



Government of Karnataka

The Millennium Biotech Policy

Introduction

1.0 Hon'ble Chief Minister, Mr. S. M. Krishna in his budget speech for the year 2000-2001 has said,

"While Karnataka is the acknowledged leader in IT, I would like the State to lead the next revolution in Biotechnology. Karnataka already has the training and knowledge base necessary to drive the revolution. We have the critical mass of biotech companies and the best research institutions. The immediate challenge is how to nurture that innovation, promote entrepreneurship and facilitate effective technology transfer to the end users. I am happy to announce a Vision Group on biotechnology is being set up to advise the government on future strategies."

1.1 As promised in the budget speech by the Hon'ble Chief Minister, the government has already set up a Vision Group on Biotechnology. Now, the Government of Karnataka is pleased to announce the Millennium Biotech Policy.

Objectives

2.0 The objectives of the Millennium Biotech Policy are:

- To spread awareness about the investment opportunities in biotechnology, genomics, bioinformatics, biofuels, contract research, etc., to the entrepreneurial community.
- To sustain and maintain the present pre-eminent position of Karnataka and Bangalore in the field of biotechnology.
- To outline a set of incentives and concessions for the biotechnology industry to attract investments to the State.
- To provide specific infrastructure as well as enhance human resources for the development of biotechnology.
- To encourage the growth of bioinformatics in Karnataka.
- To provide an appropriate institutional framework to achieve all these objectives.

Opportunities

- 3.0 The opportunities in Biotechnology are numerous and multi-faceted. They are also growing in diversity and market value very rapidly.

Genomics

- 3.1 The Human Genome Project (HGP) was the first mega project in biology, involving international participation and public and private partnership.
- 3.2 The HGP has deciphered the existence of 30,000-40,000 genes, less than half the originally predicted 100,000 genes. This, therefore, points to multifunctional genes expressing several proteins, each acting in intricate networks. This has thrown open immense challenges and opportunities in functional genomics and proteomics. India is in a unique position to harness this opportunity through researching its vast and varied disease populations in conjunction with its human diversity. The opportunities and challenges will therefore revolve around mining these large databases for new knowledge, and for creating economic value.
- 3.3 A concerted effort in this area provides promising high value products and technologies in disease diagnostics and therapies on a pharmacogenomic platform. Indications already exist in Indian gene pools to provide new information on breast and colon cancer, asthma, diabetes and a host of other disease segments.
- 3.4 Another emerging area is that of differentiated diseases by the way of disease subsets e.g. five different genetic aberrations causing asthma, which calls for five different treatments. Here tissue characterization and pharmacogenomic studies play key roles where two cancers which appear similar under a microscope respond differently to treatment regimes. This enables targeted drug discovery to occur instead of the trial-and-error methods currently used to generate new drug molecules.
- 3.5 The genomics area can be segmented as follows: (i) Reagent and chip companies; (ii) Tools and Bioinformatics companies; (iii) R&D and contract research companies; (iv) Product and therapy companies.

