TAKSHASHILA INSTITUTION

Towards India's US$ 2.6 Trillion Bioeconomy by 2047

2026 Update — Assessment, Progress, and New Recommendations

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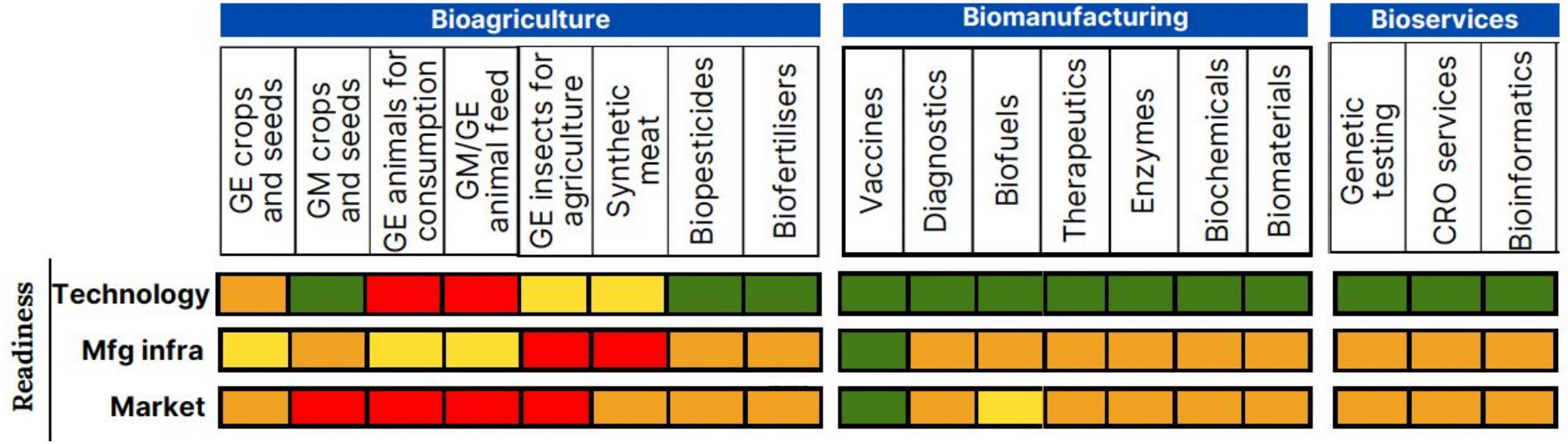
INDIA'S BIOECONOMY LANDSCAPE 2024



Highlights

Areas of Strength

- Research in biomanufacturing
- Overall land, water and unskilled labour availability
- Ability to manufacture affordably

Areas of Improvement

- Market access in emerging tech is heavily regulated
- Appropriately skilled labour
- Overall R&D spending

Levers of Improvement

- Funding
- Semi-skilled and skilled labour
- Infrastructure
- Market

Technology	No academic research	Only academic research	Proof of Concept/Protoyping	Commercialisation
Manufacturing	No infrastructure	Infra from other applications	Few institutions with infra	Entrenched infra
Market	Govt. restriction	Significant govt intervention	Domestic market penetration	Intl. market penetration

INDIA'S BIOECONOMY: 2024 → 2026

Bioeconomy Value	GDP Contribution	Biotech Companies	Biotech Startups	2030 Target
$165.7B	4.25%	~5,365	~6,750	$300B
↓	↓	↓	↓	↓
$195.3B	**~4.8%**	**10,075+**	**10,000+**	**US$ 300B**
+18%	**+0.55pp**	**+88%**	**+48%**	**On track**

Sources: DBT India BioEconomy Reports 2025 & 2026; NITI Aayog Roadmap (July 2026)

