

MAIN CONTENT OF OVERALL PLAN FOR BIOTECHNOLOGY DEVELOPMENT IN VIETNAM UNTIL 2020

There are 4 main parts:

- I. Current status of biotech development and application, and need in coming years
- II. Guidance point of view and goals for the development
- III. Task
- IV. Main solution and organization implement

A. CURRENT STATUS OF BIOTECH DEVELOPMENT AND APPLICATION, NEED IN NEXT COMING YEARS

- I. STATUS OF BIOTECH DEVELOPMENT
- II. THE NEED OF BIOTECH DEVELOPMENT IN VIETNAM

I. STATUS OF BIOTECH DEVELOPMENT

1. ACHIEVEMENTS IN BIOTECH REARSEARCH AND IT'S APPLICATION

- Developing edible and medicinal mushroom farming
- Establishing processing industry based on application of biotech
- Developed a number of crops with high yield and quality, and resistance to diseases using biotech.
- Sequenced a number of genes from local organisms and registered in the gene bank.
- Developed several disease diagnostic KITs for human, livestock and crops
- Produced 9 in 10 kinds of vaccines to be used in Public Vaccination Program.
- Biotech application in aquaculture and processing
- However, most of the products have limited quality and low capacity for competition in the domestic and foreign markets

I. STATUS OF BIOTECH DEVELOPMENT

2. HUMAN RESOURCE TRAININGS AND FACILITIES

2. Human resource trainings:
In 10 years (2001-2005) trained 5000 cadres specialized in biotech in which 600 received master, and 120 received doctor degrees (including those were trained abroad).
3. Facilities:
The government invested in 5 national key laboratories on biotech with an average expense of more than 50 billion VND for each laboratory. The government also invested in building 40 laboratories on plant cell and tissue culture in many provinces.
However, several key laboratories are still confused in running, managing, and are lack of qualified human resource and that affects the investment efficiency.

I. STATUS OF BIOTECH DEVELOPMENT

4. Financial Investment

- Estimation of financial investment on Biotech in each period (see attached table; amount of investment in 2001-2005 period does not include investment for 5 national key laboratories)
Investment for research and development is increasing. However, the level of investment is still too low; this is one of the reasons that there is yet a breakthrough in Biotech in Vietnam.

| Period | Investment fund (USD/year) |
|--------------|-------------------------------|
| 1981-1985 | 20.000 |
| 1986-1990 | 200.000 |
| 1991-1995 | 300.000 |
| 1996-2000 | 500.000 |
| 2001-2005(*) | 1.000.000 |

B. GUIDANCE POINT OF VIEW AND GOALS FOR THE DEVELOPMENT

- I. Guidance point of view
- II. Goals for the development

I. GUIDANCE POINT OF VIEW

1. To set up and develop biotech in Vietnam to become one of the important economical-technological industries for the national industrialization and modernization
2. To develop biotech to serve the sustainable development of agriculture, to develop a food processing industry, to protect human health and environment, meanwhile to develop enterprises and services.
3. To develop biotech based on internal capacity, selective acquirement and master of global advanced technologies
4. Development of biotech requires high level of investment, therefore, it is necessary to invest correctly, sufficiently, and uniformly; to select suitable products to invest.
5. One of the most important factors for the development of biotech in Vietnam is to have high qualified human resource on science and technology.

II. GOALS FOR DEVELOPMENT

1. Overall goals

- Develop and broadly apply Biotech on different economical sectors;
- Develop an industrial biotech and produce key products for national economical growth;
- Focus on Biotech investment and improve investment efficiency, establish a market for Biotech so that by the year 2020 Biotech in Vietnam will reach the advanced level.

