



India's Bioinformatics Industry: An Engine for Global Growth

Experience and expertise is fueling opportunity

Bioinformatics is the fastest-expanding field in India's biotechnology sector today. There are over 200 companies in Bangalore, Hyderabad, Pune, Chennai, and Delhi that are in some way involved in bioinformatics. Large IT organizations such as Intel, IBM, and Wipro are also getting into this sector in India. Just as important, over 300 college-level institutes across India now offer degrees in biotechnology, bioinformatics, and biological sciences. These facilities are educating millions of students annually. This educational base is creating a bright future for India's bioinformatics industry.

The growth is due to the linkages between IT and biotechnology. India's software engineers are established around the globe. This breadth of expertise is, in turn, creating an engine for global biopharmaceutical growth. In fact, because of India's global presence in bioinformatics, Indian scientists and bioinformatics professionals are in high demand.

Today, the country's talented software engineers are establishing themselves as more than just inexpensive. As a result, salary differentials today are shrinking quickly. Engineers in India today command salaries around half those in the US, compared with as little as one fourth in 2001, according to John Morrow, PhD, president of Newport Biotech (Newport, KY), and a contributing editor to the recent joint BioPlan Associates and Society for Industrial Microbiology publication, *Advances in Biopharmaceutical Technology in India*. Thus, as India heads toward salary parity with the West, the country's bioinformatics sector is expected to provide innovative technology advantages, not just cost advantages. Morrow notes,



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The biotech industry could become the single largest sector for skilled employment in India.

"Innovation in bioinformatics is driving internal demands, and R&D in India will ultimately produce technologies that are unavailable in the EU and US."

India's government recognizes the opportunities and is investing heavily. The Department of Biotechnology, for example, has improved intellectual property protection. The government also supports the industry through financial incentives, tax benefits, and loans for R&D activities to both the public and private sectors. Manju Sharma, PhD, former director of the Department of Biotechnology, says that the biotech industry could become the "single largest sector for employment of skilled human resources in the years to come."¹

BIOINFORMATICS NETWORK

India was one of the first countries in the world to establish a nationwide bioinformatics network. The Department of Biotechnology (DBT) initiated a program on bioinformatics in 1986. The Biotechnology Information System Network (BTIS), a division of DBT, now connects 57 key research centers, covering the entire country. More than 100 databases for biotechnology have been developed. Two databases, namely one that covers data regarding biotechnology research on coconuts [QA: edit ok?] and another that contains the complete genome of the white spot syndrome of shrimp, have been released for pub-

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lic use. In addition, several major international databases with applications for genomics and proteomics have been established under the National Jai Vigyan Mission.

BTIS also has decided to establish five advanced research and training centers. These Centers of Excellence (COE) in Bioinformatics undertake advanced research in bioinformatics, provide PhD and postdoctoral training, develop new solutions to support the Indian Bioinformatics industry and its academic institutions in India, help in solving complex biological problems, and retain required high-end manpower.

INDIA'S ADVANTAGES

The core R&D strength in Indian biotechnology is its relatively well-educated and trained labor force, with a strong base of English-speaking scientists who are well versed in mathematics, physics, and chemistry. Thus, the country has the scientific skills that encompass capabilities for handling all aspects of biological information acquisition, processing, analysis, and interpretation.

India's well-known software skills are, of course, another key advantage in global bioinformatics. For example, notes Nanda Kumar, PhD, an attorney at Reed Smith LLP [QA: **location?**], India's professionals have the capabilities to build tools such as biochips (particularly biochips patented outside India). Lack of government interference is another advantage. "There is freedom to operate in India and perform data analysis related to genomic sequencing, functional genomics, and proteomics fields," says Kumar. "These advantages are fuelling the outsourcing of bioinformatics services to India."

India also offers pro-pharma government policies. The New Millennium Indian Technology Leadership Initiative (NMITLI), launched by the Council of Scientific & Industrial Research

(CSIR), provides financial support as grants-in-aid to institutional and industrial partners. Since 2003, it has funded 37 projects involving 65 industry partners and 175 R&D institutions with an estimated outlay of \$67.5 million. Of the 37 on-going projects, four are in bioinformatics.

POTENTIAL PROBLEMS

A full understanding of the complex IT requirements and biotechnology processes is key for IT suppliers if they are to bridge the gap between IT and biotechnology. From the study [QA: **what study?**], some major opportunity areas for IT companies include:

- Creating mechanisms to support effective approaches for producing robust software that can be widely shared
- As major pharmaceutical and genome-based biotech companies invest heavily in software, Indian IT companies have the opportunity to offer complete database solutions
- Improving the content and utility of databases
- Developing better tools for data generation, capture, and annotation
- Developing and improving tools and databases for comprehensive functional studies
- Developing and improving tools for representing and analyzing sequence similarity and variation.

Because of the small size of most organizations in the field, the need for educational programs, and inadequate financial rewards, commercialization of basic science discoveries into industrial products is limited.

A major issue in India is the level of skills required to develop custom applications to integrate geographically and functionally separate databases and programs. Many biotech professionals have superficial IT knowledge, according to the study. Often, those who opt for bioinfor-

matics have life sciences backgrounds, and have not been exposed to the IT side of bioinformatics.

This problem, however, is not limited to India. According to Kristina Obom, PhD, associate program chair, Biotechnology, at Johns Hopkins University (Baltimore, MD), "Bioinformatics is an important part of R&D in Biotechnology. Training and education are essential in bioinformatics as it requires complex skills in computer science, bioscience, and information technology. Most scientists in biotech today simply do not have all the necessary skills to be successful in the field. This lack of education tends to prolong R&D and increase costs of discovery."

SUMMARY

Indian IT companies have an opportunity to offer complete database solutions to major pharmaceutical and genome-based biotech companies. The IT industry can take advantage of opportunities in bioinformation through offerings in hardware, database packages, implementation and customization of software, and functional database enhancements.

Venture capital sources would be more supportive if the government increased its role in building infrastructure and funding small- and medium-sized entrepreneurs. Foreign companies can offer knowledge Indian companies may lack, so partnering will likely become an important element in this segment's growth. Many Indian companies recognize that expertise in bioinformatics is not enough without resources and expertise in deficit areas such as lead generation, toxicology studies, regulatory affairs, and patenting. ♦

REFERENCES

1. Sawant D. Life sciences education in India. In: Langer ES, editor. *Advances in Biopharmaceutical Technology in India*. Rockville, MD: BioPlan Associates. 2008.

