Current Status and Options for Biotechnologies in Food Processing and Food Safety in Developing Countries

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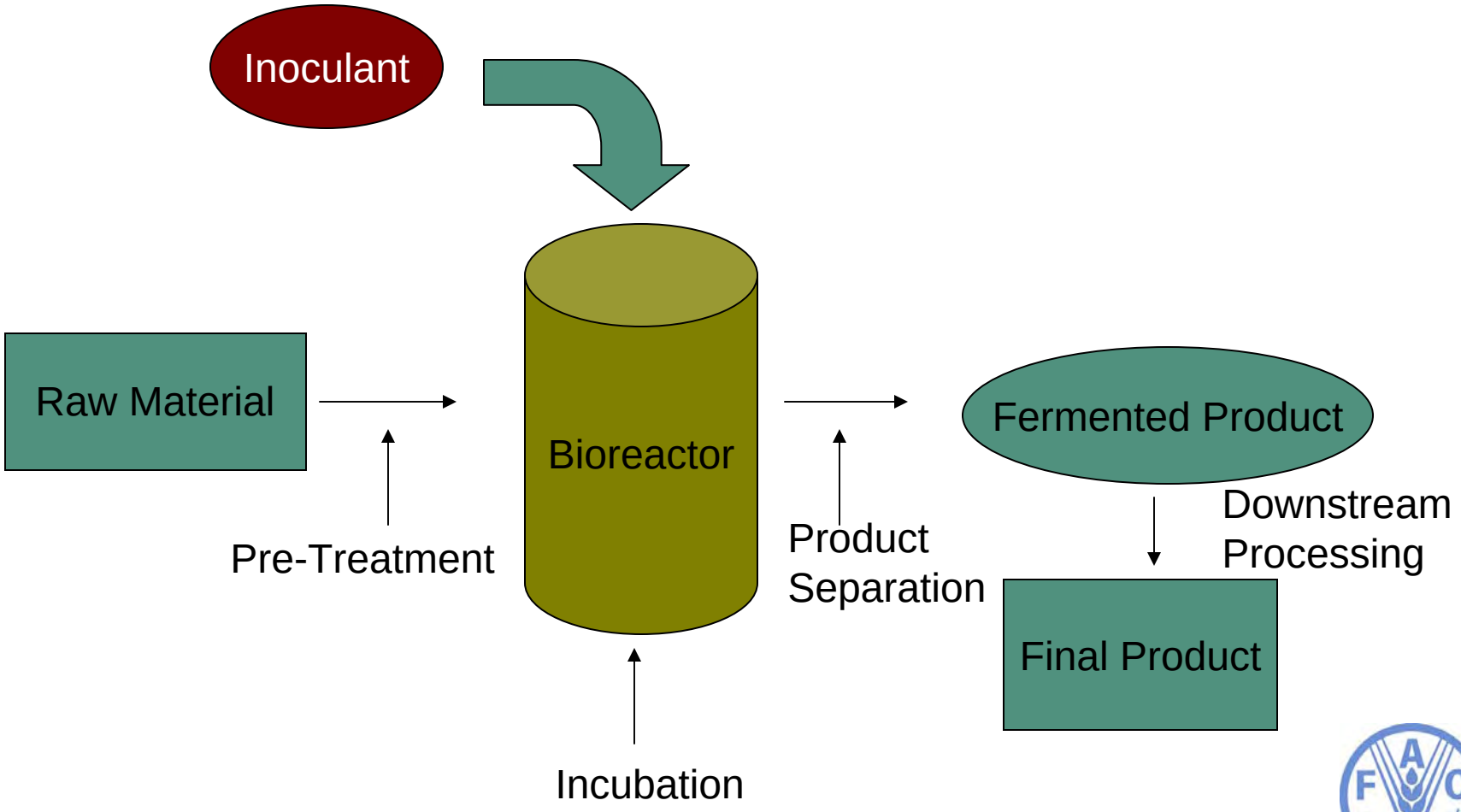
Biotechnology

"*any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.*" Convention on Biological Diversity.