II. GOALS FOR DEVELOPMENT

2. Goals for development and application of Biotech till 2010

- Acquire, master, and create a number of key technologies; implement and apply these technologies in agriculture, fishery, medical, processing industry, environmental protection, national military security
- Create new products such as crops, livestock, microbes, vaccines, industrial processed products ... that have high economical values
- Set up a network of research organizations with high capacity for research and technology development
- Establish a number of enterprises and services in biotech field
- Since 2006-2010, train more than 8000 staffs in biotech field with 200 PhDs, 800 MSc, and approximately 3000 technicians

II. GOALS FOR DEVELOPMENT

3. Goals till 2015

- Acquire and master fundamental technologies of biotech in order to develop international, advanced technologies; broadly apply biotech in different areas for social- economical development.
- Establish several centers for biotech research and development at the ASEAN level.
- Establish advanced biotech industry to produce high quality products for domestic use and export
- From 2011-2015, train more than 12000 staffs on biotech with more than 300 PhDs and 1200 MSc, and send a number of staffs abroad for short-course and long-term study

II. GOALS FOR DEVELOPMENT

4. Vision till 2020

- Human resource on biotech: sufficient quantity, and highly qualified
- Establish several national centers for research and technology development at the international level.
- Develop strong biotech industry in Vietnam that can produce sufficient essential products for national economical growth

C. TASK

I. MAJOR TASKS

II. ORGANIZE AND IMPLEMENT PROGRAMS, PROJECTS AND MAJOR TASKS

I. MAJOR TASKS

1. Develop and broadly apply biotech to production and life
2. Develop scientific and technological potential for biotech
3. Establish a biotech industry
4. Develop legal documents, procedures, policies in order to boost development and application of biotech

1. Develop and broadly apply biotech to production and life

- 1.1. For agricultural and rural development
- 1.2. For aquaculture
- 1.3. For medical treatment and public health protection
- 1.4. For environment protection and sustainable development
- 1.5. For processing industry
- 1.6. For national defense and security

1.1. For agricultural and rural development

- For agricultural plants: Focus on gene technology to create new plant varieties, GM plants; micro propagation; application of high technology to optimize crop production and quality
- For forestry plants: apply cell technology, micro propagation to multiply forestry plants with high production and good wood quality; gene technology in create plants resistant to diseases

1.1. For agricultural and rural development

- Livestock: Research and improve breeding technology; apply molecular marker technology, gene transformation in breeding of new cattle, in sex of embryo determination; research and produce sufficient vaccines for livestock, especially vaccines for bird flu and strange cattle diseases.
- Microbiology: Research and produce at the industrial level microbiological products for plant protection, soil improvement, and for processing of agricultural, food/feed products, and environment treatment.
- Effective use of gene technology in conservation and exploitation of gene sources

1.3. For medical and public health protection

- Medical:
 - Stem cell technology for disease treatment;
 - Development of monoclonal technology
 - Gene technology for disease diagnosis and treatment;
 - Research and production of new generation vaccines (sufficient for 80-90 % of domestic demand)
- Pharmacia products:
 - Bioactive substances from bio-organisms for industrial production of medicines
 - Research and production antibiotic, vitamins, amino acids, protein by microbial fermentation and recombination technology.
 - Cell technology for conservation and development of valuable herbal medicines

II. ORGANIZE AND IMPLEMENT OF PROGRAMS, PROJECTS AND MAJOR TASKS

1. National program on research and application of fundamental technology of biotech
2. Key program on development and application of biotech in agriculture and rural development
3. Proposal for development and application of biotech in medical field till 2020
4. Proposal for development and application of biotech in aquaculture till 2020
5. Proposal for development and application of biotech in industrial processing till 2020
6. Proposal for development and application of biotech in environment protection till 2020
7. Building human capacity for biotech
8. Develop network and strengthen facilities for research institution, centers, laboratories
9. Overall program for biotech development till 2020
10. Project on bio-safety law and implemental guidelines

National program on research and application of fundamental technology of biotech

- Main goals of the Program

- a- Develop science and technology capacity of biotech; master fundamental technologies (gene, enzyme-protein, microbiological, and cell technologies)
- b- Application of fundamental and advanced technologies of biotech to develop new innovation technologies for social-economical development, particularly in agriculture-forestry-fishery, health care, environment protection, national defense and security

National program on research and application of fundamental technology of biotech

- Main task of the program :

- a, Characterization of genomes of Vietnamese minority groups, mitochondria DNA, sex chromosomes genes, for strengthen medical precautionary solution and treatment of disease via gene therapy; construction human DNA library for security; application of DNA hybridization, gene transformation, molecular marker and gene mapping in plant and animal breeding. Research and application of advanced technology in production of new generation vaccines, and in diagnose and treatment of human, animal and plant diseases.