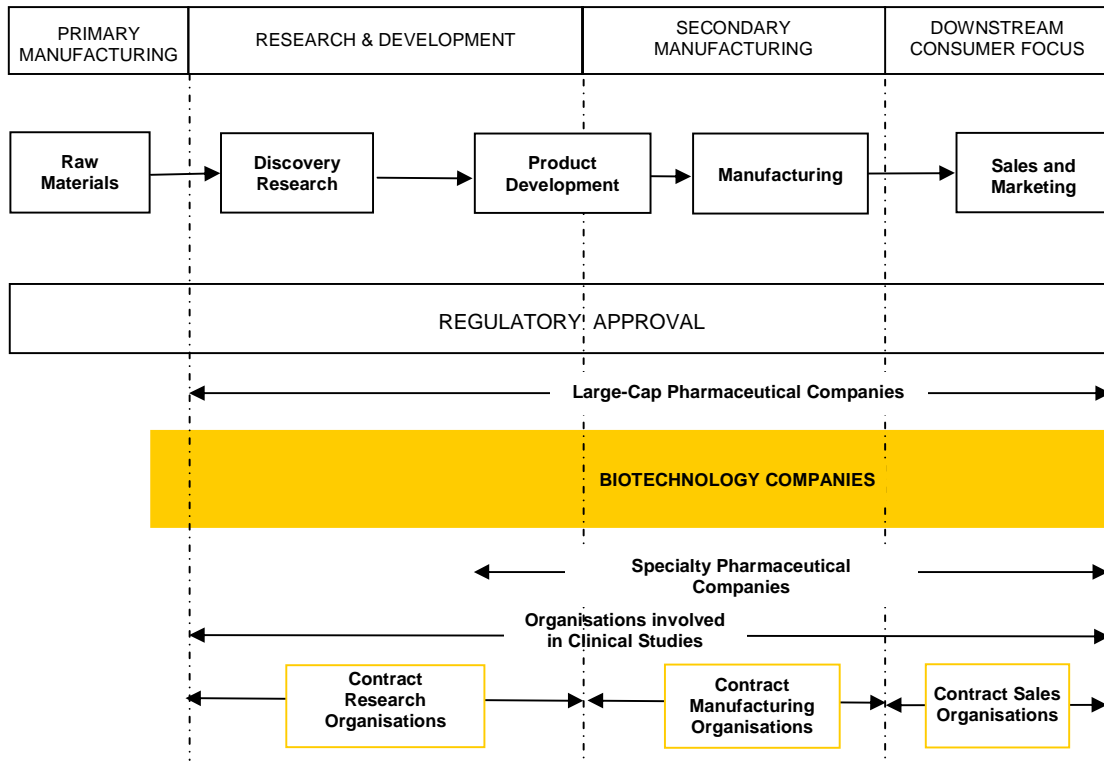
Biofuels

- 3.6** The world is experiencing an energy crisis. The search for alternative fuels has been on for long. Biofuels offer an attractive opportunity to conserve and economise conventional fuels like petrol and diesel. Biofuels are being used the world over as admixtures with conventional fuels at levels that do not require modifications of IC engines. Pure biofuels can also be used. However, this requires a modification of IC engines. In general, blends containing 25% biofuels can be effectively used, resulting in lower cost of fuels (50% the cost of petrol) with low polluting emission characteristics.
- 3.7** Brazil is the leader in biofuel usage, where biofuels have been used in automobiles for over 25 years. Brazil currently produces 13 billion litres of bioethanol from sugarcane, fuelling over 3.5 million vehicles on pure ethanol. The rest of the vehicles run on 75-80% blends of ethanol and gasoline.
- 3.8** In the latter part of 2000, Thailand announced 40 new ethanol plants in addition to the existing 22 plants to produce 3 billion litres of ethanol for use as automobile fuel. The Bangkok Mass Rapid Transport Authority currently uses ethanol-blended fuels containing 15% ethanol in all public vehicles.
- 3.9** Karnataka has a vast and vibrant sugar industry. Sugarcane is grown in an area of 2,30,300 hectares in the State and 22 million tonnes of sugarcane is produced annually. The total sugar production in Karnataka is 1.7 million tonnes.
- 3.10** Sugar factories in Karnataka produce 600,000 tonnes of molasses annually, most of which is converted by distilleries to produce rectified spirits and eventually into potable alcohol. Sugarcane farmers experience large fluctuations in prices depending on the crop yields. A poor year pushes the prices up, resulting in farmers planting more sugarcane. However, this results in an imbalance in supply and demand, leading to a glut the following year, with sharply declining prices. There is need to encourage greater cultivation of sugarcane and to provide commensurate demand. Biofuels offer the ideal solution to the aforementioned problem. The Karnataka State, therefore, proposes to support the setting up of biofuel plants so that surplus molasses can be converted to biofuels. This will help to achieve a dual benefit of cost savings as well as of a cleaner fuel with a positive impact on the environment. The Excise Department will work out the detailed guidelines for this sector.

Contract Research Organisations

- 3.11** The trend to outsource low cost R&D capabilities in biotechnology is increasing. This represents a tremendous opportunity for Indian companies to do contract research for overseas corporations. The current global spend on outsourced R&D is approximately \$7 billion and is expected to grow at 30% per annum for the next 5 years. Typically, opportunities exist in basic gene sequencing work, cDNA library preparation, genetic research related to medical diagnostics, new crop varieties and early stage drug development. Large multinational corporations follow a strategy of subcontracting parts of their R&D programmes to smaller and lower cost companies and derive benefits in costs as well as time. Companies in Bangalore with excellent technical manpower are well suited to take up such contract research. Apart from these companies, MNCs also have the benefit of world-renowned institutions such as IISc, NCBS, JNCASR etc. located at Bangalore, which enhances the contract research dimension in Bangalore.
- 3.12** The key stakeholders in this segment would be pharma companies, entrepreneurs, research institutions (public & private), R&D facilities, funding agencies and educational institutes.
- 3.13** Contract Research Organisations (CROs) have great potential to function as export oriented units and are comparable in their activity to the software development activities in the IT sector. Software services were outsourced by the large overseas IT companies in a very similar manner, starting initially with the sub-contracting software development of small modules of complex software and a decade later, the Indian IT sector is now capable of handling the entire software, the primary reason for the prolific growth in the IT sector. Contract research in Biotechnology offers the same template of growth and the Government of Karnataka is firmly committed to supporting these organisations.

3.14 The chart below shows the typical role of a CRO.



Resources in Karnataka

Corporates in Biotechnology

- 4.0 Karnataka has a large number of biotech companies, ranging from start-ups to well established concerns such as AstraZeneca India, Biocon India, Cadilla, SmithKline Beecham and Wockhardt. For more names, please refer to the inside back cover of this brochure.

