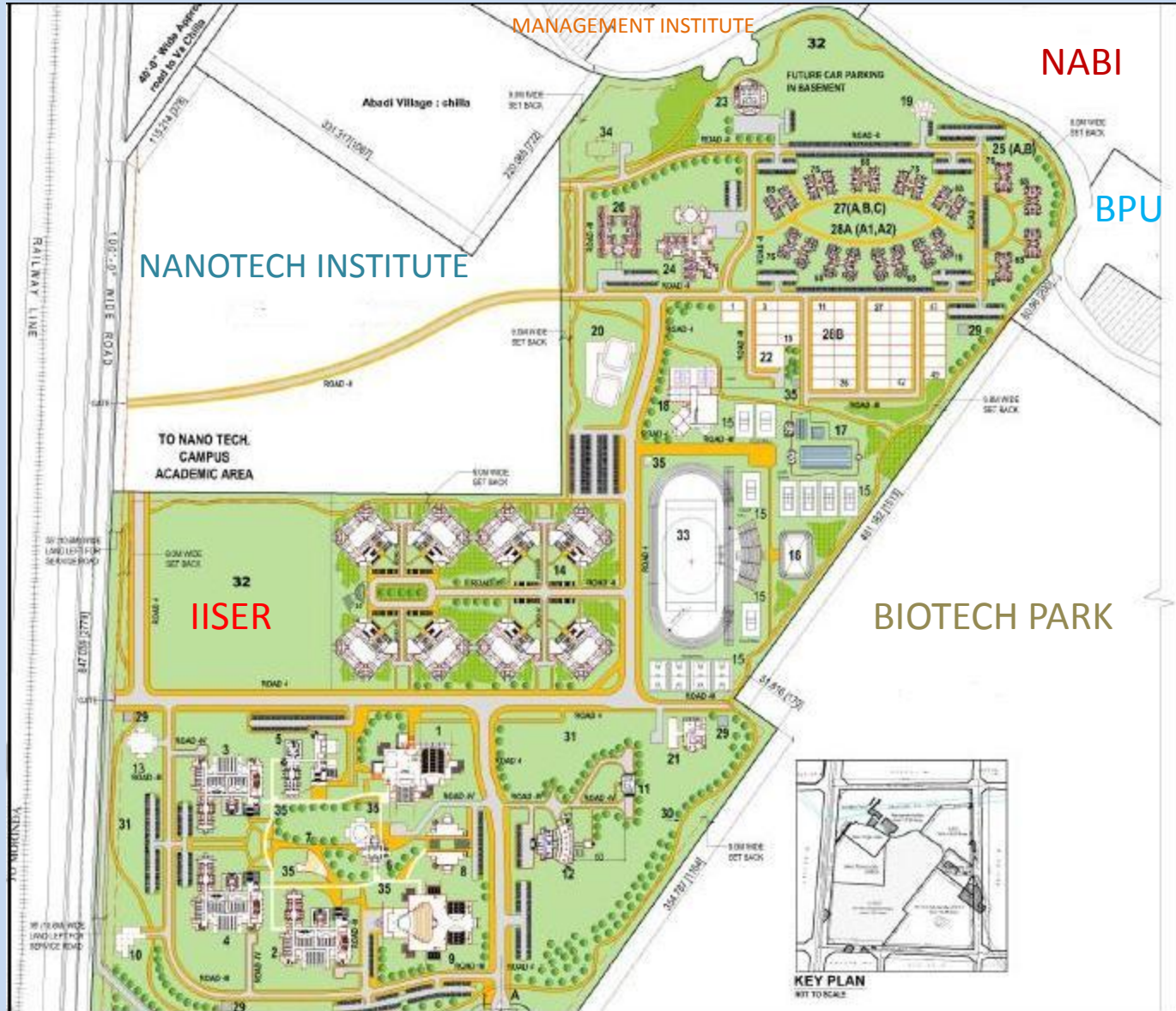
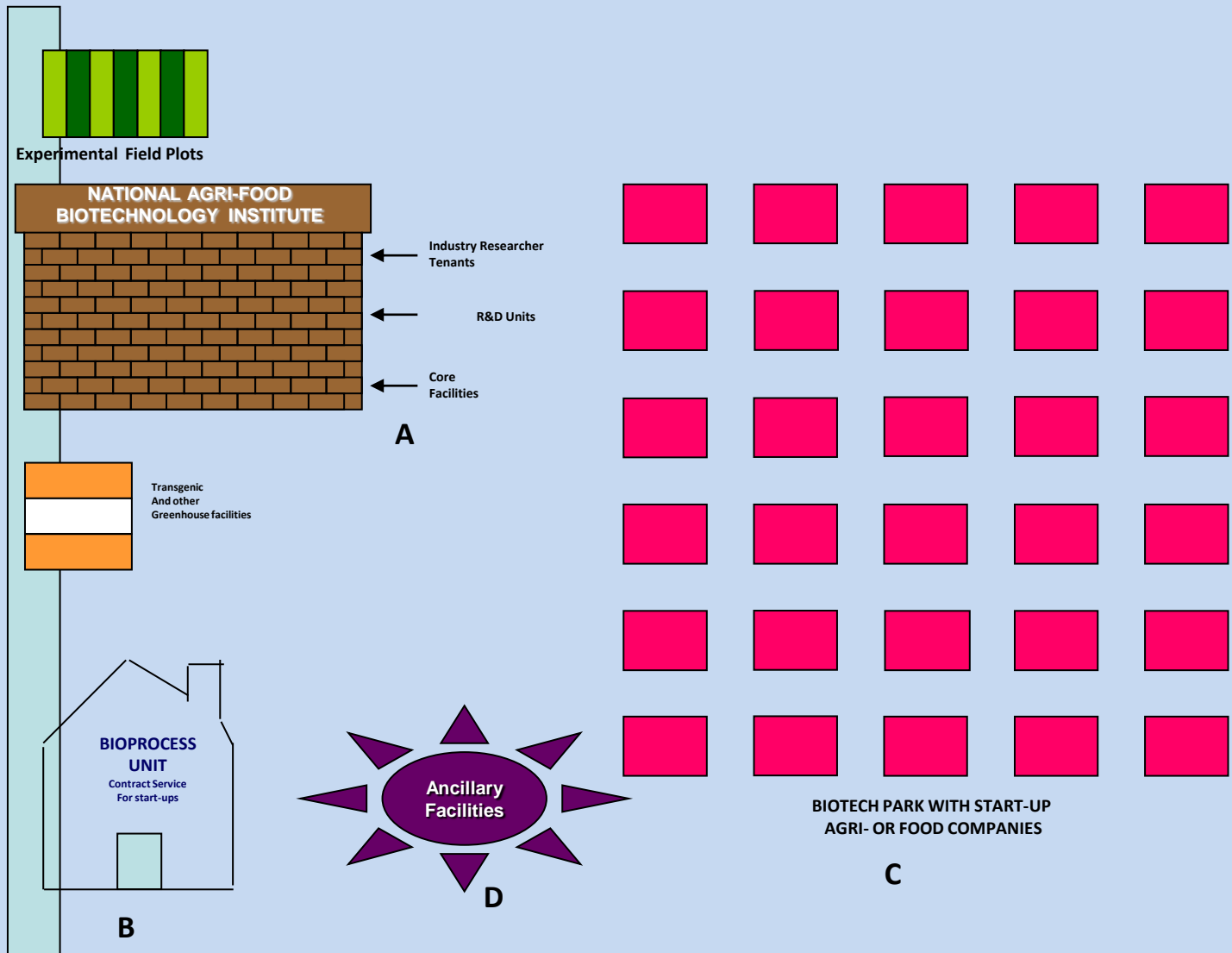


