

The Next Industrial Frontier in Healthcare: From Plants to Platforms-Building a Resilient Health Economy: Value Chains, Innovation and the Biomanufacturing Imperative

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SUMMARY

The Union Budget 2026–27 introduced the Biopharma Shakti mission, a ₹10,000 crore initiative aimed at developing an integrated biopharmaceutical ecosystem in India over the next five years, focusing on domestic biologics and biosimilars production to address the growing burden of non-communicable diseases such as diabetes, cancer, and autoimmune disorders. Concurrently, India's vast medicinal and aromatic plant (MAP) biodiversity with over 7,000 medicinal species documented represents an under-utilized reservoir of bioactive compounds. This article reviews the policy context, scientific opportunities, systemic challenges, and proposes a multi-pronged action plan to align bio-pharma advancements with MAP-based research to build a resilient, innovation-driven healthcare ecosystem. This article further emphasizes end-to-end value chain development linking producers, researchers, industry, financiers, regulators, and healthcare delivery systems to ensure sustainable translation of bio-resources into accessible health solutions. It argues for mission-oriented convergence across bio-manufacturing, clean technologies, digital infrastructure, and advanced research platforms to build a resilient bio-economy and future-ready healthcare system aligned with the next industrial transition.

INTRODUCTION

Biopharma Shakti and India's Health Burden

The Biopharma Shakti mission, announced in the Union Budget 2026, allocates ₹10,000 crore over five years to strengthen research, clinical trial networks, regulatory capacity, and advanced manufacturing for biologics and biosimilars. These complex biologic therapies often target non-communicable diseases that are becoming increasingly prevalent. For example, diabetes affects a significant proportion of the adult Indian population, with estimates frequently citing over 100 million individuals living with the condition. Biologics and biosimilars are high-value pharmaceuticals derived from living cells and offer targeted, effective treatment options compared with conventional small-molecule drugs but require advanced infrastructure, skilled workforce, and robust regulatory systems for development and manufacture.

India's MAP Biodiversity and Research Potential

India is considered a mega-biodiverse country, housing a wide range of medicinal flora — with over 7,000 documented medicinal plant species used in traditional healthcare systems. This rich botanical diversity provides a natural chemical library for discovery of therapeutic molecules. Research literature underscores the potential of plant metabolites in managing metabolic disorders like diabetes and obesity, elucidating multi-targeted modes of action using network pharmacology and computational approaches.

Role of MAP-Based Research in Biopharmaceutical Innovation

1. Source of Bioactive Molecules

Plant secondary metabolites, such as polyphenols, alkaloids, terpenoids and glycosides, have been historically foundational in drug discovery (e.g., vincristine/vinblastine from *Catharanthus roseus*). While many modern drugs originated from such compounds, systematic research using computational and experimental pharmacology can accelerate identification of candidates for chronic disease targets.

2. Complementary Therapeutics

Phytochemicals with anti-diabetic, antioxidant, and immunomodulatory properties can provide complementary or adjuvant therapies alongside biologics, potentially improving treatment outcomes and patient adherence. Such leads can feed into preclinical pipelines, where high-throughput screening and advanced analytics refine candidate selection.

3. Innovation and Intellectual Property

MAP research can anchor indigenous drug discovery and strengthen intellectual property portfolios if supported by translational science, pharmacological validation, and standardized clinical evaluation addressing concerns that traditional botanical knowledge remains under-leveraged in high-value pharmaceutical development.

Opportunities Under Biopharma Shakti

- The mission's focus on ecosystem development presents several entry points for MAP-integrated research, including:
- Clinical trial infrastructure: Planned network of 1,000 accredited sites provides venues for testing novel plant-derived therapeutics in controlled settings, advancing evidence-based validation.
- Regulatory strengthening: Enhanced regulatory frameworks and scientific review capacity can support phytopharmaceutical evaluation standards aligned with global benchmarks.
- Research and talent development: Expansion of research institutes and allied health training can build a workforce equipped for both biotech and phytochemical research, including translational sciences.