Premier Institutions in Karnataka

- 4.1 The premier position of Bangalore in the knowledge segment has been due to its strong tradition in education and in science and technology. Institutions dedicated to, or with strengths in, the biological sciences include: the Indian Institute of Science, National Centre for Biological Sciences (TIFR), NIMHANS, Jawaharlal Nehru Centre for Advanced Scientific Research, Central Food Technological Research Institute (Mysore), Kidwai Memorial Institute of Oncology, Manipal Institute for Neurological Diseases, Rajiv Gandhi University of Health Sciences and the University of Agricultural Sciences.
- 4.2 The physical science oriented institutions include the Raman Research Institute, Indian Space Research Organization, Indian Institute of Astrophysics, National Aerospace Laboratories, and Electronic and Radar Development Establishment. The premier National Law School of India University and an Indian Institute of management are also located in Bangalore.
- 4.3 Karnataka has around 82 engineering colleges, 23 medical colleges, 46 pharmacy colleges, almost 200 polytechnics and 300 industrial training centres.

Indian Institute of Science

- 4.4 The Indian Institute of Science (IISc) was established in the days of the Maharaja of Mysore in collaboration with Tatas in 1909. The Indian Institute of Science has been ranked as the 18th best university in the world. The institute has a number of departments in various areas of biology and biotechnology: Bio-Chemistry, Micro Biology & Cell Biology, Molecular Reproduction, Development & Genetics, Molecular Biophysics, and Ecological Sciences.

Jawaharlal Nehru Centre for Advanced Scientific Research

- 4.5 The Centre was established in 1989 by the Department of Science and Technology to commemorate the birth centenary of Pandit Jawaharlal Nehru. The Institute has been set up by Prof. C.N.R. Rao and has close links with the

Indian Institute of Science. The Institute's main objective is to promote scientific research at the highest level in frontier and disciplinary areas of science and engineering. In the biological sciences, it has an Evolutionary and Organismal Biology Unit, a Molecular Biology and Genetics Unit, as well as, in collaboration with IISc, a Chemical Biology Unit.

National Centre for Biological Sciences

4.6 The National Centre for Biological Sciences (NCBS), Bangalore is a new centre of the Tata Institute of Fundamental Research, Mumbai. It is located in north Bangalore, on the campus of the University of Agricultural Sciences. The mandate of NCBS is basic research in frontier areas of biology. The research interests of the faculty are in the following areas: Biochemistry, Biophysics & Bioinformatics, Genetics & Development, Cellular Organisation & Signaling, and Neurobiology. The centre has Ph.D., Integrated Ph.D. and Physics-in-Biology Ph.D. programmes.

Biotechnology Centre

4.7 The Centre, located on Bannerghatta Road, is the first of its kind in the country in the public sector, aiming at integrating all spheres of biotechnology for the cause of horticulture development. The activities of the centre include: large scale cloning, *in vitro* conservation, crop improvement, quality control facilities for biofertilizers, biocontrol agents and biopesticides, residual analysis of chemical pesticides and fertilizers, soil, water and leaf analysis, training in mushroom handling & processing and dissemination of information on horticultural biotechnology.

4.8 The various research institutes in Bangalore have sophisticated state-of-the-art facilities in biotechnology including a modern primate surgical theatre, capillary DNA sequencers, CCD-based quantitative fluorescence imaging facilities, confocal microscopes, DNA and protein sequencing facilities, FACS scan-flow cytometers, ecological field research facilities, hybridoma and tissue culture facilities, IVF and embryo-culture facilities, molecular modelling and visualization packages, monoclonal antibody facilities, optical spectrometers, rapid mixing machines for millisecond measurement, sequence submission, searching and retrieval packages.

Bangalore - The IT Capital of India

4.9 Bangalore is appropriately called the IT Capital of India. The city has over 21 engineering colleges, which is the highest in the world; over 75,000 IT

professionals and over 900 software export companies. Over 125 multinational companies are located here. Bangalore is known for its Integrated Chip Design Software, telecom software as well as system software. The city also boasts of excellent quality companies: 12 out of 22 SEI CMM Level 5 companies in the world are located in Bangalore.

- 4.10** The city offers one of the best telecom connectivity in India. The connectivity is presently available via VSNL as well as STPI. The state has already announced its free right of way policy and several private companies have already laid 1800 kms of fibre optic cable. In the next few months, we expect connectivity from a few of these private players also.
- 4.11** Karnataka has unparalleled human resources in various areas of technology. The state accounts for about 15% share of higher education in the country. It is also the pioneer in liberalising higher education: Out of the 82 engineering colleges, only 2 are in the government sector.