MASTER PLAN OF KNOWLEDGE CITY , MOHALI



AGRI-FOOD BIOTECH CLUSTER AT MOHALI



NABI at the Agri-Food Biotech Cluster at Mohali

VISION: *To be a nodal organization for knowledge generation and translational science leading to value added products based on agri-food biotech innovations.*

MISSION:

To transform agri-food sector into globally rewarding and sustainable biotechnology-based enterprise through innovative solutions in primary and secondary agriculture, including high-end food processing.

To develop synergy among knowledge providers and investors in agri-food sector to carry innovations to marketplace.

Agri-Food Biotech Cluster in Punjab

(for R&D–Industry proximity for traversing path from
Discovery to Market)

**National Agri-Food
Biotechnology**

**Institute : discovery &
innovative solutions**

Discovery of
concept

Proof of
concept

Demonstration
of concept in
crop species

Validation of
technology
on industrial
platform

Technology
in field

Agri-Food Park
enhancing competitiveness of
industry, back-forward
integration & commercialization

Bioprocessing Unit

Translational research/
Technology optimisation/

Knowledge cluster (IISER/Nano/ISB) at Sector 81, Mohali, Punjab + NIPER, PGI, PU etc

LAND : NABI: 35 acres (Agri, Food,Nutri)
BPU: 15 acres
Park: 80 acres

Synergy of several organisations would lead to developing a
unique model in Agri-Food Sector