National program on research and application of fundamental technology of biotech

- main task of the program:

- b, Research and application of molecular immunology, proteomics for characterization of gene functions and identification of high value protein, production of recombinant proteins; application of enzymes in processing industry in order to improve quality and competitive potential of agricultural, forestry, fishery products

National program on research and application of fundamental technology of biotech

- Main task of the program:

- c, Research, conservation, and effective use of biodiversity of microorganisms in endemic ecosystem of Vietnam; application technologies for development of valuable microorganisms, for fermentation, for production of medicines, adjuvant, food color substances, fertilizers, pesticides, and environment treatment substances.

National program on research and application of fundamental technology of biotech

- Main task of the program

- d, Research and application of plant cell technology in micro propagation of agricultural, forestry, plants (artificial seed, apomixis). Research and application of animal cell technology in asexual reproduction, tissue, embryo, and stem cell technologies for cell therapy.

NATIONAL BIOTECH PROGRAM 2006-2010

- GOALS
- CONTENTS
- EXPECTED PRODUCTS
- EVALUATION CRITERIA

Goals

- Building capacity for science and technology (facility, human resource);
- Master fundamental technologies (gene technology, enzyme-protein technology, micro biotechnology, cell technology, nano biotechnology);
- Application of fundamental technologies to develop products for social-economical development, especially in agriculture, forestry, fishery, pharmacy, industry, environment, security and national defense

Contents

1. Gene technology

- Research and application of recombinant DNA, gene transformation, molecular marker, gene mapping, nano bio technologies in breeding of plants, animals and microbes for production of new generation vaccines; develop DNA technology in criminal identification and national defense;
- Research and application of biotech in production of KITs for early diagnosis of severe diseases such as SARS, cancer, H5N1, HIV, ...
- Research and master nano biotechnology, bio-informatics, for gene sequencing and diagnose of new diseases

Contents

2. Cell technology

- Application of artificial seed technology, apomixis in propagation of agricultural, forestry and medical plants... Production of secondary organic substances for husbandry, veterinary, and pharmacy;
- Research and application of animal cell reproduction technology in breeding;
- Development of cell technology for industrial propagation of high value plants
- Master stem cell technology for treatment of severe diseases: cancer, heart diseases, eyes diseases ... Develop of animals that have potential for internal organ replacement

Contents

3. Enzyme-protein technology

- Research and produce different high economical value enzymes for processing of high market value products;
- Research and development of enzymes and protein for production of traditional and advanced medicines

Contents

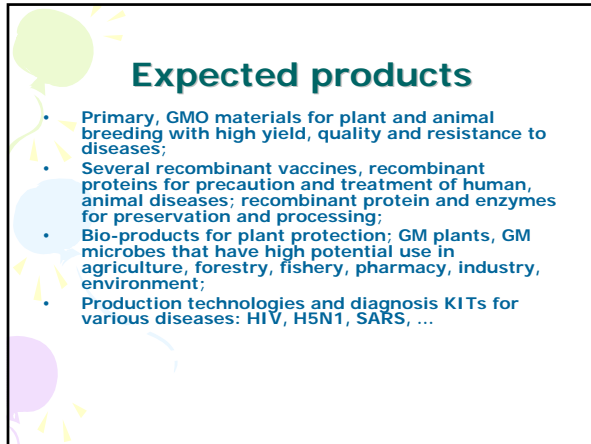
4. Microbiotechnology

- Research and development of new recombinant microorganisms that can produce high bioactive substances for production of new generation vaccines, medicinal products, adjuvant, bio-fertilizers, and substances for environment treatments