Venture Capital in Bangalore

- 4.12** Bangalore has all the ingredients for a successful incubation in both information technology and biotechnology. It has excellent companies, world-renowned institutions and research centres as well as venture capital funds. Some of the venture funds that are operating in Bangalore are listed below.
- 4.13** APIDC Venture Capital, Canbank Venture Capital, Gujarat Venture Capital, IDBI Venture Capital, IFB Venture Capital, IFCI Venture Capital, Industrial Venture Capital, KITVEN Fund, Marigold Advisors, SICOM Venture Fund, SIDBI Ventures, UTI Ventures, Alliance Venture Capital, Barings Pvt. Equity, Chrysalis Capital, Global Tech Ventures, HSBC Private Equity, ICF Ventures, Indus Venture Management, JF Electra, Jumpstartup Advisors, KVP Ventures, Pathfinder Investment, Ant Factory, Blueshift Ventures, e4e Labs, SIFY Innovations, Indchem/Silkroute, 2i Capital, Connect Capital, Dhunn Carr, eIndia Capital, Hexagram Fund, iNestor, Newbridge Capital, Passion Fund, Q5 Capital, AIG Capital, Alchemy Ventures, Bank of America, Carlyle Fund, CDC Advisors, Chase Capital, Citibank Pvt. Equity, Deutsche Bank, eVentures, Gary Wendt Capita, GE Capital, Global Internet Ventures, ICICI Eco Net, ICICI Ventures, IDEA, IFC, Washington, IL& FS Venture Corporation, Ind Asia Fund, Infinity Capital, Intel Corporation, Kotak Mahindra, Morgan Stanley, Schroeders, Vertex Management, VIEW Group, Walden, Warburg Pincus, Westbridge Capital.

The Biotech Industry

Definition of a Biotech Company

5.0 A Biotechnology Company means and includes *inter-alia* a company engaged in any of the following activities:

- Research & development and/or manufacture of products or processes, which use or are derived by using specific living systems, and or enzymes/biocatalysts derived therefrom.
- Genetic engineering or cell culture or microbiology or biochemistry
- Bio-informatics.

Note: "Living system" would include plants, animals and microbes.
"Biocatalyst" would mean proteins or proteinaceous molecules naturally occurring in or derived from living systems whose primary function is to assist in biochemical reactions.

Taxation on Biotechnology Products

5.1 The Government of Karnataka's stand on the taxation of the biotechnology products is similar to that on the information technology products. In fact, the Government of Karnataka believes that the knowledge based industries like information technology and biotechnology should not be taxed for next 3-5 years. Relevant extract of the Hon'ble Chief Minister's speech at the first IT Minister's Conference that was held in Delhi on 15 July 2000 is reproduced below. This conference was attended by 14 Chief Ministers and was chaired by the Hon'ble Prime Minister.

"In this connection, I request the Prime Minister, the Union Minister of IT and my esteemed colleagues to intervene and ensure that the government will keep the IT sector out of the ambit of all taxation measures for the next 3-5 years."

5.2 However, the Government of Karnataka to abide by the decisions of the empowered committee of State Finance Ministry on Tax Reforms, constituted by the Ministry of Finance, Government of India.

Fiscal Incentives

- 5.3 The biotechnology industry will be exempt from the payment of entry tax on all inputs as well as capital goods, including captive generation sets, during the implementation stage, which can be up to 5 years or during the construction period whichever is earlier.

Mega Projects

- 5.4 Mega projects will be offered a unique package of concessions including concessions stated elsewhere in this policy, for a maximum period of 8 years. They will also be offered upto 50% concession on stamp duty and registration charges for first sale and first lease. A mega project will be one which will have investment of more than Rs. 50 crores in a new company or in the expansion of an existing company, or which will provide employment to 250 in Bangalore or to 100 in any other city in the State of Karnataka. The concessions will be applicable to new investors as well as to any such company that creates employment from incremental investment.

Captive Generation

- 5.5 Captive generation sets installed by the biotechnology industry will be eligible for the following incentive:
- Total exemption from electricity tax for a period of 5 years.

Safeguards

- 5.6 In order to establish a biotechnology unit, the entrepreneur must fulfill various requirements depending on the specific nature of the unit. These requirements are those of the (i) State Pollution Control Board (SPCB), (ii) Hazardous Wastes (Management and Handling) Rules, 1989, (iii) Manufacture, Storage and Import of Hazardous Chemical Rules, 1989, (iv) Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Micro-organisms, Genetically Engineered Organisms or Cells, (v) Genetic Engineering Approval Committee (GEAC), New Delhi, (vi) Public Liability Insurance Act, (vii) Environmental Impact Assessment Notification, 1994, (viii) Radiological Physics and Advisory Division etc. Details are available on the web site www.bangalorebio.com.

In addition, the Biotechnology Coordination Committee (BCC) shall monitor the safety regulations in installations engaged in the use of genetically modified organisms/hazardous microorganisms and their applications in the environment. The district level committees shall visit such installations,

formulate information charts, as certain hazards and risks and coordinate activities with a view to meeting any emergency.

Power

- 5.7 Biotech companies will be treated as industrial, not commercial consumers and the relevant electricity tariff will be levied on such companies. Uninterrupted and quality power supply being one of the prime requirements for sustenance and growth of biotechnology industries, these industries will be given priority in sanction and servicing of power and will also be exempt from power-cuts without any time limit.

Zonal Regulations

- 5.8 Bioinformatics companies that use up to 5 KVA power will be permitted to be established without any locational restrictions. The companies can be established in residential, industrial or commercial areas.

Urban Development

- 5.9 The government is pleased to relax FAR for all biotech projects set up outside the limits of the municipal corporations in the state. This concession will be available to projects notified by the Department of IT and Biotechnology. A maximum relaxation of up to 50% of the existing FAR will be available to such projects.

