VALUE ADDITION TO AGRICULTURE THROUGH FOOD PROCESSING: SCIENCE, TECHNOLOGY, BENEFITS

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Indian “A-A-A” sectors at a glance

“Agro, Animal husbandry, & Aquatic (AAA)” sectors - key drivers for national growth – resulting in self-sufficiency in food production

- **Availability of arable land**
  - 52% v/s 11% global average

- **Varied Climatic Zones**
  - All the 5 v/s a few in most nations
  - 20 agri-climatic regions

- **Different Soil Types**
  - 46 out of 60 in the world

- **Diurnal changes**
  - Suitable for cultivation through the year

- **Largest**
  - Live stock population (300m)
  - Milk production (167 MMT)
  - Grain production (285 MMT)

- **Second-largest**
  - Fruits & vegetable (305 MMT)
  - Aquaculture production (6.8 MMT)

- **One of the Top SIX Producers of**
  - Rice, wheat, groundnuts, tea, coffee, tobacco, spices, sugar and oilseeds.

- **Agro-Food Revolutions**
  - GREEN, WHITE & BLUE, PL
## Growth Trends in Agro-Food Production

<table>
<thead>
<tr>
<th>Commodities</th>
<th>2000 (MMT)</th>
<th>2017(MMT)</th>
<th>Growth* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agriculture</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grains - Ce, Pu &amp; Os</td>
<td>199.00</td>
<td>285.00</td>
<td>43</td>
</tr>
<tr>
<td>Horticulture - FV, Sp</td>
<td>127.00</td>
<td>304.00</td>
<td>139</td>
</tr>
<tr>
<td><strong>Animal Husbandry</strong></td>
<td></td>
<td></td>
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<tr>
<td>Beef</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Sheeps &amp; Goats</td>
<td>5.00</td>
<td>7.83</td>
<td>57</td>
</tr>
<tr>
<td>Poultry</td>
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<tr>
<td>Milk</td>
<td>72.00</td>
<td>165.00</td>
<td>129</td>
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<tr>
<td>Eggs</td>
<td>29.00b</td>
<td>88.00b</td>
<td>203</td>
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<tr>
<td><strong>Aquatic</strong></td>
<td></td>
<td></td>
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<tr>
<td>Capture</td>
<td>5.30</td>
<td>10.90</td>
<td>106</td>
</tr>
<tr>
<td>Culture</td>
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</tr>
</tbody>
</table>
# Agro-Foods - Production, Processing Levels

<table>
<thead>
<tr>
<th>Commodities</th>
<th>Production (mmt)</th>
<th>Processing, %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agriculture</strong></td>
<td></td>
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</tr>
<tr>
<td>Grains - Ce, Pu &amp; Os</td>
<td>285.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Horticulture - FV, Sp,</td>
<td>304.00</td>
<td>2.20</td>
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<tr>
<td><strong>Animal Husbandry</strong></td>
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<tr>
<td>Beef</td>
<td>7.83</td>
<td>21.00</td>
</tr>
<tr>
<td>Sheeps &amp; Goats</td>
<td>7.83</td>
<td>21.00</td>
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<tr>
<td>Poultry</td>
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<tr>
<td>Milk</td>
<td>165.00</td>
<td>37.00</td>
</tr>
<tr>
<td>Eggs</td>
<td>88.00</td>
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<tr>
<td><strong>Aquatic</strong></td>
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<tr>
<td>Capture</td>
<td>3.90</td>
<td>27</td>
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<tr>
<td>Culture</td>
<td>7.00</td>
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</table>
### Food Losses & Waste in Food Supply Chain