Biotechnology in Food Processing

- The fermentation bioprocess:
  - Is the major biotechnological application in food processing
  - Is one step in a sequence of food processing operations
  - Makes use of microbial inoculants to enhance
    - Taste
    - Aroma
    - Shelf-life
    - Texture
    - Nutritional Value

Schematic of Steps of an Ideal Fermentation Process



Dried soybeans

RAW MATERIALS

Grading

Dehulling

Gravity separation of hulls

1st Soak cotyledons for overnight at room temperature

Boil 60 minutes in soak water

2nd Soak cotyledons for overnight at room temperature

place into the net - plastic bag and tight

steam or boil for 30 minutes

drain and cool

PRE-TREATMENT

Inoculation with powdered “ragi tempe”

INOCULATION

Pack into perforated plastic bag (about 200g) and seal

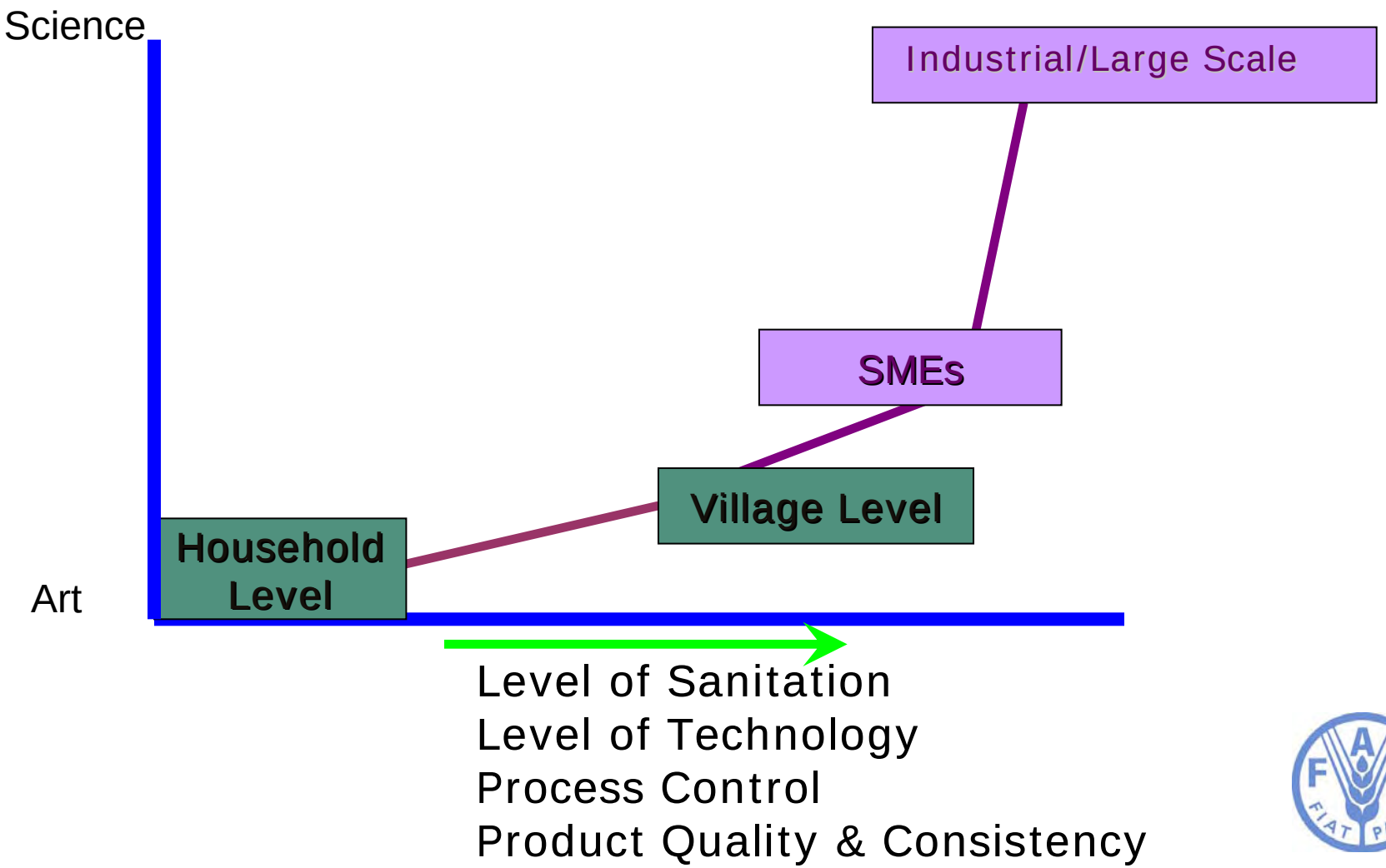
Incubation in the bamboo rack for 36-40 hr

