

Full Length Research Paper

Enrichment and strengthening of Indian biotechnology industry along with academic interface

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For many years, humankind has been incorporating biosciences in different places- from agriculture to food and medicine. Today, the nomenclature of biology has been redefined as Biotechnology, a technological science with a perfect blend of sophisticated techniques, manuals and application of fast delivery equipment and vehicles. It encompasses chemical engineering, bioprocess engineering, bioinformatics (computer aided biotechnological science), biosensor, robotics and many more. Biotechnology is so advanced that it requires multiple phased regulatory system to check the ethical issues in industry. In raising the biotechnology industry, the government has extended support like financial assistance and infrastructure. But to transform any industry there is a great demand from industry/academia to come and share knowledge and upgrade the demands as industrial products and services. On this road map to industrial development and its strengthening, academia needs to focus on policies framework and plan for a better industrial maneuvers to achieve set goals.

Key words: Indian Biotechnology Industry, industry academia linkage, strengthening indian biotechnology, academic reforms.

INTRODUCTION

Biotechnology is today known as the revolutionary science; it has transformed the complete industrial scenario scaling from basic industrial outlook to a rejuvenation which has proved to be a turning point for life sciences industry.

With enormous potential in every sector, Biotechnology industry also offers **E-factor** outputs like *Eco-friendly, Efficient, Economically Viable and Exclusive* options for in-situ waste treatment and degrades potentially hazardous toxic waste into harmless/relatively less harmful by-products. India is now recognised as technology generator and with the immense support of Department of Biotechnology and other allied bodies

techniques such as *Industrial Effluent Treatment, Paper and Pulp Mill Effluent Treatment, Oilzapper Technology, Chemobiochemical process, Biosensor for Detection of Pesticide Residues, Detection of Pathogens in Drinking Water, Biosurfactants from Wastes, and Bioscrubber for Removal of Odours from Industrial Emissions* have taken a lead.

Talking about sector, India is witnessing an exponential growth and it is playing a pivotal role in the Indian economy. In the years 2009-2010, the Indian biotech industry breached EUR 2,218.58 million mark with a staggering growth of 17% over the previous year. BioPharma recorded a growth rate of 17.69% with

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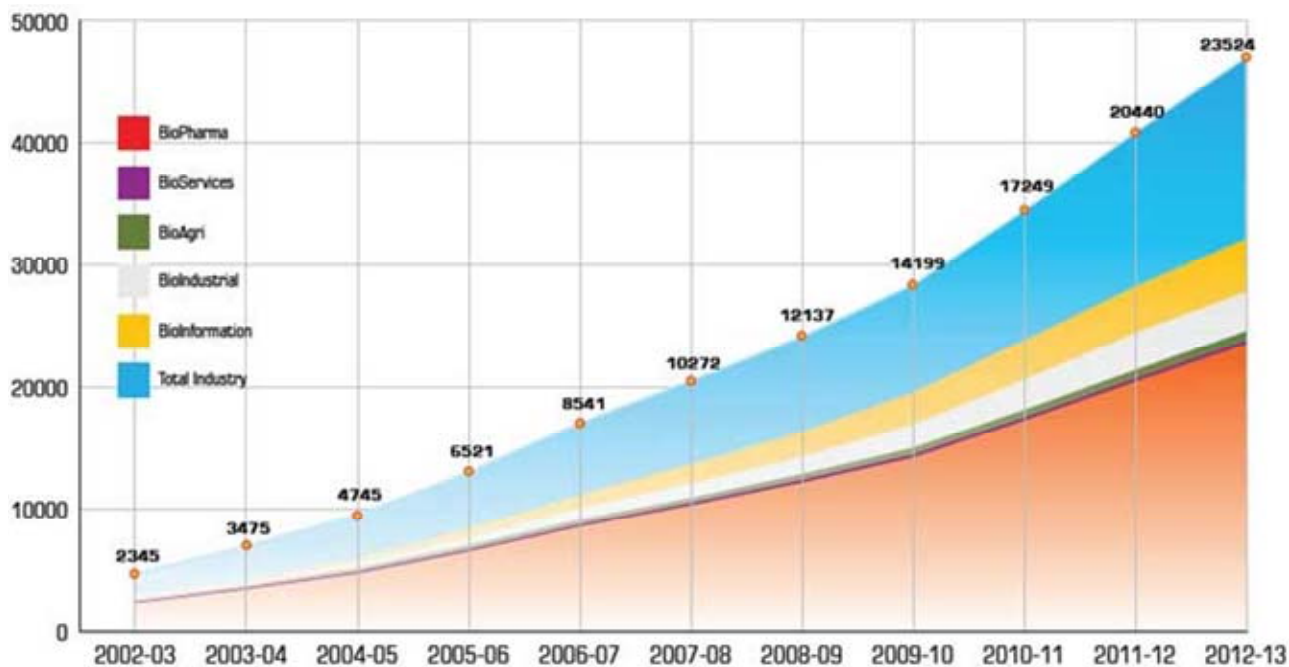


