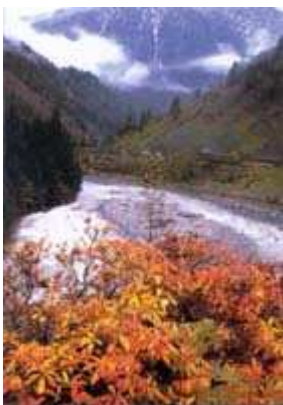


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A. INTRODUCTION

Tamil Nadu has emerged as a front ranking State in attracting investments. The growth in knowledge-based industries in the State in recent years has been phenomenal. The export of software from the State which was *only* Rs.37 crores in 1995-96 has reached Rs.1,914 crores in 1999-2000. In order to consolidate these gains and carry the State forward in the path of economic development, the Government of Tamil Nadu has decided to focus on another knowledge-based industry, i.e. Biotechnology.



2. There is growing realisation world over that Biotechnology along with Information Technology is going to be the major thrust area in the new millennium. With the announcement of the Human Genome sequence and the progress made in genetic engineering in the last two decades, Biotechnology as an industrial activity is set to increase exponentially in the future.

B. BACKGROUND



3. Tamil Nadu is rich in bioresources. The variety of geographical terrains in the State provides tremendous biodiversity rarely seen in any other single State. The forest, agricultural and plant resource base of the State are both large and diverse and represent great market opportunity for biotechnology products. There are more than 5,000 species of flowering plants and the forest cover in the State spreads over 22,500 sq.kms. The State also has one of the largest coastlines in the country which again presents opportunities for Marine Biotechnology. The State is also fortunate to have a pool of experts in various areas of Biotechnology with experience in commercialisation of Biotech products. Tamil Nadu is thus well-placed in terms of human resources to exploit the

opportunities in Biotechnology.

4. Industrial activity so far in the area of Biotechnology has been largely in first generation Biotechnology like fermentation of antibiotics. A number of Tissue Culture Units to produce food and ornamental plants have also been set up by leading industrial houses in Tamil Nadu. Thus, Tamil Nadu has the potential to create a critical mass of industrial *activity* in Biotechnology, graduating from the current first and second generation Biotechnology projects to modern Biotechnology products involving recombinant, DNA- based products and Bioinformatics. In line with the developed world, the Government would strive to focus on modern processes in the area of agriculture, industry, medical and veterinary sciences and environment, together with focus on traditional Biotechnology products, especially in the area of industrial and food enzymes where there are a number of opportunities to tropicalise products which are already used in the western world. These are likely to provide good commercial opportunities in the short-term and need to be included in any co-ordinated steps taken by the State in Biotechnology.

C. OPPORTUNITY AREAS FOR TAMIL NADU

Tamil Nadu needs to pursue opportunities in all the four segments of Biotechnology:

- Medical/Human & Animal Healthcare.
- Agriculture-food.
- Environment.
- Industrial Products.



Though medical and Agriculture-food areas *are* more relevant from the international market point of view, in the Indian context (and particularly Tamil Nadus context, where textiles and leather are major industry sectors), environment and industrial products are also likely to present immense

opportunities in the short term -both for traditional and modern Biotechnology products.

i) Medical

Tamil Nadu would present an attractive market for Medical Biotechnology products as it accounts for about 11% of the pharmaceutical market in the country. Apart from penicillin manufacturing and a reasonably large number of loan licence formulation units, investment in this sector within the State has been low. Hence Biotechnology presents an ideal opportunity for the State to reverse this trend.

Innovative efforts to collaborate with strong institutes within the State will be encouraged. For example, collaborative effort with the TB Research Centre, Chennai, to develop an effective vaccine, will be highlighted. The vast collection of clinical specimens and the work going on at this Institute as well as several others would be showcased for further research and product development.

A few other areas of focus under the Medical Biotechnology will be .>

- Diagnostics
- Vaccines (Hep C, Malaria, etc.)
- Therapeutics (Interferon, Insulin, etc.)
- Veterinary Drugs (including vaccines).

ii) Agriculture-Food

Opportunities to work with the germ plasm database available with institutions, like Tamil Nadu Agricultural University (TNAU) and M.S. Swaminathan Research Foundation (MSSRF) will be focus areas. Agriculture-food products like rice, coconut, sugarcane and tea, which have a strong presence within the State will be targetted for Biotechnology research.