FERMENTATION

Tempeh

PRODUCT

From Art to Science: Levels of Technology



Types of Inoculants

- "Appropriate" Starter Cultures
  - Back-slopping
- Defined Starter Cultures
  - Propagated and maintained under sterile conditions
- "Chance" inoculation of fermentation processes is also widely employed

Chance Inoculation

“Appropriate” Starter Cultures

Mould Starter Cultures

Defined Starter Cultures

Super Tempeh Kit & Instructions

Contents: Rhizopus Oligosporus Culture & Rice Flour
NET WT : 4 Gr.

TEMPEH SUPER STARTER
RAGI TEMPEH SUPER ASLI INDONESIA

Makes 12 Lbs

Bioreactor Technology

Soy Sauce Fermentation (Asia)

Cassava Fermentation
W. Africa

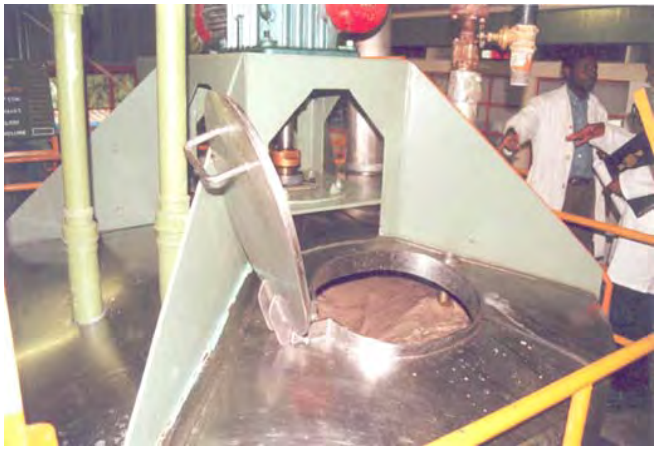
Earthenware Pots used as Bioreactors

Bioreactor Technology

Traditional Koji Chamber

New Koji Chamber

Bioreactor Technology



Traditional Sorghum Beer Production

Role of Biotechnology in Starter Culture Development

- Enhancement of starter culture safety
- Tailoring of cultures to achieve desirable products.
- Improve yields, quality and consistency of product

All of the above are possible with the appropriate bioreactor conditions

Biotechnological Tools For Starter Culture Improvement

	Biotechnological Tools
I. Diagnostics	
Characterization of microorganisms	PCR Specific and Non Specific Gene Amplification Genome sequencing

Biotechnological Tools For Food Safety Assurance

Food Safety	Biotechnological Tools
I. Pathogen Detection	Specific Gene PCR Amplification Specific protein identification by Immunoassays Biosensors
II. Detection of chemical and biochemical hazards	Immunoassays Biosensors
III. Traceability of Food	DNA Bar code - Unique DNA Polymorphism