Venture Capital

- 5.10 The biotechnology industry is in the initial stages and requires active monetary support from the Government. Accordingly, the government will encourage setting up of venture capital funds for biotech industries with private participation. It may also be noted that the state has several major financial/VC players, as in section 4.13.

Registration Charges

- 5.11 Karnataka recognizes the potential of biotech companies to create new employment opportunities. All new biotech companies, which create employment of more than 100 in Bangalore and 50 in other areas in the State during the first year, will be eligible for rebate either on the stamp duty or rebate on the cost of the land. A rebate of 15% on the cost of the land will be applicable to those companies that get land from the state agencies like Karnataka State Small Industries Development Corporation, Karnataka Industrial Areas

Development Board, KEONICS etc. For other companies rebate of 50% on stamp duty and registration charges on first sale/lease transactions are applicable. This rebate on stamp duty is also applicable to the existing biotech companies expanding or modernizing, as well as creating additional employment as stated above.

Concessions for Creating Employment

- 5.12** Pre-existing tiny and small-scale industries taking up expansion, diversification and modernization get a concession on registration charges. These companies pay nominal stamp duty on lease-cum-sale deeds executed with State Government agencies like Karnataka State Small Scale Industries Development Corporation, Karnataka Industrial Areas Development Board, KEONICS, etc. Even when the absolute sale deeds are executed, the stamp duty depends on the consideration amount agreed upon at the time of leasing. These concessions are also applicable for companies in the biotech sector.

Labour Laws Simplified

- 5.13** Section 11 of the Shops and Commercial Establishments Act 1951 restricts the opening and closing times of any establishment and Section 12 requires closure of the establishment on one day of the week. Section 25 of the Act prohibits employment of women at night. The Government approved an amendment to sub-section (2) of Section 3 of the Act. This amendment will put the IT industry outside the scope of section 11 and 12 of the Act. An amendment to Section 25 is also approved enabling the IT sector to employ women at night. The said benefit would also be made applicable to the biotechnology industry.

Specific Infrastructure for the Development of Biotechnology

Biotech Parks

6.0 Karnataka is a pioneering state where several international standard IT Parks have already been established. The International Technology Park Ltd. was established through a joint venture of the Government of Karnataka, the TATA group and Singapore Consortium. The Institute of Bioinformatics and Applied Biotechnology as well as Avesthagen Technologies are located here.

The Government of Karnataka would like to encourage such hi-tech parks in the biotech sector too. The following concessions are offered to the Biotech Parks.

- Exemption on payment of Entry Tax on machinery, equipment, capital goods and construction materials, for a period of 3 years or till the date of completion of the project, whichever is earlier, on condition that each invoice should not be less than Rs. 25 lakhs or Rs. 10 lakhs in case of construction materials.
- Upto 50% exemption from the payment of stamp duty and registration charges.
- In case of first lease, as well as a subsequent lease of biotechnology companies, concessions will be available for biotechnology parks certified by the Department of IT and Biotechnology. Such parks should have a minimum built up area of 50,000 sq. ft.

6.1 The first Biotech Park will be established on the campus of the University of Agricultural Sciences, Bangalore. About 30 acres of land will be handed over to the Department of IT and Biotechnology for this purpose. This international standard park will have reputed R&D institutions, biotech companies and incubation facilities, etc. The entire management of the park will be under the guidance of the Vision Group on Biotechnology. The facilities shall be primarily on commercial lines.

6.2 The Department of IT & Biotechnology will establish another Biotech Park in the Karnataka University, Dharwad, where about 15 acres of land shall be made available.

The Department of Fisheries/University of Agricultural Sciences, Dharwad will establish a Marine Biotech Park at Karwar for promoting research in marine Biotechnology.

Biotech Corridor

- 6.3 The Government of Karnataka is committed to establish a Biotech Corridor for the development of the biotech industry in Karnataka. The Corridor in Bangalore shall extend from the Indian Institute of Science to the University of Agricultural Sciences.

Centre For Human Genetics

- 6.4 The Centre for Human Genetics is being set up in Bangalore with leading scientists and science policy makers on its Governing Board. Its Director, H. Sharat Chandra, is Chairman of the Task Force on Human Genetics and Genomics of the Department of Biotechnology, New Delhi. The Centre will bring together a group of highly talented Indian scientists to join the ongoing revolution in our understanding of human genes – their nature, organization, evolution and their relationship to disease – and, in the process address the existing lacunae in research, education and technology. Suitable land, and a corpus grant will be made available to this institute.

Institute of Agri-biotechnology

- 6.5 An Institute of Agri-biotechnology will be set up in Dharwad by the Department of Agriculture with the active collaboration of the University of Agricultural Sciences. The institute will be housed in the buildings of the university itself, and a special grant of Rs. 5 crores will be made available to set up and run this institute. The institute will primarily be set up for the application of biotechnology in the agricultural sector, with a focus on productivity improvement. The institute will be managed by the Department of Agriculture.

K-Ganga

- 6.6 The Karnataka Global Advisory Networking Group on Agriculture has already been announced. This initiative, headed by C.S. Prakash, will comprise leading agriculture scientists from Karnataka who are presently working in the U.S.A. and other developed countries. This network of global advisers will focus attention on the applications of biotechnology in the agricultural sector. The Institute of Agri-biotechnology and the Department of Agriculture will service K-Ganga.