INDIA'S BIOECONOMY LANDSCAPE 2026

	BIOAGRICULTURE								BIOMANUFACTURING							BIOSERVICES			NEW FRONTIERS		
	GE crops & seeds	GM crops & seeds	GE animals	GM/GE animal feed	GE insects	Smart Proteins	Biopesticides	Biofertilisers	Vaccines	Diagnostics	Biofuels / bioenergy	Therapeutics (biosimilars, C&GT)	Enzymes	Biochemicals	Biomaterials	Genetic testing	CRO / CDMO	Bioinformatics	Bio-AI	Bio-Quantum	Space Biomanufacturing
Capital	E	N	N	N	N	D	D	D	D	L	D	D	L	E	D	D	L	D	D	E	D
Technology	D	D	E	E	E	D	D	D	D	D	D	D	D	E	D	D	L	D	E	E	D
Manufacturing infrastructure	D	D	N	N	N	D	D	D	L	D	D	D	L	E	D	D	L	D	E	E	E
Path to market (domestic)	D	N	N	N	E	E	E	E	L	D	L	D	L	D	E	D	L	D	E	E	E
Path to market (international)	E	E	E	D	N	D	E	D	D	E	E	D	L	D	E	D	L	D	E	E	E
Talent	D	D	E	E	E	D	D	D	D	D	D	D	D	E	E	D	D	D	E	E	E
Market	D	E	N	N	N	D	D	D	L	D	D	D	D	E	E	D	L	D	E	E	E

Maturity band: N Nascent / restricted · E Emerging / early · D Developing · L Leading / commercial

KEY POLICY MILESTONES: 2024–2026

Aug 2024	BioE3 Policy approved — India's first national biotechnology policy
Sep 2024	Bio-RIDE scheme approved (₹9,197 Cr) — merges R&D + entrepreneurship + biomanufacturing
Feb 2025	Union Minister calls on states to establish BioE3 cells
Mar 2025	India BioEconomy Report 2025 and Bio-Sarthi global mentoring launched
Feb 2026	Union Budget: Biopharma SHAKTI launched — ₹10,000 Cr over 5 years for biologics
Mar 2026	BioE3: 11 calls for proposals; Mulankur Bio Enablers network announced
Jul 2026	NITI Aayog: 'Roadmap for BioEconomy Powerhouse by 2035' — ₹50,000 Cr Growth Fund

SCORECARD: 2024 RECOMMENDATIONS vs GOVERNMENT ACTION

2024 Recommendation	Status	2026 Assessment
Tailored Policy Action	ADOPTED	BioE3 creates 6 thematic sectors with differentiated support
Biotechnology Authority	PARTIAL	No BRAI; NITI roadmap proposes inter-ministerial coordination
Bioeconomy Roadmap	ADOPTED	NITI Aayog released full roadmap, Jul 2026, ₹50,000 Cr fund
Carbon Credit for R&D	NOT YET	Scheme exists but not extended to biotech R&D funding
VC System for Biotech	PARTIAL	Bio-RIDE entrepreneurship support; no dedicated biotech VC fund
Match Grants for States	PARTIAL	BioE3 cells proposed; Union Minister called for state adoption
Tier II/III Capacity	PARTIAL	Mulankur network planned; biomanufacturing hubs beyond Tier I
Vocational Courses	PARTIAL	3 new NIPERs (postgrad); separate vocational skilling not yet
IPR / Judiciary Cadre	NOT YET	No action announced
Cluster Formation	ADOPTED	BioE3 Mulankur hubs + bio-clusters under Bio-RIDE
Research Hubs	ADOPTED	Bio-AI Hubs, Biofoundries under BioE3 and Bio-RIDE
Shared Mfg Hubs	PARTIAL	PLI for biomanufacturing proposed
Technology Transfer Offices	PARTIAL	7 BIRAC TTOs continue; state-level expansion target unmet

CEMENTING INDIA'S POSITION IN THE BIOECONOMY STACK

Market & Deployment	Creation of markets is essential as novel therapies are costly and bio-products compete with cheaper petroleum-based products. EU is leading here.
Scale-up platforms	Scaling up manufacturing of bio-based products – require reliable feedstocks, specialised skills, and capital intensive infrastructure. China is building its edge here.
Value-add platforms	Genome engineering, AI. Requires specialised skills and infrastructure. The US and China compete for this layer. However,with correct investments, India may also become a competitor.
Biological Data & Genetic Resources	The foundational layer — India has a strong base in biodiversity across organisms. Requires investment to catalogue biodiversity.

