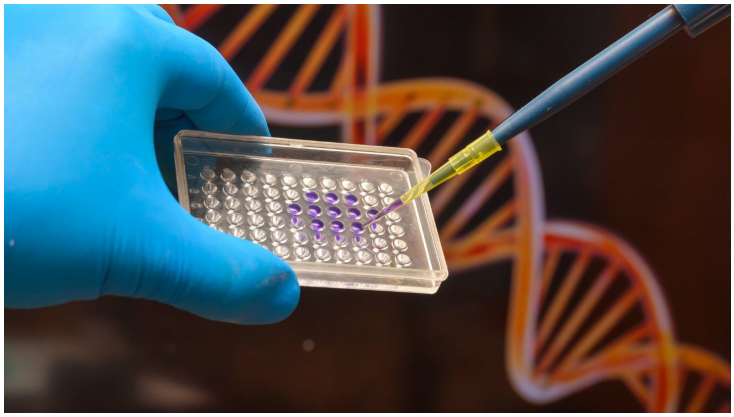
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Boosting Innovation, Collaboration & Entrepreneurship with BioE3 policy

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Bharat has demonstrated a strong economic growth in the past decade and is poised to be amongst the global leaders in the next industrial revolution by leveraging emerging technologies and new innovative solutions. Bharat is competitively positioned to be amongst the global leaders in futuristic manufacturing that leverages living systems. Biomanufacturing can fundamentally transform the global economy from todayâ??s consumptive manufacturing paradigm to the one based on regenerative principles. Biomanufacturing refers to the use of engineered microbial, plant, and animal (including human) cells with increasing precision and control to produce commercially important products on scale. These are versatile processes that have the potential to create bio-based products allowing efficient utilisation of resources, in a scalable and cost-effective manner with reduced environmental impact. Keeping in view the national priority of steering Bharat on the path of accelerated â??Green Growthâ??, an integrated BioE3 (Biotechnology for Economy, Environment and Employment) Policy for â??Fostering High-Performance Biomanufacturingâ?• with an aim to make a green, clean, prosperous, and self-reliant Bharat was released on September 12 at Global Bio-India (GBI) 2024. Letâ??s take a look at how the BioE3 Policy for biomanufacturing is set to transform this landscape.



Bharat's BioEconomy is worth almost $300 billion and is among the top destinations for biotechnology worldwide and the third largest destination for biotechnology in the Asia Pacific. India's BioEconomy reached an estimated $151 billion by 2023 and has witnessed an exponential increase in valuation in the past eleven years, with COVID-19 giving the industry a much-needed push. Today, India is poised as one of the leading destinations for bio innovation and biomanufacturing and hence identified as a sunrise sector and a key part of India's vision of reaching a $5 trillion economy by 2027.

The government introduced the BioE3 (Biotechnology for Economy, Environment, and Employment) Policy—a strategic framework designed to propel India into the next era of industrialisation through high-performance biomanufacturing. The BioE3 Policy was approved on August 24, 2024, by the Union Cabinet for "Fostering High-Performance Biomanufacturing". The policy chalks a strategic roadmap to making India a global biomanufacturing hub by promoting high-performance biomanufacturing through innovation for the development of bio-based products and building an infrastructure that enables scale-up and commercialisation.

The policy aims to empower Indian institutions, universities, startups, and industries to engage in transformative innovations by boosting domestic biomanufacturing capabilities by enabling synergy between science, technology, engineering, and manufacturing. The policy lays out plans for accelerating the transition to biomanufacturing by promoting integrated use of AI, digitalisation with 'omics', and upstream biotechnology innovations through bio-AI hubs, biofoundries, and biomanufacturing hubs across the country.

The six thematic areas of focus highlighted in the BioE3 Policy include bio-based chemicals and enzymes, functional foods and smart proteins, climate-resistant agriculture, carbon capture and utilisation, futuristic marine and space research, and precision biotherapeutics. Out of these six, the area of focus relevant to life sciences industries that BioSpectrum will aim to explore is Precision Biotherapeutics.