Figure 1. Indian Biotechnology sector-wise growth 2002-13.

revenues of Rs. 14,923 crore; Bio Services, Rs. 4,329 crore; BioAgri, Rs. 3,210 crore; Bio Industrial, Rs. 772 crore; Bioinformatics, Rs. 290 crore (www.ableindia.in/admin/attachments/newsletter/news112_enable_July13new.htm) (Figure 1).

Analysts say that the industry is poised to grow but it needs strong support from investors and government regulatory authorities. To nurture this sector, industries have moved ahead with mergers, collaborations and innovative product galore, still a long journey is left untraveled. To boost the industry, a strategic road map was undertaken through DBT's *National Biotechnology Development Strategy* (NBDS) designed in consultation with stakeholders, regulatory authorities, universities, private players, government and international-domestic investors. The framework intends to come up with the challenging issues of Indian research and development, capital generation, technology development and transfer, intellectual property issues and human resource development with emphasis on industrial requirement. The authorities also aimed at developing a blend of industry and academia through several programme such as promoting the *Public Private Partnership* (PPP), *Biotechnology Industry Partnership Programme* (BIPP), promoting *Small Business Innovation Research Industry* (SBIRI), *Biotechnology Industry Research Assistance Council* (BIRAC) to nurture and catalyze the industrial research and development and also to empower the Indian human resource capital with advance skill sets and knowledge base.

The bioeconomy of the country is accelerated by two major driving forces that is *technological advancements* and *adaptive societal changes* development of scientific tools and products viz. artificial organs, target drug models, improvements in plant varieties along with enabling disease detection and gene level modifications to name a few. Another major accomplishment in biotechnological advancements is genetically engineered (GE) products galore like Bt-cotton, Bt-maize, etc.

Catalyzing the Indian biotechnology industry

To provide an impetus to the Biotech sector in India, the Government established Department of Science and Technology (DST), Department of Biotechnology (DBT), and Health Biotech Science Cluster (HBSC) under the Ministry of Science and Technology.

Government has extended immense support in form of funding like:

1. Funding ideas through the *Biotechnology Ignition Grant (BIG)* scheme (www.dbt.nic.in)
2. Establishing the early POC through *Small Business Innovation Research Initiative (SBIRI)* (www.dbt.nic.in).
3. Taking the products to market through *Biotechnology Industry Partnership Programme (BIPP)* (www.dbt.nic.in).

Based on the above, Government of India has launched several individual and collaborative schemes/projects to

Table 1. Some industrial partners who have enriched India's industrial values.

Advanced Enzymes Technologies Ltd.	Novozymes South Asia Pvt. Ltd.
Bharat Biotech International Limited	NuziveeduSeedsPvt. Ltd.
Bharat Serums and Vaccines Ltd.	OcimumBiosolutionsLtd.
BioconLimited	PanaceaBiotechLtd.
SyngeneInternationalLimited	PiramalHealthcareLimited
Dr. Reddy's Laboratories Ltd	Quintiles India
Eli Lilly and Company (India) Pvt. Ltd.	RasiSeeds (P) Ltd.
GlaxoSmithKline Pharmaceuticals Ltd.	Reliance Life Sciences
IndianImmunologicalsLtd.	Serum Institute of India Ltd.
Jubilant Life Sciences Limited	ShanthaBiotechnicsLimited
KrishidhanSeeds Private Limited	SIRO Clinpharm
Lambda Therapeutic Research Ltd.	Strand Life Sciences
Mahyco	VeedaClinicalResearchLimited
Monsanto	VimtaLabsLimited
Novo Nordisk India Pvt. Ltd.	

boost the biotechnology industrial growth and research facilities as:

1. Karnataka Biotechnology and Information Technology Services (KBITS) in collaboration with Scottish Development International (SDI) and Georgia Department of Economic Development at a mega event - Bangalore India Bio (www.biospectrumindia.com/biospecindia/news/174038/india-signs-biotech-mous-bangalore-india-bio).