BIOECONOMY STACK: MAPPING RECOMMENDATIONS TO LAYERS

Market & Deployment	2024: Tailored Policy Action ✓ · Preferred Purchase Agreements ✗ · VC System ◐ 2026: PLI for Biomanufacturing · Bio-Based Procurement Standards · Bilateral Agreements
Scale-up Platforms	2024: Cluster Formation ✓ · Shared Mfg Hubs ◐ · Vocational Courses ◐ · Tier II/III ◐ 2026: Biomass Supply Chains · Match Grants & Tier II/III · Vocational Accreditation
Value-add Platforms	2024: Research Hubs ✓ · Technology Transfer Offices ◐ · Biotech Authority ◐ 2026: Synthetic Biology & Biofoundries · Marine & Algal Feedstocks · Ministry of Biotechnology
Biological Data & Genetic Resources	2024: Build Research Hubs for Future Technologies ✓ 2026: National Enzyme & Strain Library · Biomass Atlas · Algae Strain Libraries · Gene Synthesis Capacity

Cross-cutting: Ministry of Biotech

✓ *Adopted* ◐ *Partial* ✗ *Not Yet*

2026 RECOMMENDATIONS

These recommendations are in addition to the 2024 ones and should be read in conjunction to the ones proposed in the NITI Aayog's bioeconomy roadmap.

ELEVATE DBT TO A MINISTRY OF BIOTECHNOLOGY

CRITICAL

Problem

Bioeconomy governance is fragmented across ministries.

NITI Aayog's Roadmap proposes an 'Empowered Inter-Ministerial Committee'. But empowered committees have a poor track record in India: they lack budgetary authority, cannot issue executive orders, meet episodically and depend on the convening ministry's bandwidth.

Strategy

Elevate DBT to a full Ministry of Biotechnology, with its own cabinet minister, independent budget line, and statutory authority.

The Ministry should absorb relevant regulatory functions currently scattered across FSSAI, GEAC, CDSCO, and RCGM into a coherent framework.

Outcome

A cabinet-rank institutional home for bioeconomy policy, with authority to:
— Set and enforce regulatory timelines
— Coordinate across agriculture, health, industry, environment
— Own the ₹50,000 Cr Growth Fund allocation
— Represent biotech in bilateral and multilateral negotiations
India's bioeconomy is 4.8% of GDP and growing at 18% CAGR. It deserves the institutional architecture that a $195B sector demands.

WHY AN EMPOWERED COMMITTEE IS NOT ENOUGH

	Empowered Committee (NITI Aayog proposal)	Ministry of Biotechnology (our recommendation)
Budget authority	Advisory — depends on participating ministries	Independent budget line; owns Growth Fund allocation
Regulatory power	Cannot issue executive orders or binding directives	Statutory authority; can issue notifications and rules
Cabinet representation	No seat at the cabinet table	Cabinet-rank minister; direct PM access
Meeting cadence	Periodic (quarterly at best); depends on convener	Standing institution with permanent staff
Accountability	No single point of accountability	Minister answerable to Parliament
Cross-ministry coordination	Request-based; depends on goodwill	Mandate-based; backed by cabinet authority
International negotiations	Not a negotiating body	Represents India in bilateral S&T, trade, Quad
Historical precedent	Multiple committees exist but few deliver	DAE, DOS elevated for strategic sectors

India's bioeconomy is now larger than its IT services exports were when IT got its own ministry.

Three Pillars for the Next Phase

1

DEVELOP MARKETS

Demand-side interventions to create markets for bio-based products — procurement, international purchase agreements, standards

2

DESIGN FEEDSTOCK STRATEGY

Secure and diversify biological inputs for biomanufacturing — agricultural biomass, waste streams, marine resources, synthetic biology

3

DECENTRALISE THE BIOECONOMY

Enable state participation— state policies, match grants, Tier II/III infrastructure

Pillar 1: Develop Markets

Demand-side policy to pull bio-based products into the economy

ESTABLISH BIO-BASED PUBLIC PROCUREMENT STANDARDS

NEW

Problem

Government is the largest buyer of chemicals, materials, fuels — but procurement does not preference bio-based alternatives.