CO-ORDINATION

NABI

BPU

Agri-food Park

Industry-seed, food, phyto

Investors, FDI

Agr Univ

State Deptt

Management Instt

ICAR, CSIR, DBT

National & State Horticultural Boards

NGOs/ SHGs

Regulators- GMO, Food, Export, Energy, Pollution

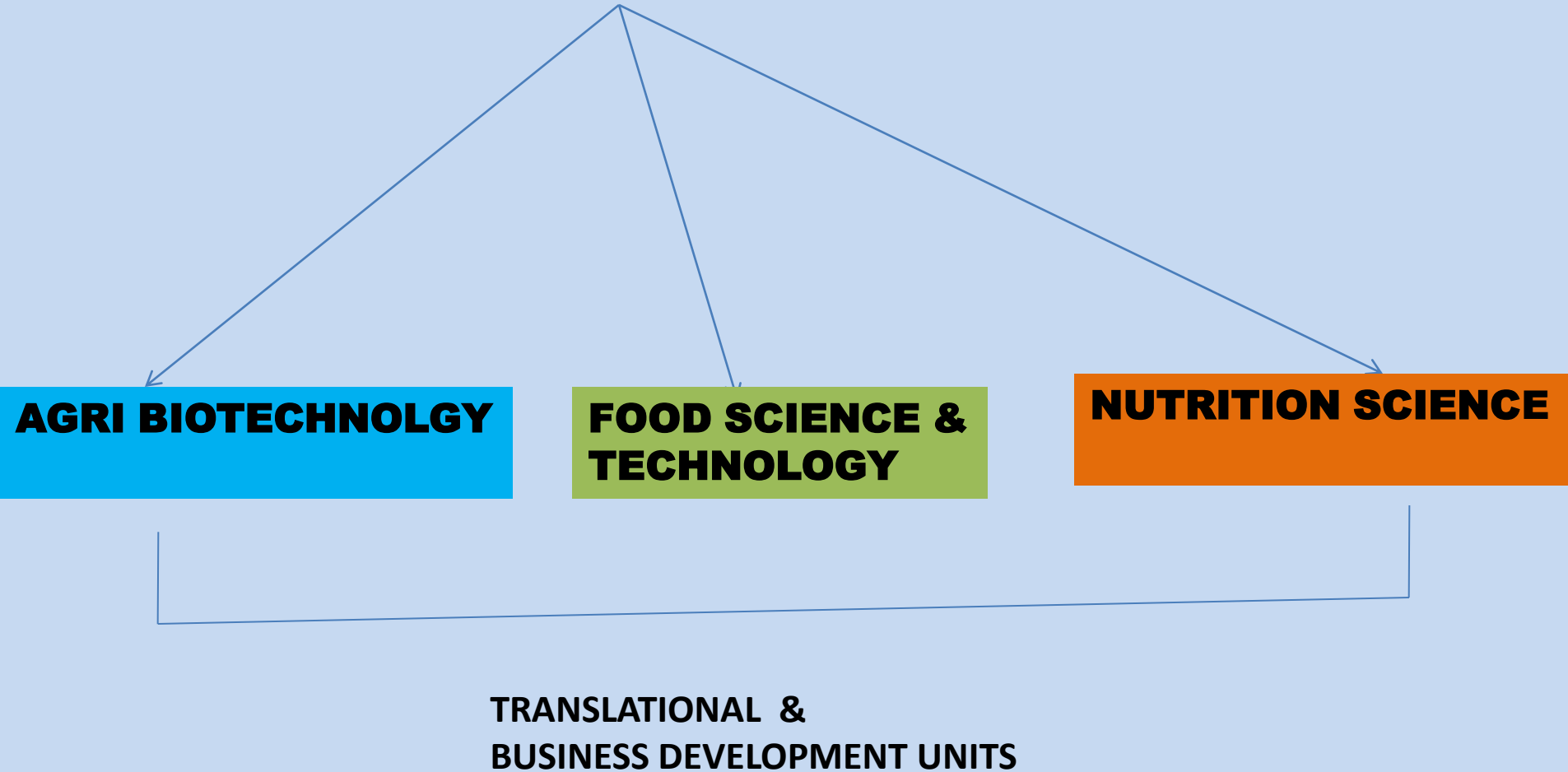
NIPER, PGI

Min of Food Processing Industries

FICCI, Intl funding , philanthropic organizations

Farmers etc

National Agri-Food Biotechnology Institute



Agri-Food *Innovation*

Food



Health



Environment



Energy



BioProducts



Fortified Foods

Functional Foods

Personalized Foods

Therapeutic Foods

Nanofood Technology

Nutritional genomics

Improved stress tolerant Plants



High-throughput Screening Technologies

Gene prospecting & Transgenic applications for designer Crops

Metabolomics

Synthetic Biology and Pathway engineering

Phenomics

Epigenomics



NABI



NABI Wheat Improvement

Agronomic traits

- Terminal temperature tolerance
- NUE, PUE, WUE
- Hybrid vigour