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Agri Prod.</th>
<th>PH, Storage &amp; Handling</th>
<th>Processing &amp; packaging</th>
<th>Distribution</th>
<th>Consumption</th>
<th>Total (As per FAO)</th>
<th>PH Loss % (CIPHET)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>6</td>
<td>7</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>22</td>
<td>4.5-6</td>
</tr>
<tr>
<td>Onion &amp; Potato</td>
<td>6</td>
<td>19</td>
<td>10</td>
<td>11</td>
<td>3</td>
<td>49</td>
<td>7.3-8.2</td>
</tr>
<tr>
<td>Oilseeds &amp; Pulses</td>
<td>7</td>
<td>12</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>30</td>
<td>3-10</td>
</tr>
<tr>
<td>Milk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.92</td>
</tr>
<tr>
<td>Meat (Goat &amp; Sheep)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.71</td>
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<tr>
<td>Poultry</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Fish</td>
<td></td>
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<td>11</td>
</tr>
</tbody>
</table>
Food consumption is on a consistent rise.

Growing at CAGR of 11.6%
(Rs. 25,81,279 crore (US $403.3 billion^ during 2015-16)

In 2017 – Food Retail market (excluding non-food grocery) is estimated at Rs 35,38,282 crore (US $552.86 billion^)

Consumption in FG segment a CAGR of 12.1 – 90%
and in FS segment at 7.2-10%

2020: Growing at a CAGR of 14.4%
Market will grow to a size of Rs 53,05,488 crore (US $828.98 billion^) in 2020
ORGANIZED FOOD SERVICE RETAIL

Large metro-cities only of Delhi and Mumbai together are estimated to have over 20%.

Six metros of Pune, Ahmedabad, Bengaluru, Hyderabad, Chennai and Kolkata, together 20%.

A balance share being contributed by other Tier I & II cities spread across the country.

Eating out culture as a way of life in India, huge scope for Multiple cuisines and related services.

Innovative concepts and formats.
Food Losses & Waste in Food Supply Chain

India suffers from heavy loss of Rs 92,000 Crores annually

A report in CSR journal says “Indians waste as much food as the whole of United Kingdom consumes

According to FAO, 1/3rd of total global food production is wasted annually

Globally 1.4 billion hectares of land is devoted to producing food that is ultimately wasted

One out of every nine people in the world is starving

Food wastage is a significant contributor to malnourishment and hunger

Wasting a kilogram of rice and wheat - draining 3500 & 1500 litres of freshwater that goes into their production
India’s case of sustainable AAA for Food Security

Self Sufficient & Enough Quantity
FOOD SECURITY

Agro-Food Revolutions
GREEN, WHITE, PINK BLUE
Food Security v/s Nutritional Security – India’s case

Consider these as against Food Security achieved over a few decades……

Despite rapid economic growth & Food Security, hunger and poverty still persist

India houses 25% hungry & poor of the world!!

Enough food availability does not translate to access of sufficient nutrition

>70% of Indian population consume <50% of the RDA of micronutrient

~6000 children die due to malnutrition and lack of micronutrients

Malnutrition problems are more prominent in rural populations

38 % of children below five years (urban: 31%, rural: 41%) are stunted (low height for age)
21% (urban: 20%, rural: 22%) are wasted (low weight for height)
36% (urban: 29%, rural: 38%) are underweight (low weight for age)
2% were overweight (above normal weight for height)
58 % of children aged between 6 and 59 months (urban: 56%, rural: 59%) are anaemic

The need is to move from SQ to 2S2Q.
The need – Movement from SQ to 2S2Q

Agro-Food Revolutions
GREEN, WHITE, BLUE & PINK

SQ
Sufficient & Enough Quantity
FOOD SECURITY

2S-2Q
Sufficient Quantity & Safe Quality
FOOD & NUTRITIONAL SECURITY

Food Safety Solutions
Safe Agricultural Produce

SQ to 2S2Q – What are the challenges?
Role of Science and Novel Technologies in food processing and benefits