'Precision Biotherapeutics' is of special focus and interest to the healthcare and biopharma sectors. The policy draws attention to biologics/biotherapies like Cell and Gene therapy, mRNA therapeutics, monoclonal antibodies, immunotherapy, as well as next-generation vaccines.

"To successfully implement the BioE3 Policy, various ministries and departments are collaborating and sharing resources. For instance, the Ministry of Electronics and Information Technology will support AI-based biomanufacturing, while the Indian Council of Agricultural Research will focus on developing agribiologicals. Other ministries like New and Renewable Energy, Space, Health, Pharmaceuticals, and Earth Sciences will play critical roles in ensuring the policy's success," said**Dr Jitendra Singh, Union Minister of State (Independent Charge) for Science and Technology.**

The minister further said "Powered by the visionary BioE3 policy, I strongly believe that Bharat would emerge as a global biotechnology powerhouse with significant contribution of Bioeconomy to our shared vision of 'Viksit Bharat' by 2047".

BioE3 for Biomanufacturing

Biomanufacturing involves the use of biological systems to produce commercially relevant products. The world is at the cusp of a new industrial revolution driven by bio-innovation, and biotechnology will strongly influence future bio-based manufacturing, many nations like the United States of America, Japan, Australia, Finland, and other European countries, have put forward their policies, strategies, and roadmaps to set up a robust framework for biomanufacturing. An efficient and

sustainable biomanufacturing ecosystem can form the backbone for biotechnology innovation and an infrastructure that truly enables the translation of innovations to society at large. Fostering these aspects will be necessary for a holistic and sustainable infrastructure that is well-positioned to achieve key milestones in high-performance biomanufacturing and robust commercialisation of such innovative biotechnology products.

"The BioE3 Policy positions biomanufacturing as a crucial solution for sustainable growth", remarked **Dr Rajesh Gokhale, Secretary to the Government of India, Department of Biotechnology (DBT), Director General, Biotechnology Research and Innovation Council (BRIC) and Chairman, Biotechnology Industry Research Assistance Council (BIRAC).** "This BioE3 policy is about scaling up – Scaling up of the ambitions of startups to become successful entrepreneurs, scaling up of their programmes to become successful products, and scaling up of capabilities so that we can change the ecosystem in the world", he said.

Emerging technologies, like synthetic biology and artificial intelligence, present opportunities to accelerate the growth of bioeconomies. For instance, applying AI algorithms and machine learning tools to biological applications has been changing the outcomes biology can provide. If established models from countries leading the bioeconomy game are to be drawn inference from, fuelling biotech innovations brewing at the interface of advanced technology, biology, and bioprocess engineering could drastically speed up the development of commercial outcomes for healthcare. In that sense, generative biology presents limitless improvements and has already started delivering game-changing outcomes.

Dr Jitendra Kumar, Managing Director, BIRAC said, "Strategic reforms, harmonised with regulatory reforms and global standards, need to be defined for facilitating production and commercialisation of novel bio-based products. The convergent and multi-disciplinary research for biomanufacturing at scale entails multiple elements of regulatory interface and approvals. Proactively engaging with all stakeholders to identify such challenges and facilitating stakeholder interactions to pursue potential solutions will be crucial – to create a convergence between biotechnology, engineering, and digitalisation. Implementation of this biomanufacturing initiative will be through a public-private co-creation model that combines expertise in academia, startups, and industry through inter-ministerial coordination. The BioE3 policy aims to achieve this through collaborations with international partners, research institutions, universities, government agencies, and public-private partnerships with startups and Indian industries, further enabling the growth of an economically and environmentally sustainable bioeconomy and contribute for making Bharat self-reliant."

The introduction of the BioE3 Policy comes at an interesting time for India's biotechnology sector, for focused industrialisation of 'bio-based products'.