No standards exist for classifying products as bio-based.

Without demand certainty, manufacturers cannot justify scale-up investment.

Strategy

Preferentially buying of bio-based content e in government procurement for select categories (cleaning products, packaging, fuels).

Develop BIS standards for 'bio-based' labelling.

Create a bio-product registry linked to procurement portals like GeM.

Outcome

Guaranteed demand floor for bio-based producers.

Standards reduce greenwashing and build consumer trust.

Signal to manufacturers to invest in capacity.

NEGOTIATE BILATERAL BIO-PRODUCT AGREEMENTS

UPDATED

Problem

India's bio-based products lack guaranteed international buyers.

Competitor nations are locking in supply agreements for enzymes, biofuels, fermentation products.

The India-Australia biomanufacturing corridor shows potential but needs formalisation.

Strategy

Use bilateral science and trade partnerships (US, Australia, EU, Quad) to negotiate preferred purchase agreements for Indian bio-products.

Target 3–5 product categories where India has cost advantage.

Outcome

Export markets secured for Indian bio-manufacturers.

Manufacturing scales in response to guaranteed demand.

International partnerships deepen beyond MoUs.

Pillar 2: Design a Feedstock Strategy

Securing and diversifying the biological inputs that biomanufacturing depends on

MAP AND SECURE AGRICULTURAL BIOMASS SUPPLY CHAINS

NEW

Problem

Biomanufacturing depends on reliable, affordable feedstocks — sugars, starches, lignocellulose, oils, waste streams.

India produces enormous agricultural biomass but supply chains are fragmented, seasonal, and unorganised.

No national feedstock mapping exists for bioeconomy purposes.

Strategy

Commission a national biomass atlas mapping agricultural residues, agro-processing waste, and forestry biomass by district.

Establish aggregation centres in major agricultural belts linked to biomanufacturing clusters.

Decouple pricing for feedstocks from farmer welfare programmes.

Outcome

Reliable, year-round feedstock supply for biomanufacturers.

Farmers gain a new revenue stream from agricultural waste.

Reduced stubble burning as biomass is diverted to industrial use.

DEVELOP MARINE AND ALGAL FEEDSTOCK PROGRAMMES

NEW

Problem

India has 7,500 km of coastline and vast marine bioresources that are almost entirely untapped for bioeconomy purposes.

BioE3 lists marine and space biotech as a thematic area but implementation is nascent.

Algae-based feedstocks offer high-value products: proteins, pigments, biofuels, nutraceuticals.

Strategy

Launch a National Marine Bioeconomy Mission under BioE3.

Establish coastal biomanufacturing pilot zones in 3–5 maritime states.

Fund algae strain libraries and pilot photobioreactor facilities.

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Outcome

New feedstock sources beyond agriculture.

Coastal livelihoods diversified.

India develops competitive position in marine biotechnology.

INVEST IN SYNTHETIC BIOLOGY FOR FEEDSTOCK INDEPENDENCE

NEW

Problem

Gene synthesis, metabolic engineering, and protein design remain dependent on foreign providers.

Genetically modified crops beyond Cotton have not been allowed.

Genetically edited crops are allowed, but very few private sector companies are developing any.

Strategy

Allow for genetically edited/modified feedstocks for biomanufacturing.

Create a library of genes, plasmids, and other inputs necessary for feedstock resilience.