Action Plan for Integrating MAP Research with Biopharmaceutical Development

To realize synergy between MAP research and biopharma ecosystem goals, the following strategic actions are proposed:

1. Establish Integrated Research Platforms

Create multi-disciplinary MAP-Biopharma Research Hubs that unite botanists, pharmacologists, molecular biologists, and clinical researchers. These platforms should facilitate:

- Systematic cataloguing and phytochemical profiling.
- High-throughput screening for biologic activity.
- Translational pipelines from discovery to clinical validation.

2. Standardize Quality and Supply Chains

Implement rigorous good agricultural and collection practices (GACP) and quality assurance protocols for MAP raw materials to ensure reproducibility and regulatory compliance in drug development.

3. Develop Clinical and Regulatory Pathways

Adapt existing clinical trial frameworks to include phytopharmaceuticals and botanical drug leads, with guidelines on safety, efficacy, and biomarker endpoints, ensuring alignment with international standards.

4. Expand Funding and Incentives

Allocate dedicated research funding for MAP-based drug discovery within the broader Biopharma Shakti budget. Encourage public-private partnerships, including competitive grants and translational research awards.

5. Strengthen IP and Data Infrastructure

Build robust systems for intellectual property protection and knowledge databases that integrate traditional knowledge with modern scientific evidence, preventing biopiracy and enhancing global competitiveness.

6. Value Chain Development for a Resilient Health Ecosystem.

A resilient biopharmaceutical and MAP-integrated healthcare ecosystem requires deliberate end-to-end value chain development, linking primary producers to patients through science, industry, and policy. At the upstream level, farmers and producer organizations play a critical role in the sustainable cultivation, quality assurance, and traceability of bio-resources through good agricultural and collection practices, climate-resilient varieties, and digital farm advisories. The midstream layer comprises researchers, technology developers, testing laboratories, and clinical research networks that translate bio-resources into validated leads through standardization, preclinical screening, formulation, and evidence generation. Downstream, manufacturers, biotech firms, start-ups, logistics providers, and healthcare delivery systems ensure scalable production, regulatory compliance, market access, and last-mile availability. Cross-cutting enablers financiers, insurers, regulators, digital

platforms, incubators, skilling institutions, and public procurement systems de-risk innovation, improve affordability, and accelerate adoption. Orchestrating these stakeholders through contract farming, co-development models, innovation clusters, outcome-linked financing, and real-world evidence platforms can convert fragmented efforts into a cohesive health value network that delivers economic inclusion for producers, innovation momentum for industry, and accessible, quality therapies for populations thereby strengthening the overall resilience of the healthcare system.

7. Way Forward: Mission-Oriented Convergence for a Resilient Bioeconomy and Health System.

The convergence of biopharmaceutical innovation and plant-based research offers a promising pathway to address India's shifting disease burden and strengthen global competitiveness. A resilient healthcare ecosystem will require:

- Evidence-driven policies that bridge traditional botanical wisdom and modern scientific approaches.
- Investments in research infrastructure and human capital to support long-term innovation.

Collaborative frameworks that align academic research, industry priorities, and public health goals. Looking ahead, building a resilient healthcare and innovation ecosystem requires a mission-mode convergence across biopharma manufacturing, advanced infrastructure, clean technologies, and digital public goods. The strategic thrust on biomanufacturing under the ₹10,000-crore Biopharma Shakti can be amplified by parallel investments in mega-science infrastructure (advanced telescope facilities), geospatial foundations for urban planning and AI-enabled governance, carbon capture and utilisation to green industrial growth, and reforms that enable access to globally competitive technologies in energy and high-end manufacturing. Together, these measures point towards a whole-of-science, whole-of-industry approach, where discovery, scale-up, sustainability, and deployment move in tandem. Aligning biopharma expansion with circular economy principles, low-carbon manufacturing pathways, geospatially informed health and infrastructure planning, and youth-driven skilling can position India not only as a global biomanufacturing hub but also as a trusted innovation partner in the next industrial transition. The way forward lies in coordinated policy design, interoperable data systems, blended finance for deep-tech and bio-innovation, and structured public-private collaboration across the entire value chain from resource stewardship and research to manufacturing, deployment, and equitable access ensuring that growth in advanced health technologies translates into affordable, sustainable, and inclusive health outcomes. By strategically integrating MAP research into the national biopharmaceutical agenda outlined in Biopharma Shakti, India can build a diversified and robust healthcare innovation pathway that leverages its unique biodiversity and scientific potential.

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