A few other important areas of focus in the Agriculture-food sector are :

- Bibpesticides and Biofertilizers
- Natural products in Healthcare (from Medicinal Plants)

- Animal Feeds / Supplements from Agricultural Products
- Flavours / Fine Chemicals / Amino Acids / Nutrient Supplements from animal waste.
- Transgenics (improved biotic and abiotic stresses agronomic and nutritive qualitative characteristics)
- Diagnostics -Disease Markets.

iii) Environment

The focus on Environmental Biotechnology products within the State will be in important sectors like leather and textiles. Collaborations with reputed institutes like Central Leather Research Institute (CLRI) will be encouraged to develop appropriate products.

A few key areas of focus will be :

- Methods / Apparatus / Techniques for Biosensors.
- Microbial strain development of Cultures for waste management

-Bioremediation.

-Effluents and waste water:

-Creation of value

-added catalog of germ plasms including microbial germ plasms.

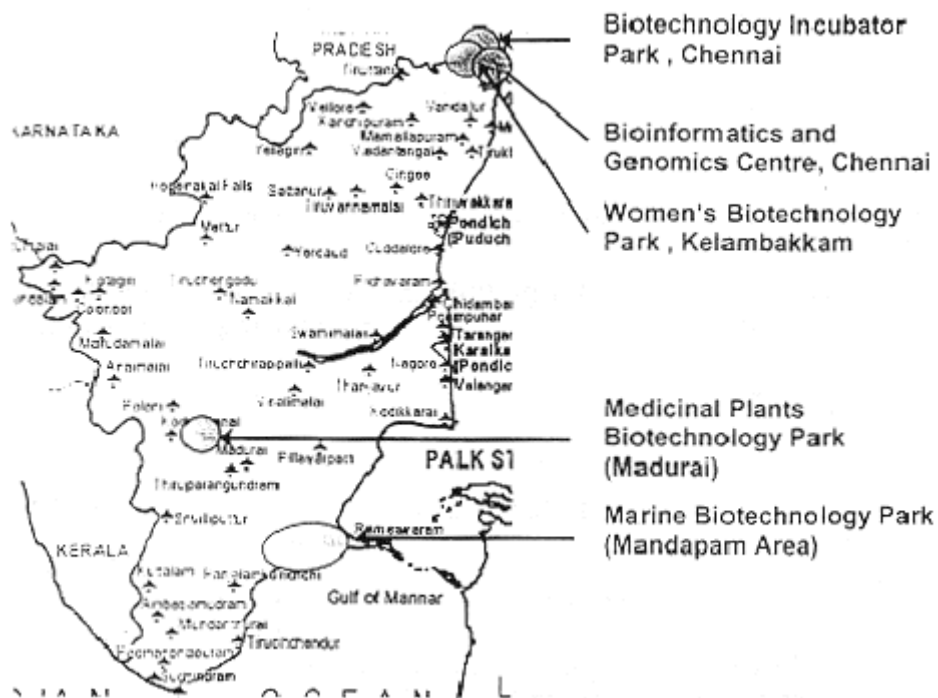
iv) Industrial Products A few key areas of focus will be :

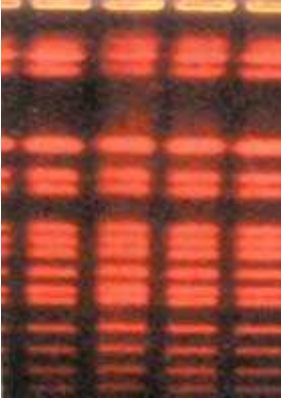
- Food and Industrial enzymes (Papain, Phytase, Lipase, Enzyme Cocktails, etc.).
- Classical Fermentation Products (antibiotics, immuno modulators, etc.) for yield improvements.
- Bioenergy.

- Surface and additives.
- Biopolymers.

To sum up, there are a number of opportunities in the above segments of Biotechnology, which can be commercially exploited to create new jobs and economic wealth in the State. Many of the opportunities are based on the bioresources available within Tamil Nadu. The Government will take steps to create appropriate mechanisms and implementation structures as stated below to derive benefit from these opportunities.