Outcome

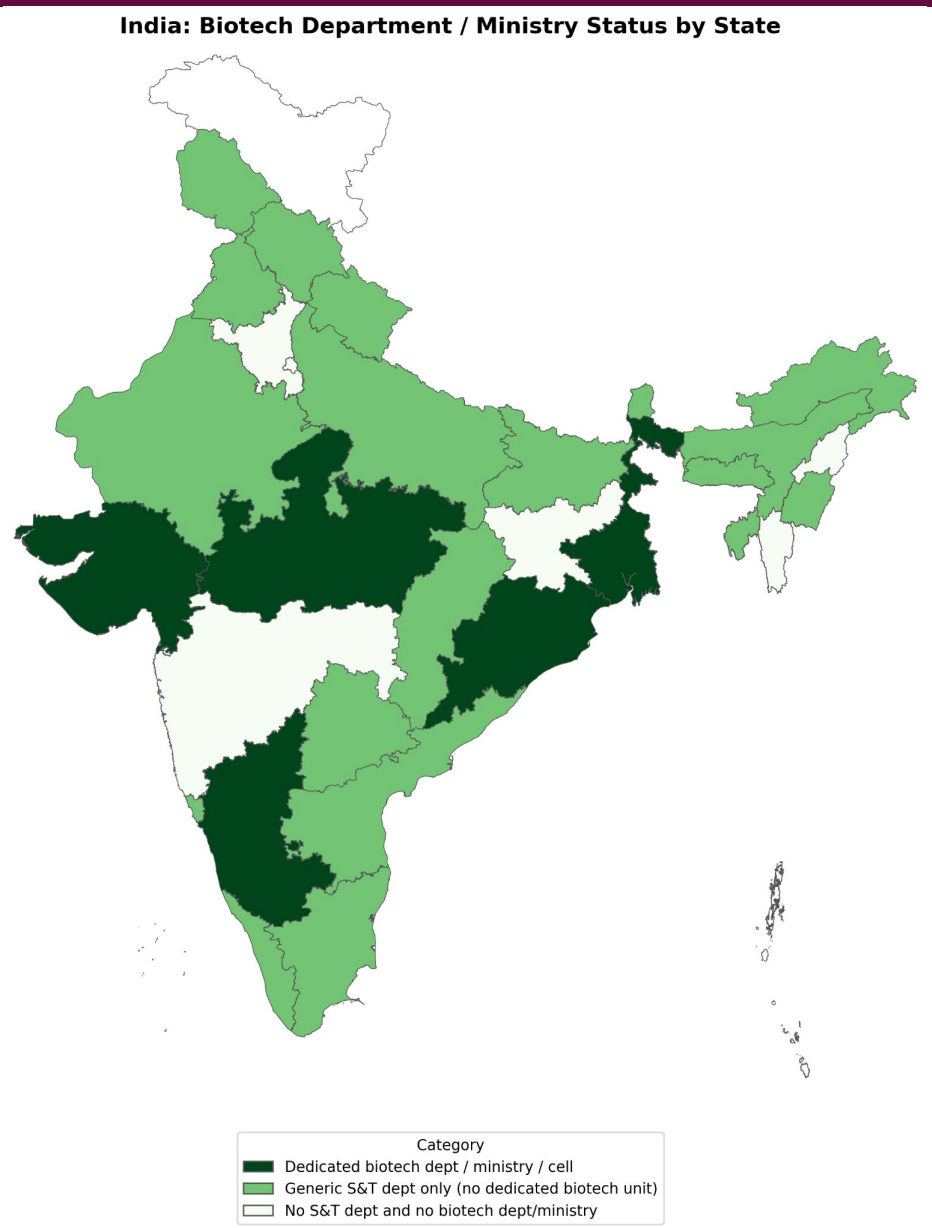
Reduced import dependence for enzymes, strains, plasmids.

Platform for next-generation feedstock innovation.

Pillar 3: Decentralise the Bioeconomy

Enable state participation

STATE BIOECONOMY: WHO HAS WHAT



EVERY STATE TO ADOPT A BIOECONOMY POLICY BY 2028

NEW

Problem

Most states lack dedicated biotech investment promotion.

BioE3 cells were proposed in Feb 2025 but few states have established them.

Strategy

Every state with a bioeconomy exceeding $5B should publish a 5-year biotech policy by 2028.

Establish BioE3 Implementation Cells within state science or industry departments.

Map state-specific bioresources (biomass, marine, microbial) to BioE3 thematic areas.

Create state-level biotech venture funds co-funded with Centre.

Outcome

Reduced regional disparity in bioeconomy.