General Infrastructure for the Development of Biotechnology

Bangalore International Airport

- 6.7 The state has already made available over 4000 acres of land for the location of an International Airport near Bangalore. Of the 7 bidders who applied, 2 have been short-listed. The government has formed the Bangalore International Airport Company Ltd. headed by Mr. N.R. Narayana Murthy, Chairman, Infosys Technologies Ltd. This company is finalising the bids, and construction of the airport is expected to start soon. A six-lane highway will connect Bangalore city to the airport.

Bangalore Agenda Task Force

- 6.8 The government has constituted Bangalore Agenda Task Force (BATF) headed by Mr. Nandan Nilekani, Managing Director, Infosys Technologies Ltd. This is one of the efforts of the government to actively involve the private sector in planning for, and providing infrastructure for citizens. The BATF has already suggested several measures to improve critical infrastructure. The government is committed to honour and involve private initiatives to improve the infrastructure and standard of living of its citizens.

World Bank - HUDCO Assistance

- 6.9 The State, with the assistance of World Bank and HUDCO, has plans to spend over Rs. 12,000 crores over the next few years on infrastructure projects. For instance, the Road Development Corporation is expected to spend Rs. 650 crores on improving Karnataka roads. The government plans to spend Rs. 3000 crores on the power sector. Initiatives in this sector include unbundling of entities, rationalization of tariffs, privatization of distribution and new generation projects. A further Rs. 950 crores will be spent in improving urban infrastructure. Many other infrastructure projects viz., the Bangalore Mass Rapid Transit System, the Bangalore-Mysore Express Highway, the Mangalore-Bangalore Petro Product Pipeline, etc. are also planned.

Human Resource Development in Biotechnology

- 7.0 The biotechnology industry, including bioinformatics, pharmaceuticals, agriculture, natural products, marine biotechnology, health care, etc., is poised for major expansion worldwide. In India, students need to be trained in modern and integrative aspects of biology, to better prepare themselves for careers in this industry. Karnataka has several universities and other research institutions offering advanced degrees in areas of the biological and physical sciences. However, these courses are specialized, not integrated. Also, there is a long time lag for updating syllabi compared to the pace of change in each field. The following measures will be taken to accelerate the development of Karnataka's human resources in this rapidly evolving area.

Scientific Computing

- 7.1 The largest single gap in the biology student's expertise is in scientific computing. Students need to know word processing, programming, spreadsheet use, networking and hardware. Each of these is individually taught in many computer training institutions. It may be best for science programmes to recommend a set of existing courses, such as those at reputed computer training institutions; at Yuva.com which is a new IT-training scheme of the Government of Karnataka; or at the IT courses in colleges, which could be counted for credits. Colleges will be encouraged to enter into reciprocal arrangements with computer training organisations to provide computer instruction in exchange for space and similar institutional resources. The Government will also formulate a scheme that encourages scientific computing for biology students.

Electronic Education

- 7.2 Faculty at the universities and research institutions are primarily geared to research and to teaching their post-graduate and Ph.D. students. Using multimedia recordings of specialised topics and an internet or CD-based distribution network, we could reach a much wider audience of students (diploma or undergraduate onwards) with little extra effort on the part of the researchers in these institutions. Such lectures are taught fresh every year in these institutions, and incorporate all the new material in these rapidly changing areas. The Government will encourage such courses in consultation with industry.
- 7.3 A committee under the chairmanship of G. Padmanabhan, IISc, with the Secretary, Higher Education and representatives of leading universities and research institutions, as members will be constituted. The inputs of industry leaders, entrepreneurs and research faculty will be sought in developing modern and meaningful syllabi in the new era of expanding opportunities in the biotechnology sector.

Bioinformatics

- 8.0 Biological research has expanded from *in vivo* and *in vitro* experimentation to include *in silico* experimentation, a development that relies heavily on bioinformatics.
- 8.1 Three developments have caused bioinformatics to take off: the “tidal wave” of information regarding gene and protein sequences, the availability of mini-and bench-top computers, and the popularization of the Internet. Aside from the draft version of the Human Genome Project, many other organisms’ genome projects are completed or in progress. Most of these relate to plant, animal and human pathogens and such other medically and economically important organisms.
- 8.2 The effort in bioinformatics will include updating sequence information as the gaps in the human genome are completed, annotations of gene sequence and function, correlation with disease and variations across the population. Of even more value to the pharmaceutical industry, similar exercises are needed at the protein level. Data from many sources needs to be amassed, classified and stored. They must be analyzed and annotated. Various types of data must be presented to workers using a variety of platforms.
- 8.3 Sophisticated data management and analysis tools have been developed to mine these data resources. Other improvements in data integration and data mining will be required to competitively transform sequence data into information that is useful for diagnosis and development of new drugs and therapy. Thus, bioinformatics will play a key role in the future of genomics, proteomics and biotech education and industry.
- 8.4 The success of both the IT and the Biotech industries in the U.S. has been attributed, among other things, to the availability of high calibre scientists, technologists and institutions in the immediate geographical vicinity. Bangalore has the largest concentration of such institutions in the country, both in the biosciences and in IT. Thus there are opportunities here for young Indians to repeat the IT success story.