Changing Socio-economics a Driving Factor for Improvement

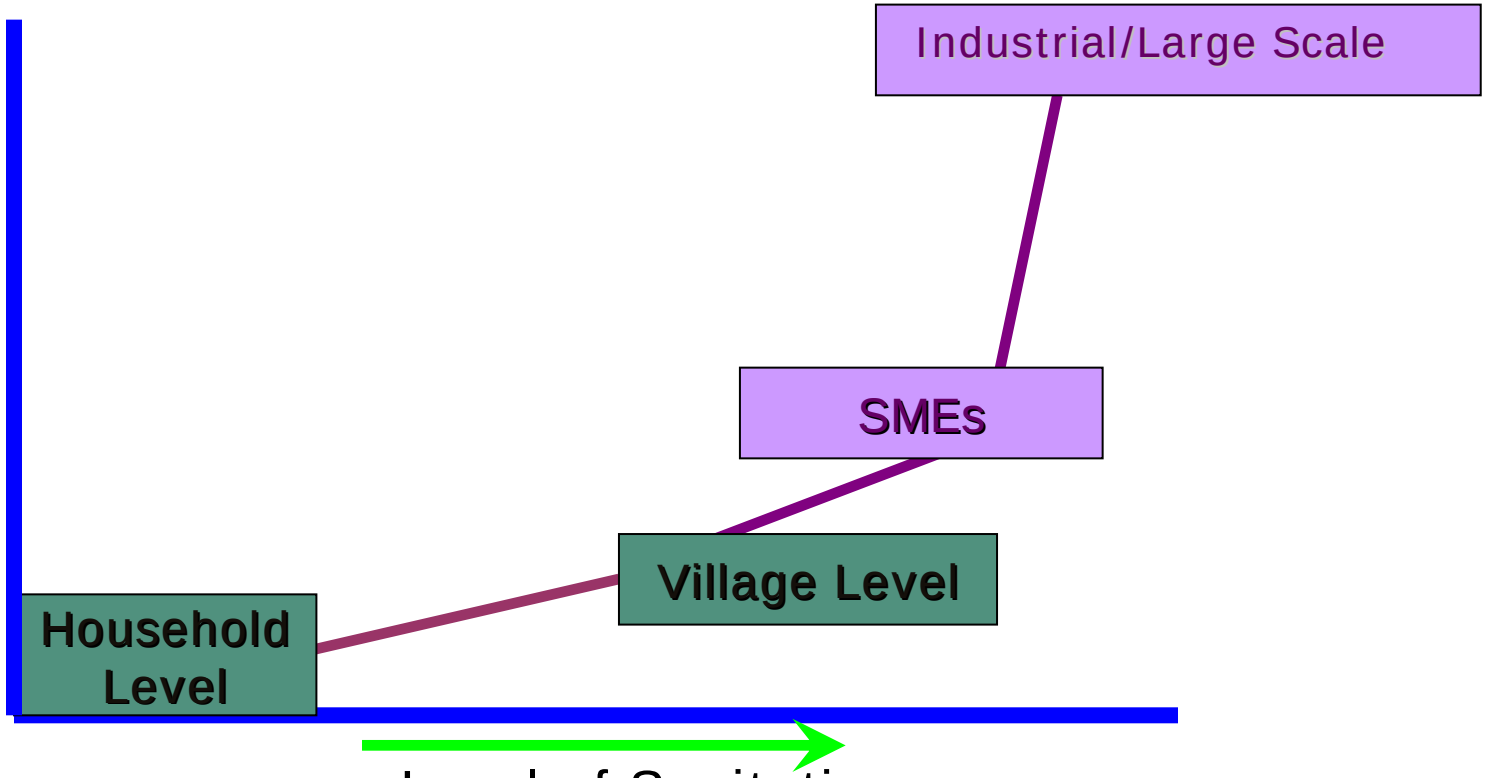
Traditional Consumer

- Affordable staples
- Taste
- Shelf-life
- Food Security and Safety

Mid-High Income

- Health food
- Quality
- Convenience
- Food Safety
- Shelf-life

From Art to Science: Levels of Technology



Lessons from the Past

- Success has been achieved where:
  - An enabling environment has been provided by Governments
    - Governmental support facilitates the adoption of improved technologies
  - Development of technical skills has been prioritized
  - Funding support exists for research
  - Industry-institutional linkages have been developed
  - North-South, and South-South collaboration has taken place
  - Industry has adopted proactive approaches
  - Production of fermented foods is market driven

- Attention must be paid to intellectual property issues
- Starter culture development is a driving force for upgrading bioreactor technology