- Rust, Kar Bunt

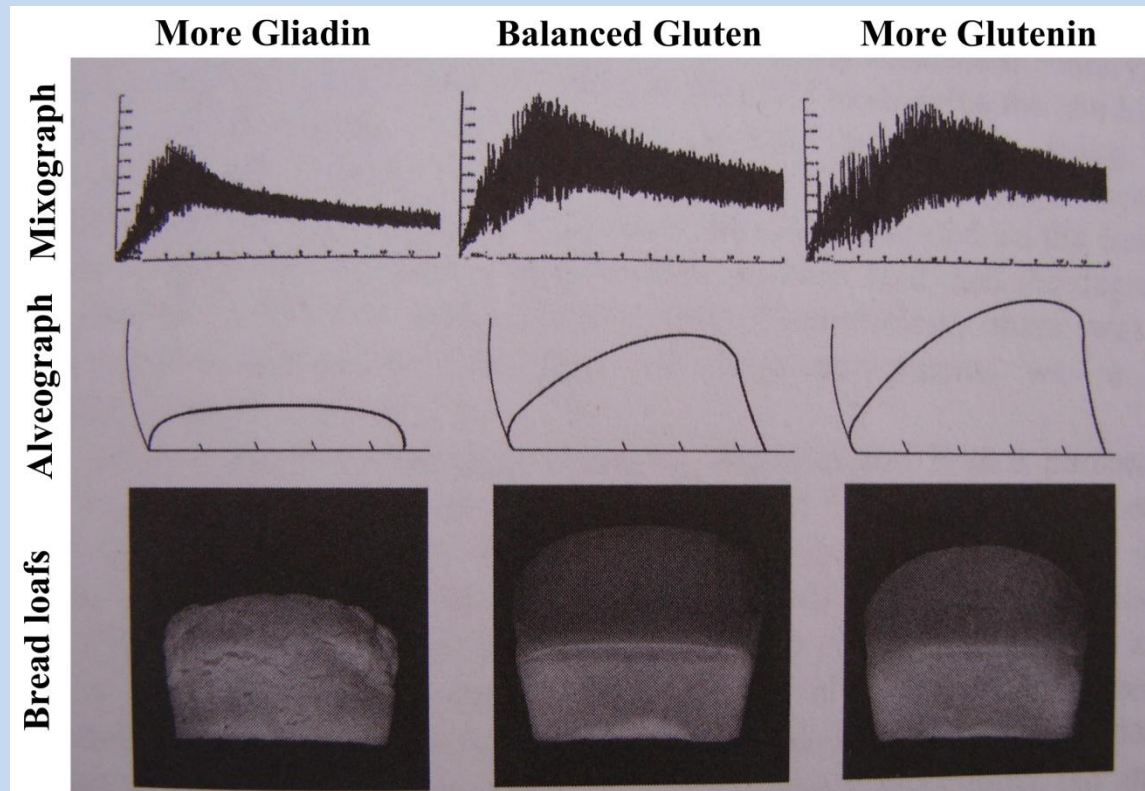
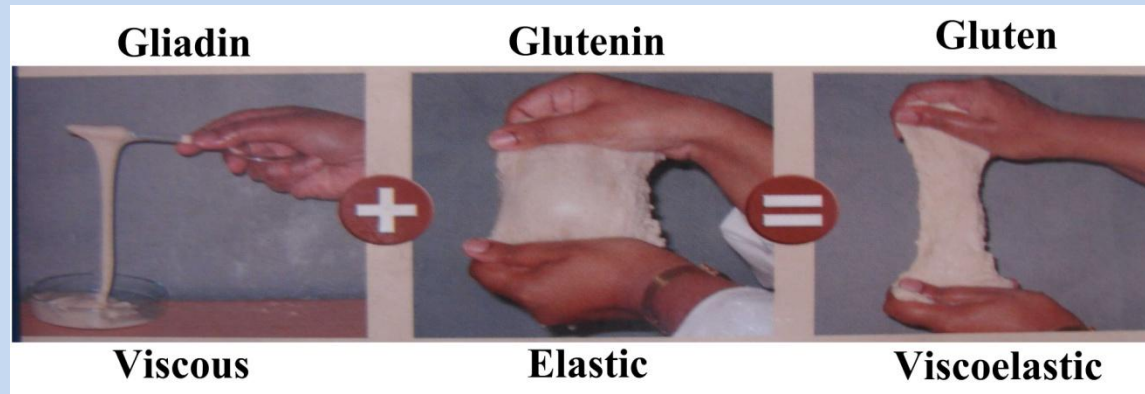
Processing traits

- Gluten strength
- Starch properties
- Grain hardness
- Pigments
- Agri-waste Process

Nutritional traits

- Fe, Zn, Vitamin A
- Folic, Fatty acids
- Polyphenols, lignans, folate, lutein, fibre, lignans, phytosterol
- Higher protein
- Non allergenic gluten
- Bioavailability

Wheat Processing Quality Related to Proteins



Parameters for good quality chapatti, bread, biscuit and pasta

	Chapatti	Bread	Biscuit	Pasta
Grain hardness	Intermediate	Hard	soft	Hard
Gluten	Intermediate	Strong & extensible	Weak & extensible	Strong
SDS sedimentation	~40 ml	>60 ml	<30 ml	>35
Grain protein content	Intermediate	>13.0%	<10.0%	>12.5
HMW glutenin subunits	20,	5+10	-	7+8, 14+15, 6+8
Glu-1 score	6 to 8	9 or 10	Lesser is preferred	-
LMW glutenin Subunits/Alleles	Not Studied	Glu-A3-b, Glu-B3b/g and Glu-D3e/b	-	LMW-2 Glu-3, aa/ca alleles
Gliadins	-	-	-	Gli-B1- γ -45