Institute of Bioinformatics and Applied Biotechnology

- 8.5 The Government of Karnataka in association with ICICI has established the Institute of Bioinformatics and Applied Biotechnology (IBAB) in ITPL at Whitefield, Bangalore. H. Sharat Chandra has been nominated Chairman of this Institute.

8.6 The objectives of this institute are:

- To offer masters and Doctoral programs in Bio-informatics and Applied Biotechnology.
- To carry out research & development activities in the field of bioinformatics & other related areas.
- To undertake short-term training programmes.
- To promote and run incubation centres for the entrepreneurs, etc.

8.7 The IBAB expects to be financially self-sustainable through fees for start-up incubation, contract research and its bioinformatics courses, and, in the long run, through generation of Intellectual Property. The institute is expected to be operational shortly. For more details, visit the website www.bangalorebio.com.

8.8 **The Governing Body of the Institute of Bioinformatics and Applied Biotechnology**

- H. Sharat Chandra, Professor emeritus, Indian Institute of Science; Bangalore
- Kiran Mazumdar-Shaw, Founder and CMD, Biocon Ltd.; Bangalore
- A.J.V. Jayachander President, ICICI Venture Funds Management Company Ltd.; Bangalore
- K.Vijayraghavan, Director, National Centre for Biological Sciences, TIFR, Bangalore
- M. A. Viswamitra, Professor, Indian Institute of Science; Bangalore
- S. Sadagopan, Director Indian Institute of Information Technology; Bangalore
- M. Ram Mohan Rao, Director, Indian Institute of Management; Bangalore
- Secretary-IT
- Director-IT

Institutional Framework for Promoting Biotechnology

- 9.0 The institutional framework within which the objectives of the Biotechnology Policy of the Government of Karnataka will be met are outlined below.

Department of Information Technology and Biotechnology

- 9.1 The Department of Information Technology and Biotechnology will be the Government of Karnataka Department that will deal with matters concerning biotechnology in the state. The Department will promote appropriate research in different sectors, lay more emphasis on fields like bioinformatics and contract research that are likely to create employment and will try to bring the companies and research centres closer.

Funding

- 9.2 Funds with the Department of Information Technology under the budget, as well as raised from other sources will also be used for biotechnology.

Vision Group on Biotechnology

- 9.3 A Vision Group on Biotechnology was constituted to advise the government on policy initiatives. Kiran Mazumdar-Shaw, a pioneer and the leader in this segment in Karnataka, is the Chairperson. The group will be a standing feature and will also be entrusted with several projects to manage directly. The group will be serviced by the Department of IT and Biotechnology.

The Karnataka Biodiversity Committee

- 9.4 The Government of Karnataka has constituted the Karnataka Biodiversity Committee, with Mr. K. H. Ranganath, the Hon'ble Minister for Forest, Ecology and Environment as the Chairman. This committee shall advise the Government on conservation of biological diversity, on sustainable use of its components, and to ensure fair and equitable sharing of genetic resources. Members of the committee include Additional Chief Secretary and Development Commissioner (Vice-Chairman), and Principal Secretary/Secretary to the Government of the Departments of Forest, Ecology & Environment; Agriculture & Horticulture; Fisheries & Animal Husbandry; Industries & Commerce; Health & Family Welfare; Revenue; Law; R.D.P.R., Controller of Drugs and Principal Chief Conservators of Forests and Principal Chief Conservators of Forests (R & W.P.).

The State Biotechnology Coordination Committee

- 9.5 The State level Biotechnology Coordination Committee (SBCC) is headed by Ms. Teresa Bhattacharya, I.A.S., Chief Secretary to the Government of Karnataka. Members of the SBCC include Additional Chief Secretary and Development Commissioner, Principal Secretary/Secretary to the Government of the Departments of Forest, Ecology & Environment; Industries & Commerce; Agriculture; Public Works; Health & Family Welfare; Head of the Microbiology Department of Bangalore Medical College, Chairman of Karnataka State Pollution Control Board and Commissioner of the Agriculture Directorate. Also see section 5.6.

Single Window Agency

- 9.6 The Single Window Agency will clear all projects of the biotechnology industry. The agency will follow up both in principle and actual sanction by the respective departments. The Karnataka biotechnology and Information Technology Services shall service the agency. Members of the Agency will include Secretary-IT & Biotechnology (Chairman), Secretary (Resources), Finance Department; Secretary, Urban Development; Chairmen of KPTCL, of BWSSB and of Karnataka State Pollution Control Board; Managing Director, KEONICS; Commissioners of Commercial Taxes, of BDA and of Department of Labour; Executive Member, KIADB; a representative from the Department of Biotechnology, Govt. of India and Director-IT & Biotechnology (Member Secretary). Representatives of other Departments shall be invited depending on the projects placed before the Agency.