Deeming the policy as a pivotal moment in India's biotechnology landscape, **Prof. K VijayRaghavan, former Principal Scientific Adviser to the Government of India,** spoke primarily about the policy's implications for successfully scaling up biotech innovations and its importance in helping the country move towards domestically developed products. He further said "India has already showcased its capacity to innovate in biotechnology, especially in vaccine development and agricultural biotech. However, scaling these innovations to meet both domestic and global demands requires a robust biomanufacturing ecosystem. The BioE3 policy addresses this need by fostering indigenous biomanufacturing capabilities. By building cutting-edge infrastructure, promoting skill development, and encouraging collaboration between research institutions, startups, and industry, this policy sets the stage for India to become a biomanufacturing powerhouse."

Remarking on the prospect of India becoming a global biotechnology leader by leveraging this policy, **G S Krishnan, President of the Association of Biotechnology Led Enterprises (ABLE)** stated, "The national Bioeconomy's growth with get further momentum with the newly unveiled BioE3 policy of the Department of Biotechnology. It is just the right catalyst to push our BioEconomy to a higher orbit by harnessing the power of biomanufacturing. The COVID-19 response demonstrated India's vaccine manufacturing prowess and BioE3 has the potential to replicate this success in many other sectors of our industry, particularly in the emerging areas of alternate proteins, biofuels, cell and gene therapy and so on."

By India, for India

Precision medicine and personalised healthcare are rapidly gaining traction globally. Broadly, precision medicine comprises detailed molecular characterisation of disease states using the biologic omics platforms to better individualise diagnostics, prognostics, and therapeutics, utilising individuals' factors like genetic, environmental, and lifestyle data to improve the prevention, diagnosis, and treatment of disease. Alongside concerns of data-sharing and patient privacy, equitable access to treatments is a major contemporary hurdle in truly manifesting large-scale effective precision medicine provision in India.

Unmet medical needs and inefficiencies drive healthcare innovation with the goal of protecting and promoting health for individuals and society at large. Non-communicable diseases are on the rise in the Indian population. The prevalence of deadly infectious diseases, along with the potential of numerous epidemic or pandemic-causing pathogens is a challenge. The prevalence of genetic disorders, and rare diseases such as sickle cell anaemia, muscular dystrophy, thalassemia, and haemophilia also poses a challenge for our society and healthcare system. The scenario not only presents opportunities but also necessitates, diving deep to act on the untapped potential for high-degree innovation and building a robust infrastructure for effectively translating health innovations to society at large.

India's biotech sector is poised to achieve new heights. India's biotechnology prowess, coupled with its leadership position in the biopharma sector, positions India to be a frontrunner in leading the 'Fourth Industrial Revolution' of bio innovation.

"Over the next decade, a lot of diseases that are currently incurable will start becoming treatable due to the advent of cell and gene therapy. It will be imperative for every country to create an indigenous platform from which a large ecosystem of companies and academia can do research to bring therapies to people in need," said **Dr Jogin Desai, Founder and CEO, of Eyestem Research** while talking about how high-performance, innovation-driven biomanufacturing collectively set to boost the precision biotherapeutics space in India, particularly cell therapy.

"Biomanufacturing is a critical bottleneck in development of cell and gene therapies and I am delighted that the policy is targeting it as one of the key initiatives. Several such initiatives exist in the UK (Catapult networks), and Canada (Centre for Commercialisation of Regenerative Medicine) besides state-level networks in the US which have led to the flourishing of such therapies in those countries. I hope India will soon see a similar cohort of innovation-driven companies", he added.

Highlighting some prominent challenges India's biotech sector is facing in developing and achieving a successful transition of innovative cell therapies from lab-to-market and pre-commercialisation, Dr Desai said, "Two main challenges for such therapies hobble the sector. The first is the ability to productise the science i.e. the transition from research-led protocols to predictable GMP scale protocols. Second is the absence of a large ecosystem of knowledgeable funders from the VC community."

While **Dr Rahul Purwar, Founder and CEO, ImmunoAct** remarked on the fact that extremely high costs of such therapies is a hurdle we need to overcome. He stressed that innovation in India and indigenous production through solid public-private partnerships (PPP) across Indian academia and industry would be important to bring down costs. "If biomanufacturing can be done in a PPP format, it will make these therapies more affordable. We need to accelerate examples of such collaborations multifold now, and this is where the BioE3 policy will help", he said.