Fe and Zn content in *Aegilops tauschii*, D genome wild progenitor vs bread wheat

S. No.	species	Fe (ppm)	Zn (ppm)
1	<i>Ae. tauschii</i> acc. 14102	109.4	62.3
2	<i>Ae. tauschii</i> acc. 14116	98.6	49.0
3	<i>Ae. tauschii</i> acc. 14118	81.4	88.6
4	<i>Ae. tauschii</i> acc. 14129	81.1	90.4
5	<i>Ae. tauschii</i> acc. 14180	99.9	56.2
6	<i>Ae. tauschii</i> acc. 9810	56.6	36.9
7	PBW343	40.9	22.2
8	C518	35.1	44.2
9	C306	32.4	30.5
10	PBW114	43.4	23.9

Process development for value from wasted wheat grain

Wheat starch: Biodegradable polymer, fructose

Wheat gluten: Adhesives, polymers, resins

Wheat germ : germ oil, lecithin, vitE, vitB,
Lipase, glycerides, Phytosterols, phytase, sucrose synthase,
Lipoxygenase, acid- phosphatase

Wheat bran: dietary fibre, amylase, phytase,
Xylanase, arabinogalactan proteins, carboxypeptidase,
polyphenol oxidase

NABI-BPU for Integrated product oriented Bio-Processing Portfolio, taking wheat as an example

WHEAT

Specialty wheat flours: Branded premix for bakery needs, rolls, pizza ,doughnuts

Breakfast cereals: ready to eat, chips ,puffed, sugar free muesli, biscuits & snacks

Wheat straw: medium to grow mushrooms, animal feed, paper making

Wheat starch: Biodegradable polymer, fructose

Wheat gluten: Adhesives, polymers, resins

Wheat germ : germ meal, germ oil, lecithin, vitE, vitB, glycerides, Phytosterols
Lipoxygenase, lipase, acid phosphatase, sucrose synthase, phytase

Wheat bran: dietary fibre, arabinogalacto proteins, carboxypeptidase, amylase,
xylanase, phytase, polyphenol oxidase



NABI



KENNOW

Fruit Crop Improvement



POMEGRANATE

Association Genetics, Mutation, Breeding

Agronomic traits

- Hybrid vigour
- Fruit Stem borer
- Bacterial blight
- Flower fall
- Early fruiting
- Tree height
- Adaptability

Processing traits

- Solid content
- Acidity
- Color
- Shelf life
- Flavour
- Seedlessness
- Bioactives from waste processes

Nutritional traits

- Anti oxidants/anthocynins/ Catechins/ Ascorbic acid
- Citric/Malic acid
- Sugars
- Minerals
- Alkaloids/Sterols/ Terpenoids
- Bioavailability

NABI For Designer Crops

SEED INDUSTRY

Global : \$ 30 b

India : \$ 1.5b

Germplasm screening for gene trait diversity: Wheat for NUE,WUE, TTT, Nutritionally superior-Zn, Fe, Vit, Nutraceuticals Processing quality-starch/gluten composition, allergens

Throughput Genotyping ,phenotyping & MAS for Agronomic, nutritional, processing centered traits

Gene prospecting & Transgenic applications for designer Crops:Seedless fruits, Insect R vegetables/fruits: Okra, Brinjol, Tomato

Male sterility for hybrid seeds(Highest opportunity in hybrid wheat & paddy : high volume & global need)

SNP chips / Microarray chips / Genome sequencing

NABI for high value farm produce

Germplasm screening for nutritional/ processing/ agronomic traits

- Wheat for micronutrients, starch/ protein quality, Term Temp Tol, NUE, WUE
- Seedless fruits
- Cotton for oil or fibre or protein?
- Sorghum for starch or biomass or sugar?

• Varieties suitable for processing technologies

Starch, protein quality, solid content, uniform size, shape, shelf life, Firmness, seedless, easily peeled rind, color, flavor, bitterness/ sweetness/acidity

Germplasm screening for phytopharmaceuticals

PROCESSED FOOD MARKET

Global : \$ 3.2 T

India : \$ 0.075 T

Post Harvest Losses India : \$ 8b

NABI for value addition to food

Nutritionally superior crop varieties and health formulations

Iron, Zinc, Iodine ,vit (A/D) rich foods, bioavailability, stability, Ashwagandha milk, health drinks

Process & variety development for utility of byproducts

Peel of citrus, grape etc, polyphenols, flavanoids, anthocyanins, tannins, vitamins, agri waste for triacontanol, waxes, xylitol, D-ribose, solenosolis, Mango peel pectin, polyphenols

Process and variety development for extended shelf life

Irradiation, sterile packing, slow ripening varieties, storage pest resistant

Process improvement to add value / economy to industrial process

Safety SOPs, quality standardisation, solar powered processing, small scale processing

Product & Trait Orientation :

Wheat

Nutritionally superior -Zn,Fe,Folic,vitB/A; NUE, WUE, TTT;
Hybridisation technology, Genotyping, MAS, Genome seq.;
Processing- gluten/starch/allergens; secy., high end

Tomato, Okra, Brinjol

Post harvest quality, Processing- pri., secy.,high end;
Hybrids, NUE, WUE,Disease/Pests, Genomic Diversity

Kennow, Guava , Litchi, Mango

Post harvest losses, Seedless Fruits, Multiple feedstock
Process.- pri., secy. high end; SNP Genotyping for
Association Genetics

NABI-BPU for agri-waste to wealth: secondary agriculture

High end Process development for high value bioactive molecules from vegetable & fruit waste

NABI

- Cereal waste
- Fruit & vegetable waste
- Processing plant waste
- Surplus fruits