1. Cold plasma technology
2. Pulsed electrified field and Ohmic heating
3. Bio-fortification
4. Irradiation: Few studies have observed increased vitamin C content of irradiated citrus fruits
5. Hydrolysis of bio-waste/protein rich foods
6. High-pressure (HP) processing, high-pressure homogenization (HPH), ultrasonication
7. Three-dimensional printing (3DP) process
Role of Science and Novel Technologies in food processing and benefits

GM/GE foods

Value addition: Farm to Fork, Organic, Minimal Processing, Frozen, Ready to Eat and similar Technologies, Extrusion Technology, Ready to Eat Foods

9. Traditional foods in packed form

10. Improved Packaging as an asset to the business with value and not just the cost

11. Health & Wellness - Food fortification to improve the nutritional value of diet

12. Use of fortified flour, fat, milk, and sugar, etc

13. Fortifying bakery products with micronutrient and bioactive compounds leads to more consumer acceptability
NOTABLE TRENDS IN THE INDIAN FOOD PROCESSING

Changing consumer tastes
Entry of international companies
Rising demand on Indian product in international market
Higher consumption of horticulture crop
Emphasis on healthier ingredient
Packaging as purchase influencer and communicator
A shift from usefulness in processing to usefulness to consumer
Frozen and processed goodness
Sensible snacking
Product innovation as the key to expansion
Strengthening procurement *Vis* direct farmer-firm linkages
Reasons to Invest

1. India ranked 6th in the World in exports of agri products in 2013

2. Major industries in processing sector: grain milling, sugar, edible oils, beverages, fruits & vegetables and dairy products

3. Share of food processing sector in GDP of manufacturing sector: 9.8% in 2012-13

4. The number of registered food processing units has increased from 36,881 in 2011 to 37,175 in 2012-13

5. One of the major employment intensive segments: 13.04% of employment generated in Registered Factory sector in 2012-13

6. Food is the biggest expense share of 38.5% and 48.6% of the total expenditure of households in rural and urban India, respectively
Zero Waste India Vision 2030

Deliverables

- Empowered Learning to Maximize the value of your waste going resources
- Zero Waste Consultancy Services: Achieve Your Zero Waste Goals with us
- Zero Waste India App: To Maximize Community Participation in Learning & Action
- Infrastructural Development for Composting; Briquetting & Pellatization.
- Sustainable Waste Management Services: Collection, Transportation & Disposal Solutions
Linkages between food systems, food environment & diet quality
<table>
<thead>
<tr>
<th>Millets</th>
<th>Pulses</th>
<th>Fruits</th>
<th>Vegetables</th>
<th>Cereals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finger millet</td>
<td>Green gram</td>
<td>Banana</td>
<td>Lentil</td>
<td>Black Wheat</td>
</tr>
<tr>
<td>Fox tail millet</td>
<td>Black gram</td>
<td>Jack fruit</td>
<td>Sword bean</td>
<td>Quinoa</td>
</tr>
<tr>
<td>Pearl millet</td>
<td>redgram</td>
<td>Dragon fruit</td>
<td>Drumstic</td>
<td>Speciality rice</td>
</tr>
<tr>
<td>Khodo millet</td>
<td>Rice bean</td>
<td>Gauva</td>
<td>Mushroom</td>
<td></td>
</tr>
<tr>
<td>Sorghum</td>
<td>cowpea</td>
<td>Pears</td>
<td>Sweet potato</td>
<td></td>
</tr>
<tr>
<td></td>
<td>soybean</td>
<td>Apple</td>
<td>Taro</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grass pea</td>
<td>Mango</td>
<td>Bitter guard</td>
<td></td>
</tr>
<tr>
<td>Peanut</td>
<td>Bael</td>
<td>Elephant foot</td>
<td>Pumpkin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ham</td>
<td>Snake guard</td>
<td></td>
</tr>
</tbody>
</table>
Challenges on the path ……

1. Organizing marginalized & unorganized farm sectors – towards ensuring production of safe produce

2. Providing Safe & Nutritious Food to 1.5 bn by 2020 – to address food disease burden, malnutrition & nutritional deficiencies – Hunger free