Contents

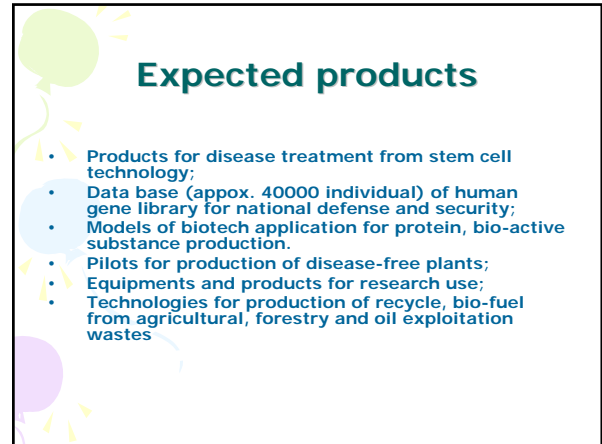
5. Application of modern biotech for conservation and sustainable use of genetic resources

- Research and development of technology and new products based on combinations of different technologies to sequence genes, diagnose diseases, and produce new bio-fuels



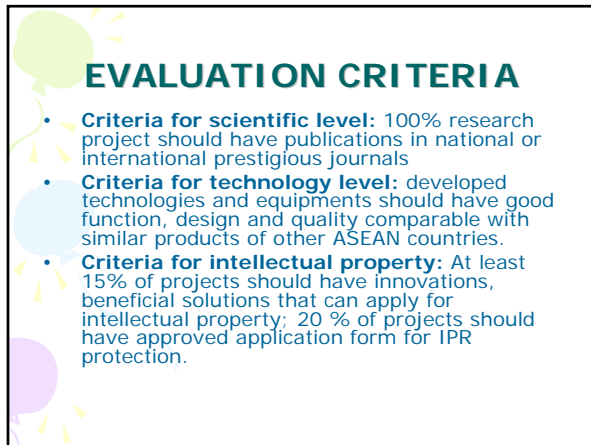
Expected products

- Primary, GMO materials for plant and animal breeding with high yield, quality and resistance to diseases;
- Several recombinant vaccines, recombinant proteins for precaution and treatment of human, animal diseases; recombinant protein and enzymes for preservation and processing;
- Bio-products for plant protection; GM plants, GM microbes that have high potential use in agriculture, forestry, fishery, pharmacy, industry, environment;
- Production technologies and diagnosis KITs for various diseases: HIV, H5N1, SARS, ...



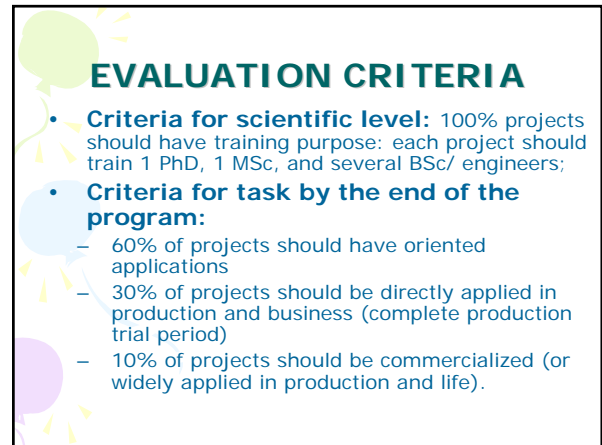
Expected products

- Products for disease treatment from stem cell technology;
- Data base (approx. 40000 individual) of human gene library for national defense and security;
- Models of biotech application for protein, bio-active substance production.
- Pilots for production of disease-free plants;
- Equipments and products for research use;
- Technologies for production of recycle, bio-fuel from agricultural, forestry and oil exploitation wastes



EVALUATION CRITERIA

- **Criteria for scientific level:** 100% research project should have publications in national or international prestigious journals
- **Criteria for technology level:** developed technologies and equipments should have good function, design and quality comparable with similar products of other ASEAN countries.
- **Criteria for intellectual property:** At least 15% of projects should have innovations, beneficial solutions that can apply for intellectual property; 20 % of projects should have approved application form for IPR protection.



EVALUATION CRITERIA

- **Criteria for scientific level:** 100% projects should have training purpose: each project should train 1 PhD, 1 MSc, and several BSc/ engineers;
- **Criteria for task by the end of the program:**
 - 60% of projects should have oriented applications
 - 30% of projects should be directly applied in production and business (complete production trial period)
 - 10% of projects should be commercialized (or widely applied in production and life).



Thank you for your attention!