D. CREATION OF BIOTECHNOLOGICAL ENTERPRISE ZONES (BIO-VALLEYS) IN TAMIL NADU





5. The Government of Tamil Nadu will facilitate the establishment of Biotechnology Enterprise Zones (Bio-Valleys) along the lines of Silicon Valley to exploit the bioresources of the State. Efforts will be made to encourage the establishment of different types of biotech entities consisting of research organisations, service providers, as well as companies which will commercialise the new products and processes. Efforts will also be made to create a network among these biotech entities to facilitate information and knowledge transfer. .

6. Four Biotech Parks and a Bioinformatics and Genomics Centre will be , established, each of which would aim at leveraging the bioresources of the agro-ecological zones of Tamil Nadu. These five entities will be the hub of the Biotechnology Enterprise Zone.

7. The above five entities will be as follows .

i) Biotechnology Incubator Park near Chennai

This will be set up at a cost of about Rs.40 crores by Tamil Nadu Industrial Development Corporation Limited (TIDCO) in association with American universities which have experience in managing such Incubator Parks successfully. The project will be structured on a commercial format, the details of which will be worked out by TIDCO. This Incubator Park will mainly focus on Agriculture, Medical, Environment and Industrial Biotechnology opportunities. The Park will provide centralised services to a large number of individual enterprises to develop and commercialise products and patents.

ii) Women's Biotechnology Park, Kelambakkam.

The Women's Biotechnology Park at Kelambakkam near Chennai will continue to receive support from the Government. This Park will mainly focus on

microenterprise and traditional biotechnologies. Efforts will be made to achieve the full potential of this Park in terms of enterprise development and employment.

iii) Medicinal Plants Biotechnology Park

A Medicinal Plants Biotechnology Park will be set up near Madurai. This Park will focus on Medicinal Plants and opportunities for sourcing of raw materials in a sustainable manner and value addition to scientifically tested herbal medicines. This Park will also provide facilities for growth of traditional medicinal systems. This Park will be established in the Industrial Park promoted by State Industries Promotion Corporation of Tamil Nadu Ltd. (SIPCOT) near Kodaikanal Road where 380 acres of land have already been acquired and developed. TIDCO and SIPCOT will jointly work on commercialising this project.

iv) Marine Biotechnology Park

A Marine Biotechnology Park will be set up in the Mandapam area for promoting ecologically sustainable Marine Biotechnology Enterprises including the use of sea weeds, production of oysters, mussels, *yees*, crabs and other sea food items. Emphasis will also be given on conservation and regeneration of mangroves and sea grass and organisation of low external input sustainable aquaculture (LEISA). The Marine Biotechnology Park will function in close co-ordination with Gulf of Mannar Biosphere Trust.

v) Bioinformatics and Genomics Centre (BGC)

This will be located in the TIDEL Park, Chennai. This Centre will explore the Indian genetic pool, exploit the germ plasm base available and leverage on the existing pool of Indian Bioinformatic scientists and low cost local software skills. The proposed BGC will also facilitate research and enable bioentrepreneurs to commercialise their research findings, validate products, contract sequence services and provide other services like training. This Centre will function on a

commercial basis. The adequate bandwidth available in the TIDEL Park will be exploited for the purpose. TIDCO will facilitate its creation.

8. The Government will also initiate an exercise to take a detailed inventory of the bioresources within Tamil Nadu with the help and possible grant from National Bioresources Board. The service of the Bioinformatics and Genomics Centre would be used to make available this information through database.

E. REGULATORY FACILITATION

9. The regulatory framework for establishing a Biotech entity or for commencing research activity is largely controlled by Central Institutions. Several Biotech bodies like Recombinant DNA Advisory Committee (RDAC), Institutional Biosafety Committee (IBSC), Review Committee on Genetic Manipulation (RCGM) and Genetic Engineering Approval Committee (GEAC), etc., are involved in the process with clearly laid-out procedure and mechanism. The role of the State Government is currently restricted to IBSC and District Level Committee (DLC) which largely involves inspection and monitoring of field trials and co-ordinating with Central Ministries from time to time. The State Government will provide single window facilitation for Biotech enterprises and entities to obtain clearances from the various Central agencies. An appropriate body will be positioned for this purpose in consultation with the Department of Biotechnology, Government of India.