3. Education – innovation – outreach through Science & Technology Convergence with digital revolution to further food & nutritional security

4. Technology & Policy interventions – Infrastructure & Financial, Food Safety Regulations, Hand holding sectors and skill Development
Initiatives to address these challenges........
To modernize such a large market need:

- Suitable policy support
- Improved supply chain
- Food quality standards
- Innovations
- Entrepreneurship Development
- Adoption of technology
- Skilled and trained manpower
Policy interventions – Food Processing

Sops to private sector participation

100% FDI under automatic route. Investment in April 2000- March 2016 stood at US$ 6.82 bn

Promoting rationalization of tariff and duties

Setting up of National Mission on Food Processing

Foreign Trade Policy 2015-2020
NEW SANCTIONS: CREATE AWARENESS, PROMOTE INVESTMENT

1. Agro Processing Clusters
2. Creation/Expansion of Processing/Preservation Capacity
3. Creation of Backward and Forward Linkages.
4. Integrated Cold Chain & Value Addition Infrastructure
5. Quality Assurance Infrastructure
“Inspiring trust - Ensuring safe food”

Harmonizing Standards & Practices to global benchmarks

Helping to set science based standards to ensure safe and nutritious foods

Building trust by ensuring the food they get in the market is safe

Compliance to standards in manufacturing, storage, transport and retail of food

Objective and transparent standards for effective compliance

Global Trust

Scientists

Citizens

Food Business

Local Trust

Food standards

Safe food practices

Food safety compliance

Food testing

Food safety training

Social & behavioural change

Consumer focus
INDIA IN THE GLOBAL CONTEXT

- Diversified, High growth and High profit sector
- Contributes to 32% of India’s total food market
- India’s grocery and food market ranks 6th in the world
- Contributes 8.8% of Gross Value Added in manufacturing sector
- Agro food processing Industry employs 18% of Country’s industrial work force
- It accounts for 6% of total industrial investment
- Indian gourmet food market valued at $1.3 billion and growing at CAGR of 20%
- Organic food business to increase by 3 times
INTERNATIONAL INVESTMENTS

- As per DIPP data FP sector received US$ 7.54 billion worth FDI during April 2000 to March 2017
- As per CII, potential to attract US$ 33 billion in next 10 years

Major investments taking place by
- The global e-commerce giant Amazon
- US based food company Cargill aims to double its branded consumer business
- Mad Over Donuts (MoU)
- Danone SA plans nutrition business
- Parle Agro Pvt Ltd is launching Frooti Fizz
- Uber technologies plans launch Uber EATS
To be a centre of excellence which integrates all facets of food technology, entrepreneurship and management and be recognized as the focal point for catalyzing the growth of the Indian food processing industry in the global context.
ACADEMIC PROGRAMMES

B. Tech: Undergraduate Programme (180 each year)
- Food Technology & Management

M. Tech: Programme (18 in each stream)
- Food Supply Chain Management
- Food Safety and Quality Management
- Food Process Engineering and Management
- Food Plant Operations Management
- Food Technology and Management

M.B.A. (Dual Specialization) (30 each year)
- Food Business Management

Ph.D Programme (85 Ph.D. students in NIFTEM)
- In all the five Departments
SPECIALIZED CENTRES AND DIVISIONS

1. International Bakery Research and Training Centre (IBRTC)

2. International Centre of Excellence for Food Safety and Quality (ICEFSQ)

3. Centre for Entrepreneurship Development

4. Skill Development Division

5. Consultancy Division

6. Corporate Resource Division
Platinum Rating from Indian Green Building Council
Swachh Campus Award by MHRD 5th Rank
Solar Roof Top Project