"Another important aspect to consider when talking about cell and gene therapy is the accessibility of the therapies. Only 10 per cent of our population can afford these therapies. Including (our) cell and gene therapies in Government healthcare access programmes, such as Ayushman Bharat and reduction in the high GST on oncology therapies, can also make cell and gene therapies affordable", he added.

Large-scale biomanufacturing and the successful scale-up and commercialisation of innovations are critical to making biotherapeutic therapies more affordable. By optimising production processes and achieving economies of scale, manufacturers can reduce the cost per unit of complex biologics, biosimilars, and advanced therapies. This, in turn, could lower the overall price of therapies, making cutting-edge treatments accessible to a broader population and addressing healthcare affordability on a global scale.

Technological advances in biotechnology have empowered companies to stay competitive by enabling efficient, cost-effective, and scalable production processes. A seamless integration of these approaches could stand as a crucial factor for our Biotech landscape. Strengthening supply chain efficiencies while driving innovation in biotherapeutics and other life sciences sectors would benefit from an infrastructure provisioning for technology-driven high-performance biomanufacturing.

Emphasising the policy's focus on self-reliance in biopharmaceuticals, vaccines, and biologics, Prof. Raghavan said, "The pandemic underscored the need for nations to secure their supply chains, especially in health-related manufacturing. Biomanufacturing will enhance India's ability to respond to future pandemics and reduce dependence on imports for critical products, fostering economic resilience."

India is an established leader in vaccine manufacturing and supply to the world. But, encouraging innovation, providing more financial initiatives and streamlining regulatory processes will benefit Indian companies engaged in the development and production of biological products, opined **Dr K Anand Kumar, Managing Director of Indian Immunologicals Limited (IIL),** while lauding the BioE3 policy for its comprehensive approach to enhancing the biomanufacturing ecosystem in India. Dr Kumar also highlighted the policy's alignment with IIL's objectives and a broader mission of advancing healthcare solutions

while achieving self-sufficiency. “The BioE3 policy complements IIL’s vision of advancing public health through indigenous vaccine development and biomanufacturing. It supports our efforts to scale up production capabilities and enhance our research initiatives,” he stated.

In the context of biomanufacturing ‘by India for India’, factors in addition to innovation could be significant contributors to shaping a forward-looking biotechnology landscape. **Krishna Mohan Puvvada, Regional President – MEIA, Novonesis** said, “The BioE3 policy envisages the path for India towards becoming a global leader, adopting and expanding the biomanufacturing ecosystem. The policy also aims to effectively steer the transition to a circular economy. Biomanufacturing will enable high-skilled job creation and intensify entrepreneurial momentum towards a knowledge-based industry sector. This initiative will accelerate India’s ambition towards de-carbonisation targets by encouraging the Indian industry to shift towards more sustainable production processes.”

Sharing his views **Aditya Sharma, Head of Process Solutions, India Region, Merck Life Science** said, “The BioE3 policy’s focus on advancing biomanufacturing will not only benefit life sciences but also bolster the related sectors, contributing to a more sustainable and prosperous economy. Advancements in some strategic segments such as cell and gene therapy will be amplified with suitable interventions aligning with global scientific research. We truly believe that with key drivers such as public-private-partnerships; appropriate FDI incentivisation; skill development with global practices, learnings, industry-ready curriculums; identifying and supporting key projects with less-paper more-trust approach, and constant industry/stakeholder consultation will amplify the potential of BioE3 policy across all the players in India.”

By India, for the world

India is set to emerge as a global leader in biomanufacturing. Recognised for its vast capabilities in producing biopharmaceuticals, biologics, and biotherapeutics at scale, and as one of the largest suppliers of vaccines and biosimilars, India’s biomanufacturing prowess would be underpinned by a robust infrastructure, skilled workforce, and competitive cost advantages. With a growing emphasis on innovation, the country continues to strengthen its position as a key player in the global supply chain, driving advancements in precision therapeutics and biologics. India's role in biopharma is critical to ensuring global healthcare access, particularly in emerging markets.