Karnataka Biotechnology Development Council

- 9.7 The Government is pleased to announce the Karnataka Biotechnology Development Council (KBDC) headed by the prominent scientist V. Prakash. The Council shall have the following members:
- V.Prakash, Director, CFTRI
 - Kiran Mazumdar-Shaw, Founder and CMD, Biocon Ltd.
 - H. Sharat Chandra, Professor Emeritus, Indian Institute of Science
 - G. Padmanaban, Former Director, Indian Institute of Science
 - Kumud Sampath, President, AstraZeneca India Pvt. Ltd.
 - Viloo Morawala-Patell, Founder and CEO, Avesthagen Technologies
 - A member from the NLSIU
 - Secretary, IT & Biotechnology
 - Director-IT & Biotechnology – Member Secretary

- 9.8** The council will develop norms for setting up biotech companies. It will hold seminars, conduct research, represent trade and interact with the Government departments. The council will be funded by the government, by contributions from the Biotech Fund and from other sources. The Biotech Fund was agreed to be established in the first meeting of the Vision Group. Each biotech company is expected to contribute 0.5% of its annual turnover to this fund. The council will also have a number of cells that will advise biotech industries in respect of various functional areas, some of which are described below.
- 9.9** Bioethics: Each biotech company shall constitute a bioethics committee to consider ethical and legal issues in the area of their work. Such committees shall be constituted in consultation with the council.
- 9.10** Intellectual Property Rights (IPR): The council will develop a comprehensive up-to-date database on patents, with on-line processing. It will establish an exclusive cell to advise entrepreneurs on how to file patents and how to protect IPR. The cell will actively interact with the National Law School, will produce publications for use of entrepreneurs, will conduct seminars and will advise companies on IPR management.
- 9.11** The council will encourage industries to adopt eco-friendly technologies: it will conduct seminars, depute experts and spread awareness on how biotechnology could be used towards a cleaner and greener Karnataka.
- 9.12** Genetically engineered products/biodiversity: The council will provide advisory services on how the statutory norms and procedures can be followed in these areas.
- 9.13** International promotion: The council shall promote Karnataka as the most attractive destination for biotechnology research, manufacturing and marketing. The council shall be networked with appropriate Indian and international biotechnology organizations and will provide a large resource base for investors in Karnataka.

The Karnataka Biotechnology and Information Technology Services will offer secretarial services to the council.

Department Of Biotechnology (GOI)

- 9.14** The Government of India established this department under the Ministry of Science and Technology in 1986. This department has given a new impetus to the development of biotechnology in India. The unique feature of the department has been the deep involvement of the scientific community of the

country through a number of technical task forces, advisory committees and the involvement of individual experts in identification, formulation, implementation and monitoring of various programmes and activities.

9.15 The Department has the following high-powered committees:

Scientific Advisory Committee

Chairperson: Manju Sharma, Secretary, Department of Biotechnology, New Delhi

Members: R. A. Mashelkar, R.S. Paroda, V.S. Ramamurthy, N.K. Ganguly, N.C. Mathur, Asis Datta, A.K. Sharma, Asha Mathur, D. Balasubramanian, H. Sharat Chandra, G. Padmanaban, K. Dharmalingam, L.M.S. Palni, P.N. Tandon, Manmohan Attavar, P. Balaram, R.B. Singh, Raghavendra Gadagkar, Sandip K. Basu, V.P. Kamboj, S. R. Rao.

Scientific Advisory Committee - Overseas

Chairperson: Manju Sharma, Secretary, Department of Biotechnology, New Delhi

Members: Inder M. Verma, Anand M. Chakrabarty, Gurdev S. Khush, M.A. Vijayalakshmi, Govindjee, John Kuriyan, Ganesh M. Kishore, B.M. Gandhi.

Biotechnology Research and Promotion Committee

Chairperson: G. Padmanaban, Former Director, IISc, Bangalore

Members: P. Balaram, Samir Bhattacharya, J.B. Choudhary, Kasturi Datta, K. Dharmalingam, Raghavendra Gadagkar, B.N. Johri, V.P. Kamboj, Sushil Kumar, M.L. Madan, H.Y. Mohan Ram, S.N. Puri, A.K. Sharma, R.P. Sharma, Gita Talukdar, P.N. Tandon, H. Sharat Chandra, E.A. Siddiq, Rajiv Modi, S.K. Basu, Asis Datta, N.K. Ganguly, V.S. Chauhan, K. VijayRaghavan, Renu Swarup, Shailaja Gupta.

Task Forces

9.16 The department has 17 task forces that deal with Agriculture Biotechnology, Animal Biotechnology, Basic Research in Modern Biology, Human Genetics and Genome Analysis, Human Resource Development, Medical Biotechnology, Plant Biotechnology, Biodiversity Conservation and Environment, Bioinformatics and Infrastructural Facilities, Biotech Product and Process Development, Biotech Based Programmes for SC/ST, Biotech Based Programmes for Women and Rural Development, Aquaculture and Marine Biotechnology, Biopesticides and Crop Management, Seribiotechnology, Food and Nutrition Security, Integrated Nutrition Management.