Enzymatic digestion

Clarification

Membrane concentration

50 litre fermentor
Microbe assisted transformations

BPU

- 500 L fermentor
- Optimization
- Simulation for 50000 L fermentor

Centrifugation

Cell lysis

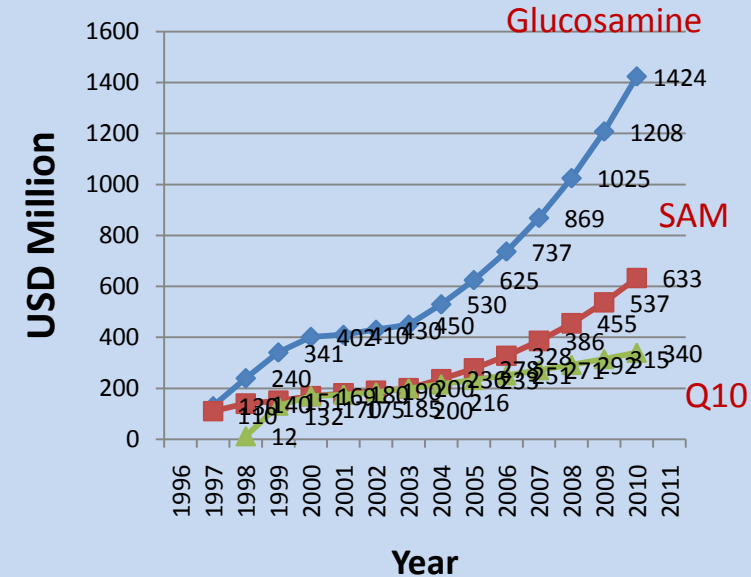
Precipitation

Nano filtration

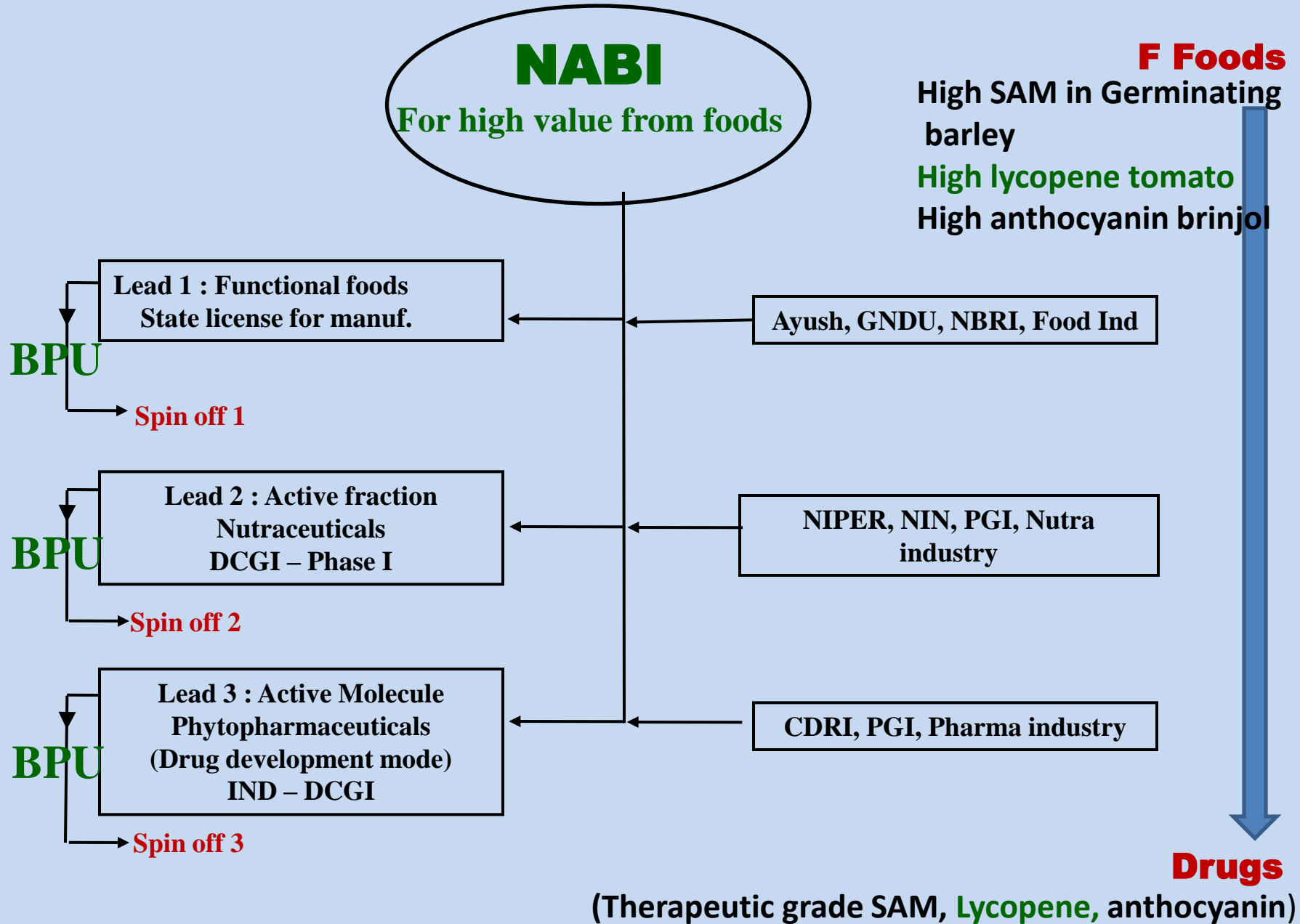
Ion exchange

Product

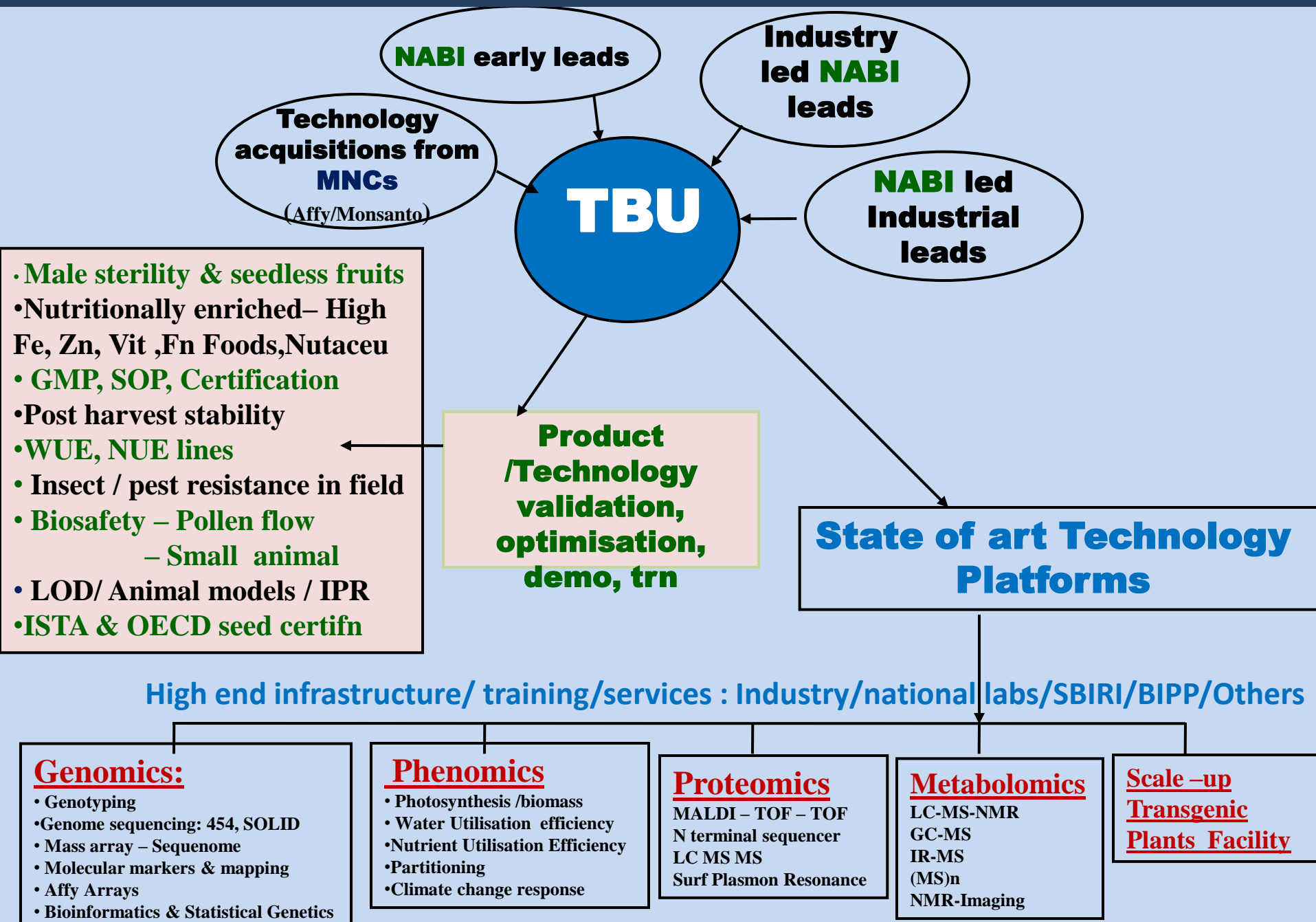
(SAM, Glucosamine, Xylitol, D-ribose, VitC)