Sharing views on impact of BioE3 policy on Contract Development and Manufacturing Organisations (CDMO) sector **Alex Del Priore, SVP Manufacturing Services, Syngene,** opined, “Over the next few years, the competitive landscape for Indian CDMOs is expected to undergo significant evolution, primarily propelled by the increasing emphasis on biologics and advanced manufacturing technologies. Indian manufacturers are producing biologics approved by US FDA and EMA which underscores adherence to international quality standards and fosters confidence in the sector. The burgeoning demand for biologics will serve as a pivotal growth catalyst, with Indian CDMOs such as Syngene, equipped with comprehensive capabilities in this domain, poised to seize a larger market share. Technological advancements like perfusion, continuous processing and automation will play a critical role in enhancing production efficiency and CDMOs in India investing in these areas are well-positioned to lead the market and capitalise on emerging opportunities. Further, the capabilities to produce peptides, oligonucleotides, plasmid DNA, mRNA enable the CDMOs to stay at the cutting edge of therapies. Continued government support through initiatives like the BioE3 policy, PRIP (Promotion of Research & Innovation in Pharma-MedTech sector) scheme and PLI (Production Linked Incentive) scheme will further bolster the capabilities of Indian CDMOs, enhancing their competitiveness globally.”

Expressing his thoughts on the policy **Dr Vishal Warke, Director- R & D (Cell Biology & Hydroponics), HiMedia Laboratories** said, “To become a global manufacturing hub as well as a supplier, we need to have excellent quality at affordable prices. That can only come with economies of scale. Our national intent is not just about boosting our biotech sector, it's about making India a global hub for import substitution to furthering Atmanirbhar Bharat to Bharat Nirbhar Vishwa.”

Dr Warke further said that with this policy, India is taking a giant leap forward in transforming the nation’s biomanufacturing landscape. “The policy focuses on fostering innovation in critical areas like precision biotherapeutics (among others). The policy aims accelerated technology development and commercialisation to biomanufacturing hubs, bio-AI centres, and biofoundries. We need to set up a foundation for a massive scale-up, which is now provisioned for in the BioE3 policy. The policy is a game-changer for India, positioning us at the forefront of the global biotechnology revolution and paving the way for a prosperous self-reliant future,” said Dr Warke.

Hailing the BioE3 policy as the Government's bold initiative to establish India as a global leader in biomanufacturing, **Chakravarthi AVPS, Advisor International Affairs, Federation of Asian Biotech Associations (FABA) and Chairman, Federation of Pharmaceutical Entrepreneurs (FOPE)** stressed upon factors that will give impetus to make this initiative a

success. “While the policy lays out an ambitious and promising vision, its success will hinge on addressing several existing challenges. These include overcoming regulatory delays, ensuring infrastructure readiness, and bridging the skill gap within the biotech sector. Effective implementation of these measures will be crucial for the policy to achieve its full potential. If executed successfully, the BioE3 policy could significantly transform India’s bio-economy and propel the country to the forefront of global biotechnology and healthcare innovation, establishing it as a major player in these critical sectors”, he added.

With the BioE3 policy for high-performance biomanufacturing, India is aiming to step into the ‘next phase’ to become one of the top global hubs for biomanufacturing. With the momentum the policy is set to provide, how Indian players in large-scale commercial production of therapeutics, next-gen vaccines, biosimilars and novel biologics will capitalise on the opportunity to be a global leading supplier will be an interesting journey.

Bruna Magnago, Senior Fellow, India-Brazil Chamber of Commerce (IBCC) shares, "The BioE3 policy will likely attract global investments into India’s bio-based API sector, and Brazilian companies could capitalise on these opportunities by investing in joint ventures or technology transfer initiatives. This would deepen bilateral trade ties, as Brazil continues to seek reliable sources of APIs, especially in the post-pandemic context where supply chain resilience is paramount.