2. Association of Biotechnology Led Enterprises (ABLE) and US-based Washington Biotechnology and Biomedical Association (WBBA) have signed a MoU to enable co-operation in the field of biotechnology encompassing healthcare, agriculture and clean energy system in country (<http://www.thehindubusinessline.com/industry-and-economy/india-us-biotechnology-tie-up-to-invest-in-joint-research/article3974971.ece>).

1. The Association of Biotech Led Enterprises (ABLE) is also leading an Indian delegation to Biotechnology Industry Organization (BIO) International Convention, to be organized at Boston, US. It would showcase the biotech parks established and in pipeline to attract global foreign biotech investors to India

2. The Government of India has extended Rs 205 crore (US\$ 30.77 million) as scholarships for women scientists under the Women Scientists Scholarship Scheme (WSSS), Ministry of Science and Technology (Ministry of external affairs, Investment and Technology promotion (ITP) division, Govt. of India).

3. The Government of India plans to set up an Indian Institute of Agricultural Biotechnology at Ranchi with an investments of Rs 287.50 crore (US\$ 43.16 million). The Institute will be a deemed university and will have

different schools to import knowledge in genomics, bioinformatics, genetic engineering, nano biotechnology, diagnostics and prophylactics and basic and social sciences and commercialization (www.ibef.org/industry/biotechnology-india.aspx Capacity building through investments).

The government is profoundly working on policy and frameworks to strengthen the industry deliberately. Strategic investments, outsourcing and exhaustive export capacity are also recognized as the key promoting agents for this industry. The government is poised to take 100% Foreign direct investment (FDI) through the automatic route for manufacturers of drugs and pharmaceuticals. According to data released by the Department of Industrial Policy and Promotion (DIPP), the drugs and pharmaceuticals sector has attracted FDI worth Rs 54,321.68 crore (US\$ 8.15 billion) between April 2000 and June 2013.

Few highlighted investments in the sector in this year are:

1. World's first clinically proven conjugate Typhoid vaccine '*Typbar-TCV*' was successfully launched by *Bharat Biotech*, offering long-term protection and which is suitable for children as young as six months

2. Roselabs Biosciences Ltd. established fully integrated pre-filled syringes (PFS) manufacturing unit in Ahmedabad (India) with an investment of Rs 400 crore i.e. US\$ 60.04 million

3. Rose labs Biosciences Ltd also plans to raise Rs. 100 crore i.e. US\$ 15.01 million in few months through private equity (PE) from a global investor in pharmaceutical sector for in-house research and development (R&D) of active pharmaceutical ingredients (APIs)

4. A modern computational systems biotechnology laboratory with state of the art infrastructure was established

at the Biotechnology Department, Sri Venkateswara College of Engineering, Sriperumbudur, Karnataka (India)

5. Biocon has launched a new biologic that could treat patients with psoriasis

6. Biocon entered into an agreement with *Mylan* for the global development and commercialization of Biocon's generic insulin analog products (longlastinginsulins), which has a global addressable market of US\$ 11.5 billion (www.ibef.org/industry/biotechnology-india.aspx).

Industrial enrichment

The Indian biotechnology industry has catalyzed itself from a nascent industry to a mid-maturity level stage industry. Over the last decade the industry has flourished and attained a CAGR of 20-22%. The sector comprising biopharma, bio-agri, bioservices, and many more has empowered the industry through its products/ technologies and services. In current scenario India is recognized as a global destination to start with respect to vaccines, increased contract bioservices, agribiotechnology to name a few. Indian organizations have improved quality productions in which Serum Institute, Bharat Biotech, Shantha Biotech have shown remarkable projections in terms of high quality and economical vaccines in which they are supplying more than 50% to world renowned organizations such as WHO, UNICEF etc.

Academic enrichment

In considering the Indian academia, there exists more than 400+ universities with funding and self financing options. The quality research output is expected from these academic infrastructures, but due to internal lacunae and lack of funds they are not performing as expected. India produces most of its graduates and postgraduates from these institutions but at some places these stuffs lack real bench work experience and analytical trainings. Enormous unorganized training centers with less equipped facilities are brewing in the market working as an agency with ready to serve projects without actual bench studies. Such agencies are a threat to the industry and its academic institutions. A strong need of remodeling and rejuvenation of course structure and content is demanded to enrich the BT-industry and skilled research pool.

Another reformation was made by the government where India has now started with few fellowships/ collaborative schemes to buildup research facilities and advancements:

1. Indo-Australian Career Boosting Gold Fellowships
2. Stanford India Biodesign fellowship programme funded by Department of Biotechnology

3. Australia-India Strategic Research Fund (AISRF) helps Australian researchers from public and private sectors to participate with Indian scientists in leading edge scientific research projects and workshops.