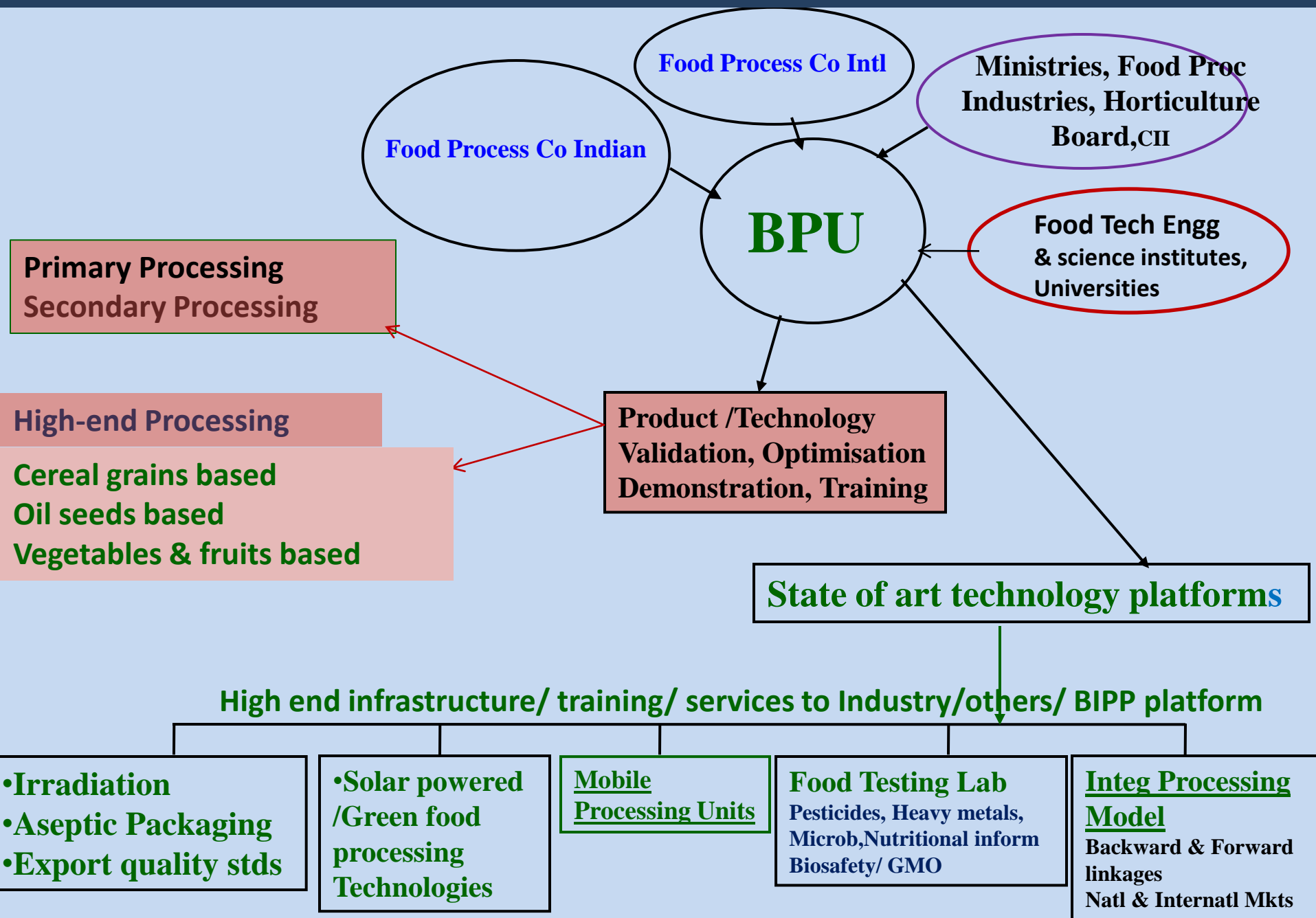
NABI for functional foods to drugs



NABI for Translational Research in Agribiotechnology



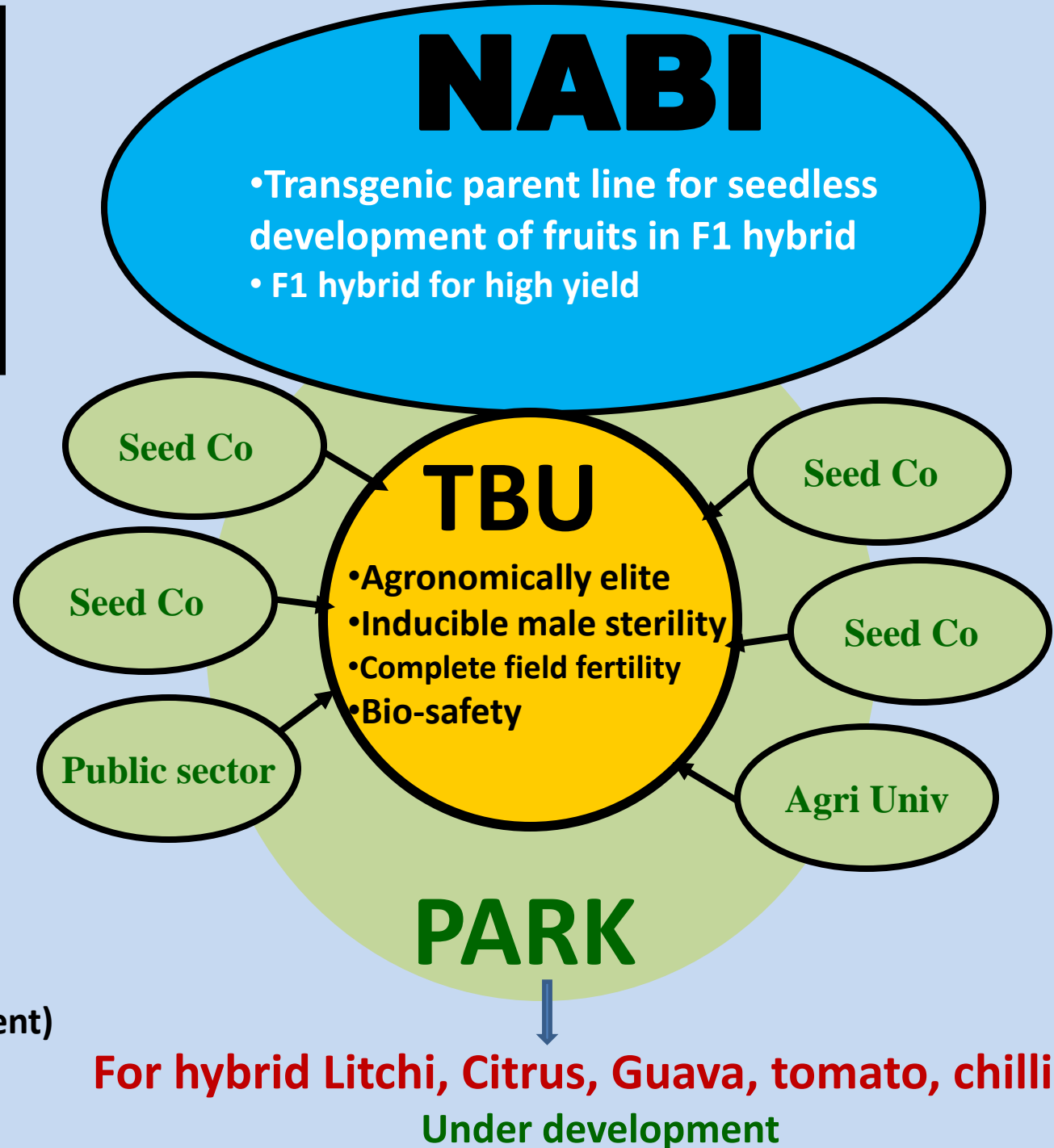
NABI/BPU for Translational Research in Food Processing Sector



**PROSPECTIVE
PROJECT FOR
SEED INDUSTRY
TRANSGENIC
SEED LESS FRUIT
CROPS**



(Two element technology
for arresting seed development)