10. The State Government will also facilitate creation of quarantine facilities and sanitary/phytosanitary measures as per the WTO agreements for biologicals and other items and facilitate quicker and easy clearances to prevent degradation of sensitive materials.

F. STRENGTHENING OF HUMAN RESOURCES POOL

11 .The Government will initiate measures to enhance the human resources pool

for Biotechnology available within the State. Efforts will also be made to facilitate greater interaction between scientists at various universities and representatives of industries including occupants of the various Biotechnology Parks. An appropriate framework will be positioned for this.

12. Human Resource Initiatives of the Government will consist of the following :

- Suitably changing the procedures in existing State-supported universities and institutions to facilitate better interaction with the business community and encourage the creation of scientist / technologist entrepreneurs.
- Initiating the creation of certain new, short duration technician oriented courses at appropriate universities in specific areas (post B.Sc. / M.Sc.).
- Increasing the intake of students in Biotechnology courses currently offered in various universities.
- Evaluate and provide one -time grant to specific institutions for establishing appropriate training courses for creating Bioinformatics professionals to exploit the emerging opportunities in this area.

13. Another major human resource initiative will be to capitalise on the existing institutions, research bodies and universities which are carrying out research in Biotechnology areas. Large volume of information is available on biological materials, knowledge of critical processes, product technologies, partnership opportunities for collaborative research, training and commercial applications. A networking facility will be established to enable the existing universities, institutions and Commercial Biotech entities to exchange knowledge, research methodologies, appropriate utilisation of bioresources, disease prevention, product validation and field trials.

G. ESTABLISHMENT OF EMERGING TECHNOLOGIES FUND FOR BIOTECHNOLOGY



14. Through TIDCO, the State Government will facilitate the establishment of a Venture Fund with an initial corpus of about Rs.30 crores for Biotechnology. This fund will be known as "Emerging Technologies Fund". The fund would be managed by professionals and would target at Biotech projects both within and outside Biotech Parks.

H. ESTABLISHMENT OF TAMIL NADU BIOTECHNOLOGY BOARD (TNBB)

15. The State Government will establish a Tamil Nadu Biotechnology Board (TNBB) under the Chairmanship of an eminent expert in the area of Biotechnology. This Board will consist of senior officers from the Government as well as eminent representatives from industry and experts from the field of Biotechnology. The TNBB in turn will set up Standing Advisory Committees in the following areas to identify and attract suitable enterprises :

- Medical and Veterinary Biotechnology.
- Food and Agricultural Biotechnology.
- Bioinformatics and Genomics.
- Environmental Biotechnology.
- Industrial Biotechnology.

16. The Board would help and advise the Government to convert the rich bioresources in Tamil Nadu into economic wealth in ecologically and socially sustainable manner. The Board would also tender advice on policy matters relating to Biotechnology such as biotechnology choice, training, human resources development techno infrastructure, crosscutting issues like biosafety, bioethics and biosurveillance. The Board will play a major role in creating the Regulatory Framework. The Board is also expected to play the role of a proactive body that will take initiatives and help in mobilising the internal and external resources (both technical and financial) essential for Tamil Nadu assuming a position of leadership in Biotechnology based on the principles outlined in Programme 16 of Agenda 21 of the U.N.Conference on Environment and

Development held at Rio-de Janerio in 1992, with reference to environmentally safe uses of Biotechnology. Accordingly, the Board will take steps to ensure that the developments in the State in this sector move towards environmentally safe uses of Biotechnology. TNBB will also explore opportunities to carry out collaborative research with other countries which have made much advance in this area.

I. TREATMENT OF BIOTECHNOLOGY AS INDUSTRY

17. All Biotech units undertaking commercial production would be treated as industry and would thus be eligible for all incentives to which industries are eligible. Power will be supplied to them by the TNEB at industrial tariff rates. The above facilities would be available based on approval / certification by the TNBB.

18. The Bioinformatics units would be allowed to have FSI norms on par with IT Industries.

For further details, Kindly contact

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