4. India-UK Science Networking programme: Indian scientists visit various research facilities in UK and develop network with UK scientists for further research collaborations. (www.dst.gov.in)

5. *India-Brazil-South Africa (IBSA) Cooperation* to start research activities in 'AIDS, TB and Malaria', 'Biotechnology in health and Agriculture', 'Nano Science and Technology' and 'Oceanographic Sciences'.

6. Prime Minister's Doctoral Research scheme (A PPP Initiative of Science Engineering Research Board (SERB) and Confederation of Indian Industry (CII)

Such collaborations have definitely added value to the backbone of current scientific infrastructure in India.

Research idea transformation to business

Like USA, India may promote the researchers and academic scientists to establish their own venture with new products/ technologies that boost the industry. In case of capital scarcity the academician may call for establishment of a joint venture under *win-win* state. A strategic intellectual property reforms may be workable which saves the concept as well as the products. Government may promote the intellects of well established labs of Council of Scientific and Industrial Research (CSIR), Indian Council of Agricultural Research (ICAR), Indian Council of Medical Research (ICMR), autonomous labs and universities. Government has initiated some extensive training programmes in collaboration with management institutions like Indian Institute of Management (IIMs), Entrepreneurship Development Institute of India (EDI), Small Industries Development Bank of India (SIDBI) for enhancing entrepreneurship and awareness of Intellectual property amongst academicians.

Strengthening industry – academia interface

In Indian scenario, it is a hard truth but the industry – academia interface needs massive strengthening. The main reason for their weak bond is their basic setup and working machinery. A similar case that is happening at US and UK may be made where this gap is bridged through inter mobility schemes, thus promoting the industry-academia relationship in stronger direction. Academia has 2 major aspects: education (*basic and advanced*) and research (*basic and advanced*). To achieve desired goal a strong industry-academia interface along with necessary activities for mutual benefit is needed, with an aim to achieve global competitiveness.

One aspect must cover the basic and advance education and other must work on transforming that knowledge into skills and technology development. Industry has a good knowledge of competitive facts that it faces and the required knowledge and skills should then be incorporated in the course curriculum. It would then work as process machinery where raw materials with basic education and skills are transformed into highly skilled brains which have capability to think new and invent. Government has envisaged in XI plan (2007-12) where there is a provision in which young faculty is given a chance from 2 months to 1 year full time in industry to revive its knowledge and imbibe new skills from the knowledge pool.

Promoting science parks

India is blessed with intellects who have nurtured the pool of science and technology. Today the country is blessed with many cities generally known for research and development. Biotechnology city, Genome Valley, Silicon Valley are few tag names of those areas. Like US and European countries, India has moved forward in developing science parks which have proved to be a successful venture and assisted the technocrats to develop themselves from laboratory to industrial scale. DBT, DST and industrial funding agencies have extended helping hands to these ventures which can utilize the seed money and generate new products for mankind.

Conclusion

India has a potential to grow, provided there are stringent norms to follow - reforms and regulations, plans and policies, government and governance which are recognized as the pillars for better development of any scheme. The infrastructure built-in must have soul which makes it accelerated so that it leads to defined goals. India was always recognized to be motherland of knowledge intellects; however, since centuries it has been grooming its scientific knowledge and disseminated across the globe. After independence the country has surpassed in almost every sector where it is scientific or non-scientific. The output and competence are definitely enhanced by enhancing weightage of academics and its application in industrial development. Industry and academia have focused on nurturing the biotechnology

industry which has been a nascent industry and just reached the mid-maturity stage. Still we can say that to be in the market, more initiatives, collaborations, mergers, and schemes are needed to compete the market. Government of India has launched several schemes to envisage a better industrial setup, but an initiative at global level is required where foreign investors join hand-to-hand and participate as knowledge exchange or network group for developing a novel drug or technology.

Conflict of Interests

The author have not declared any conflict of interests.

REFERENCES

- <http://www.thehindubusinessline.com/industry-and-economy/india-us-biotechnology-tieup-to-invest-in-joint-research/article3974971.ece>
 Ministry of external affairs, Investment and Technology promotion (ITP) division, Govt. of India
www.ableindia.in/admin/attachments/newsletter/news1112_enable_July13new.htm
www.biospectrumindia.com/biospecindia/news/174038/india-signs-biotech-mous-bangalore-india-bio
www.dbt.nic.in
www.dst.gov.in
www.ibef.org/industry/biotechnology-india.aspx
[www.ibef.org/industry/biotechnology-india.aspxCapacity building through investments](http://www.ibef.org/industry/biotechnology-india.aspxCapacity%20building%20through%20investments)