MOHALI KC FOR FOOD PARK & PROCESSING

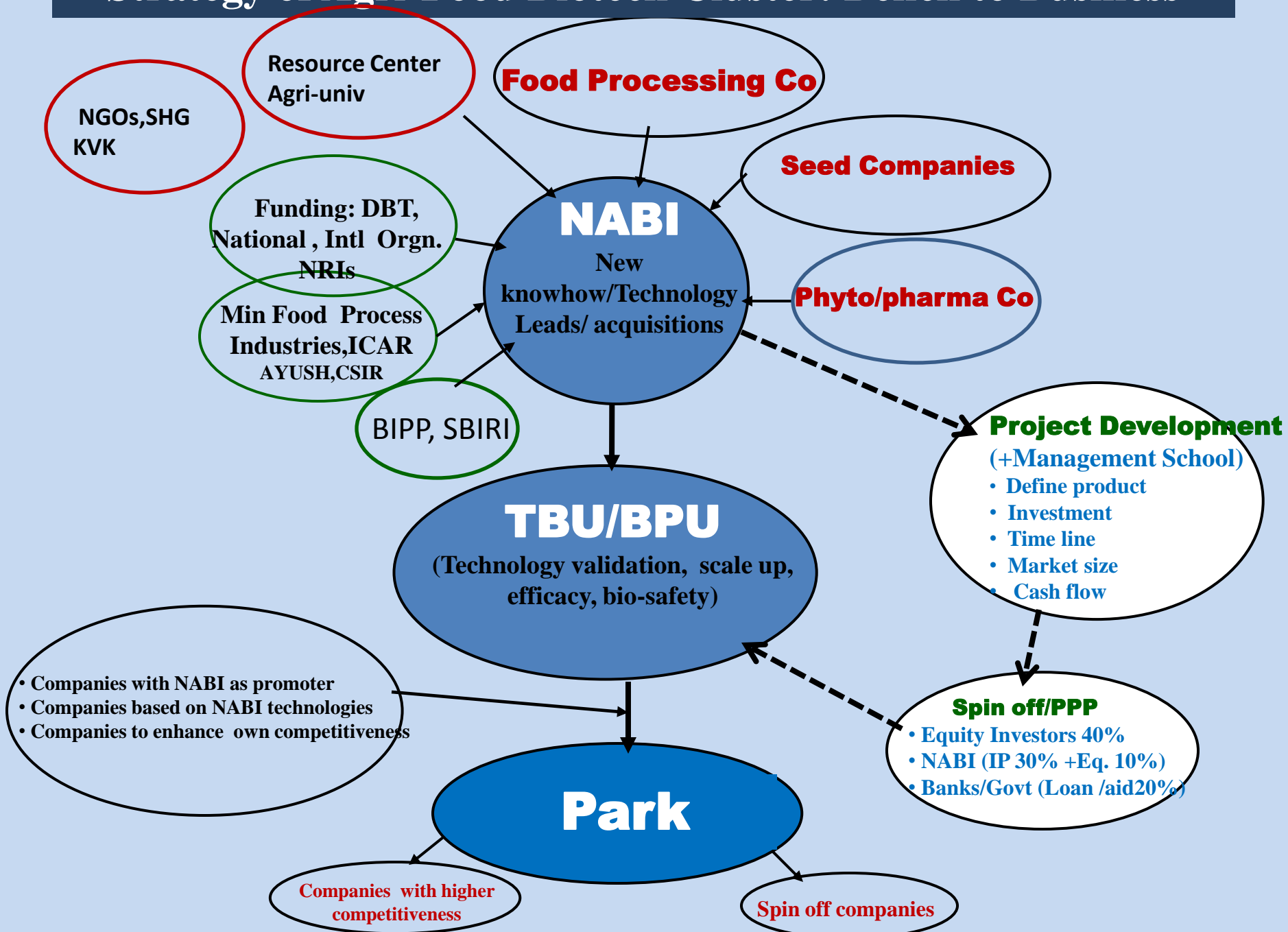
PPP/Entrepreneur Driven Management/SPV

- Capacity utilization based on mix of crops/ agricultural/ horticultural surplus/waste
- Capacity utilization & profit sharing through Farmers Cooperatives/ SHG
- On-farm primary processing infrastructure
- Cold storage, transportation, supply chain
- Grading & processing units, Portable processing units
- Establishing national & international market linkages
- Meeting ground for farmers, processors, retailers, govt

Companies for development of novel products

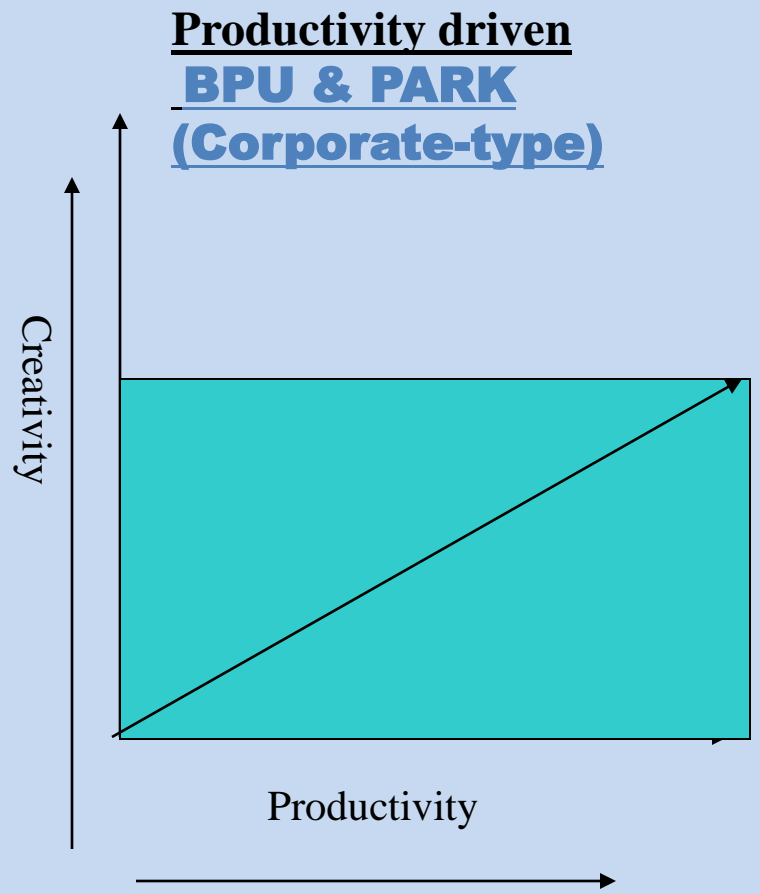
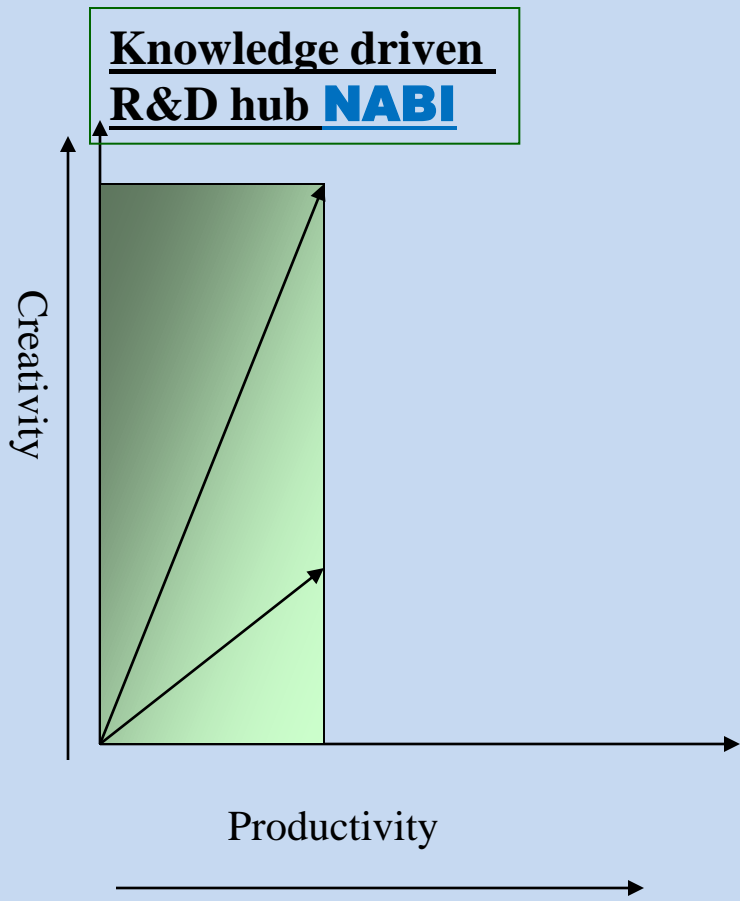
- Sports & energy drinks
- Juices: Kinnow, Guava, Litchi, Peach, Phalsa, Sapota, Pear, Ber
- Carotene oil, Quality Potato fingers
- Herbal beer, Quality wines

Strategy of Agri-Food Biotech Cluster: Bench to Business



Scientists, Technologists & Managers with vision, skills & determination to take challenges in developing knowledge cluster at Mohali are invited to join on their terms

People with High Creativity and High Productivity



THANK YOU

... The best to come is not even thinkable today