NIFTEM Signed MoU with SECI for 1 Mega Watt Solar Roof Top Project
Agricultural Leadership Award

in Entrepreneurship Development in Food Sector

AGRICULTURE LEADERSHIP AWARD
2015
NATIONAL AND INTERNATIONAL COLLABORATIONS

International:
Netherlands: Wageningen University
USA: Kansas State University, University of Nebraska-Lincoln IFSH, Chicago, Michigan State University,
Canada: University of Saskatchewan, McGill University
Ireland: Queens University

National:
CFTRI (Mysore), IARI (Delhi), GS1 India (Delhi), NDRI (Karnal), NITIE (Mumbai), EDI (Ahmedabad), APFPS (Govt. of Andhra Pradesh), IIM (Lucknow), FICCI-FISCI, Central Warehousing Corporation, FASSI, Aachi Masala Foods, Danfoss India
NIFTEM INCUBATION FACILITY FOR TRAINING AND SKILL DEVELOPMENT

1. Fruits and Vegetable Processing
2. Dairy and Dairy Product Processing
3. Meat and Poultry Processing
4. Ready to Eat and Traditional Foods
5. Bakery
High temperature processing
LOW TEMPERATURE PROCESSING
Cream Processing, Butter and Ghee chhach and lassi section
DAHI/CHHACH/LASSI/PANEER & SHRIKHAND SECTION
Ice cream Section
READY TO EAT PILOT PLANT

1. Raw Material Receiving & storage Section
2. Traditional ready to eat and ready to cook section
3. Non-Traditional/Heath extruded snack foods
4. Packing Unit & Storage Unit
Meat & Poultry Processing
Meat & Poultry Processing
CEREAL AND GRAIN PROCESSING

- Mechanized harvesting
- Cleaning and Grading
- Drying and bagging
- Transportation
- Grain protection treatment and
- Storage in Silos or proper storage facility - PDS/ Internal consumption / APMCs
- Grinding and fortification
- Use for making Ready to eat / ready to cook product
BAKERY PROCESSING

- Biscuits
- Bread
- Snacks including baked chips
- Roti (Chapati), Nuns, Kulchas and Pizzas
- Cakes and Pastries

300 Sq M of area is used to set up bakery plant
Food Testing Laboratory

- For analysis of physical, chemical and microbiological parameters, residues of different toxicants, contaminants
- Laboratory Accredited as per ISO/ IEC 17025
- NABL Accredited Lab

Aim: To be National Referral lab for quality certification of food products

Center for Risk Assessment studies (collaboration with FSSAI)
NIFTEM Welcomes All Stakeholders to avail the facilities available at FTL!!
SKILL DEVELOPMENT

Provide the required skills in un-organized sector of Food Processing Industry

Design special modules of Training Programme to cater separate segment of people

To create networking among NGOs, Corporate sectors, SHG (Self Help Groups), ITI and other training institutions to cater the need of food processing Industry

Provide required trainings to the farmers/small scale entrepreneurs/middle and lower level workforce in FP Sector
NIFTEM – DANFOSS COLD CHAIN DEVELOPMENT SCHOOL
Credit based academic course – For B.Tech and M.Tech students

To connect students to the grass roots of the country and contribute in nation building

To train farmers and rural youth to become entrepreneurs in food processing, value addition, etc

To take concept of value addition, preservation, reduction of wastages to rural masses for inclusive growth

To contribute towards Nation building by taking up all around development of villages

To inculcate scientific temperament in rural minds

Students - learn from farmers; understand post-harvest supply chain
COVERAGE OF VILLAGES UNDER VAP

- About 1100+ Students (M.Tech+B.tech)
- 36 Groups covering 39 villages
- 18 States
Team NIFTEM with Rural Entrepreneurs at Rashtrapati Bhavan

Hon’ble President of India Shri Pranab Mukherjee, NIFTEM Team and partners of Smart Model Village Initiative of Rashtrapati Bhavan
Thank you

www.niftem.ac.in

Admission 2019 are now open!!