As India strengthens its bio-based pharmaceutical industry, both India and Brazil are increasingly focusing on regulatory convergence and reliance initiatives. By aligning regulatory frameworks, particularly for bio-based APIs, businesses in both countries could benefit from streamlined market entry and faster regulatory approval processes, paving the way for smoother cross-border transactions.

India’s shift towards bio-based APIs under the BioE3 policy is expected to enhance the global competitiveness of Indian pharmaceutical exports. For Brazil, this opens up avenues to import high-quality, bio-based APIs at competitive prices, reducing dependency on traditional synthetic APIs and contributing to cost-effective, sustainable healthcare solutions."

"We at Supriya Lifescience view the new BioE3 policy as a means to ‘shift the gear’ for the Active Pharmaceutical Ingredient (API) sector and one that aligns with our expanding growth and vision for sustainable innovation. BioE3 Policy places us in the best position due to our current path which has included huge boosts in production capabilities. It will enable us to apply state-of-the-art (SOTA) technology to our operations concerning both productivity and sustainability as envisaged by the policy through the setting up of regenerative bioeconomies and biomanufacturing cities. While welcoming the prospects opened by the BioE3 policy, we would also like to stress our intentions to create partnerships with academic centres, research institutes, and industry members. These collaborations will help us to advance transformative research programmes and collaborate on expertise that will expand and enhance the industry’s biomanufacturing capabilities and the development of new therapeutics", said **Shivani Wagh, Joint Managing Director, Supriya Lifescience.**

Biosuppliers Boosting Biomanufacturing

Biosuppliers play a critical role in enhancing biomanufacturing by providing essential raw materials, equipment, and technologies that enable efficient and scalable production of biologics, biosimilars, vaccines, and other biotherapeutics. Their contributions span across upstream and downstream processes, offering innovations in areas like single-use technologies, bioreactors, filtration systems, and advanced analytical tools that ensure quality and regulatory compliance.

In the context of the growing demand for biologics and emerging therapies such as cell and gene therapies, biosuppliers are crucial in accelerating production timelines while reducing costs. By fostering collaborations with biopharma companies, investing in R&D, and improving supply chain resilience, they can help streamline production processes, minimise contamination risks, and maintain high safety and efficacy standards. As the biotech industry evolves, biosuppliers are positioned as key partners in driving technological advancements, ensuring consistent manufacturing capacity, and supporting the global expansion of biomanufacturing capabilities.

V Sankaranarayanan, Managing Director, VFL Sciences opined, “The BioE3 policy is a welcome move by the government, and it is the need of the hour for India. This policy will attract more biosupplier companies to invest in India. This will also kindle entrepreneurship among the youth, and we can expect more startups to come into the biosupplier area. Biosuppliers are a very important part of this policy as equipment, consumables and reagents will be needed in large quantities to support the programme. Currently, India is depending more on imported products in this space, and the funds from the government for such programmes are very limited. In order for the programme to be a grand success, the government should support the biosuppliers from India.”

Sharing views about the primary obstacles biosuppliers face when scaling up innovative bioprocesses for large-scale production, commercialisation of precision biotherapeutics and biologics, Sankaranarayanan said, "The biosupplier industry is evolving, however, the market is currently very small. Due to the smaller market, we are not able to attract the best talent. Engineers with better experience in developing innovative products are very limited in India. As the market evolves and more players come into the market, I feel this will develop automatically. India currently lacks any government research lab which supports the biosupplier industries. We don't have labs that are working on novel instruments. There is very little happening on the instrumentation part for life sciences."

Elaborating on how biosuppliers can capitalise on the momentum the policy is set to provide to drive high-performance biomanufacturing and large-scale production capabilities, he further said, " It is a good time for Indian companies engaged in the production of such instruments to upgrade the quality of the product as well as the support infrastructure to grow the business. I also expect more people with global experience to join Indian companies to support them with the knowledge and process. I also hope more global companies come forward and work with Indian manufacturers to develop the industry further. With the scale improving it is possible for global companies to set up their own manufacturing facilities in India. Overall it is going to be a very interesting time for Indian biosuppliers."