State strengths leveraged: marine biotech in coastal states, agri-biotech in UP and MP, pharma in Gujarat.

Better coordination between Union and state governments.

MATCH GRANTS AND TIER II/III INFRASTRUCTURE

UPDATED

Problem

State government R&D funding remains low.

Laboratory infrastructure and cutting-edge technology access is limited to Tier I cities.

Students and scientists in Tier II/III cities have limited exposure to bioeconomy opportunities.

Strategy

Union government to liaise with states through matching grants for state-identified priority biomanufacturing projects.

Provide grants and non-monetary incentives (land, utilities, connectivity) to private companies setting up in Tier II/III cities.

Outcome

Better utilisation of individual states' bioresource strengths.

Bioeconomy infrastructure reaches beyond 5 dominant states.

Private sector investment flows into new geographies.

ACCREDIT VOCATIONAL BIO-MANUFACTURING COURSES

RETAINED

Problem

India's workforce is bifurcated: overqualified PhDs driving up costs, and graduates without wet-lab or bioprocessing skills.

Biomanufacturing jobs require mid-level technical skills that existing education doesn't provide.

Strategy

Accreditate a national vocational training programme for biomanufacturing, modelled on ITI courses but dedicated to bioprocessing, fermentation, and quality control.

Programmes should be run by public or private institutions in states with biomanufacturing clusters.

Outcome

Increased workforce availability to expand biomanufacturing.

Reduced costs as optimally trained workforce replaces overqualified or undertrained labour.

Skilling pipeline aligned with industry demand.

The Takshashila Institution is an independent centre for research and education in public policy. It is a non-partisan, non-profit organisation that advocates the values of freedom, openness, tolerance, pluralism, and responsible citizenship. It seeks to transform India through better public policies, bridging the governance gap by developing better public servants, civil society leaders, professionals, and informed citizens.

Takshashila creates change by connecting good people, to good ideas and good networks. It produces independent policy research in a number of areas of governance, it grooms civic leaders through its online education programmes and engages in public discourse through its publications and digital media.

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APPENDIX - Maturity Bands for Each Layer

Lever	N Nascent / Restricted	E Emerging / Early	D Developing / Domestic	L Leading / Commercial
Capital	No risk capital of any kind	Public grants only; no private pipeline	Private capital flows for incumbents	Deep VC/PE pipeline, private R&D dominant & secondary market
Technology	No academic research in India	Academic R&D and proof-of-concept only	Commercially viable domestic platform	At or near the global frontier; indigenous IP used internationally
Manufacturing Infrastructure	No infrastructure anywhere in India; not even adaptable adjacents	Infrastructure from adjacent applications theoretically adaptable; no dedicated facility	Few institutions or commercial facilities with relevant infrastructure	Entrenched infrastructure at commercial GMP scale
4 · Path to Market (domestic)	Government restriction or judicial freeze blocks market entry entirely; or no regulatory pathway defined	Significant government intervention OR domestic pathway stated but not operationalised;	Clear domestic pathway; some international access via WHO-PQ or ICH alignment;	Clear domestic and internationally recognised pathway; bilateral MRA or data reliance with ≥1 G7 regulator;
Path to Market (International)	No international regulatory engagement of any kind	Limited, non-systematic international engagement	Established, repeatable international access via a recognised multilateral or harmonised route	Bilateral mutual recognition, data-reliance, or equivalent standing arrangement with ≥1 G7-tier regulator
5 · Talent	No professional community exists in India; skill not taught in any curriculum	Academic cohort exists (IITs, IISc, ICAR); industry cannot absorb graduates without 1–2 year bridging programme	Commercial workforce exists for current platforms; next-generation skill gaps documented; brain drain ongoing	Plug-and-play academic pipeline; no bridging needed; India is net talent importer for this skill
6 · Market Penetration	No commercial product in the market; zero revenues; government restrictions may block entry	Pilot or early domestic commercial sales; <5% penetration of addressable domestic market; no export revenue	Domestic market well-penetrated OR LMIC export substantial; G7 premium market access limited or absent	Meaningful G7 export revenues OR dominant global market share (including LMIC)