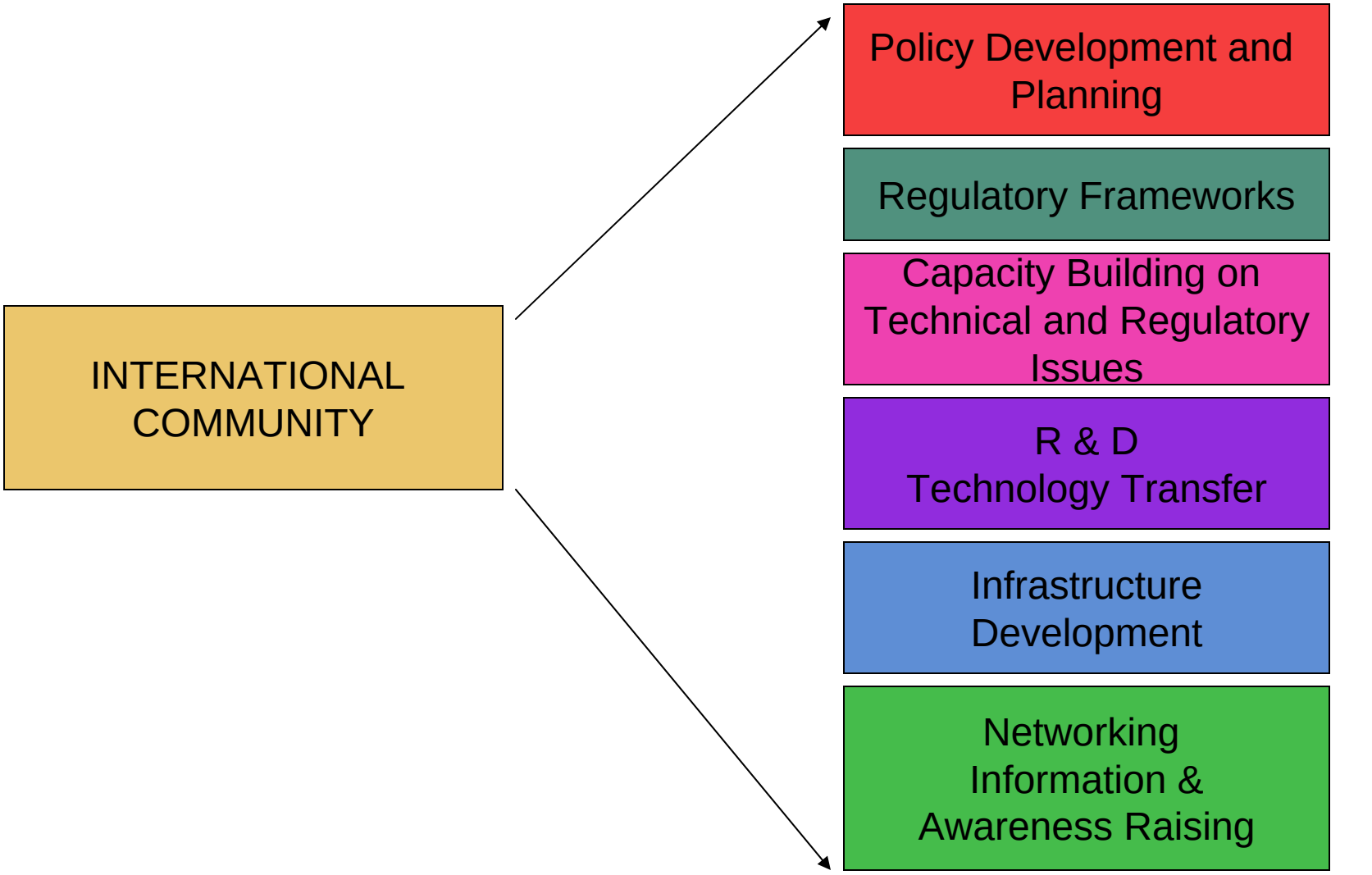
Country Level - Priorities for Action

- Regulatory and policy issues
  - Food Safety
  - Food and nutritional security
  - Technology transfer and innovation
  - Business policy
- Education Policy
  - Consumer education
  - Academic and vocational education on food biotechnology - fermentations
- Institutional Strengthening and Capacity Building
  - R&D support targeted to the food bio-processing sector
  - Dissemination of improved technologies
  - Strengthening of food safety management systems

Country Level - Priorities for Action

- Infrastructure Development
  - Transfer and adaptation of technology
- Intellectual Property Rights
- Information, Networking and International Cooperation
  - Access to specialized technical information
  - Networking and exchange among institutions and across regions

Role of the International Community



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