Sharing his perspective about the challenges biosuppliers face in scaling up innovative bioprocesses for large-scale production of precision biotherapeutics and biologics, **Dr Girish Mahajan, Senior Vice President - Microbiology Department, HiMedia Laboratories** said, "While some industrial R&D facilities can begin optimising from the start using highly automated, synchronised mini-bioreactor systems, the cost is prohibitive for many new developers. As the scale increases by factors of 5x or 10x, nearly every parameter contributing to the complexity of the molecules must be carefully optimised. Scaling up cell cultures presents significant challenges due to variations in growth and performance at larger volumes, often leading to inconsistent yields and product quality. Additional technical hurdles include modifying bioreactor designs and mitigating contamination risks."

He further said, "High-end analytical tools are required to measure key variables in (production of) therapeutic molecules, and the cost of equipment or outsourcing these analyses further adds to the expense. Logistical issues also arise, including the high costs of purifying biologics to meet stringent quality and regulatory standards. Even if these hurdles are overcome, the feasibility of the project is often questioned based on the yield. For instance, achieving an optimised yield of 3.5 g/L may not be commercially viable if the minimum required yield is 5 g/L. For academic research institutions, such projects are feasible only with full funding support for the necessary advanced infrastructure."

With regards to how the BioE3 policy framework can strengthen the link between biotechnology research, scale-up, and commercialisation, he said, "The policy, promotes the development of advanced biomanufacturing technologies such as single-use bioreactors, perfusion systems, and wave bioreactors, which are critical for cost-effective and scalable production. The policy ensures collaboration between academia, industry, and regulatory bodies, increasing the likelihood of bringing new biotherapeutics from the research stage to market. By streamlining regulatory processes and offering subsidies for infrastructure development, BioE3 aims to accelerate the scaling and commercialisation of biologics, particularly in areas like precision medicine and biotherapeutics."

No time like present

The Government of India has introduced several Production Linked Incentive (PLI) Schemes aimed at enhancing domestic manufacturing and attracting significant investments in the life sciences-related sectors. Additionally, initiatives like 'Make-in-India', National Biopharma Mission (NBM), as well as new provisions from the Anusandhan National Research Foundation (ANRF), to name a few, are set to boost innovation and technological prowess. The country's total biotech startup base has expanded to 8,531 companies in 2023. The base grew from 3,397 companies in 2019. India is also witnessing an increase in the number of incubators and knowledge parks in the biotechnology landscape.

As highlighted by DBT BIRAC's India BioEconomy Report (IBER) 2024, MSMEs remain the backbone of India's BioEconomy, despite certain challenges. Their contributions are vital for the sector's growth and resilience, and with continued support and development, they are well-positioned to sustain their crucial role in the industry's future.

The IBER 2024 also highlights that Indian BioEconomy's drivers are rooted in diverse segments like BioPharma, BioIndustrial, and BioServices. This adaptability positions the India BioEconomy for continued success. Some of the key upcoming trends include global biosimilars market, therapeutics innovation and sustainable bio-industrial practices. Tech integration in the bio IT/research services will also be a major driver in the coming years.

Expanding global acceptance of Indian-made biosimilars presents a lucrative opportunity for the BioPharma sector to capture a larger market share in developed countries. Continued advancements in BioPharmaceuticals, personalised medicine, and precision treatments are expected to propel the therapeutics segment forward. Integration of advanced technologies like bioinformatics, data analytics, and artificial intelligence in bioresearch services is poised to accelerate, enhancing research capabilities and driving growth in BioIT/Research Services.

The picture this paints certainly points to the notion that it is going to be an interesting, perhaps revolutionising time for Indian biotechnology, albeit challenges and hurdles that will need to be overcome. How the BioE3 Policy for biomanufacturing will lead this revolution, time will tell.

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