

KMUTT Strategic Research Themes



Sustainable Bioeconomy

Biofuels and Biorefinery

Bioresource Management and Utilization

Food for The Future

Sustainable Agriculture



Sustainable Energy and Environment

Earth System and Climate Change

Energy Efficiency

Energy System Integration

Energy and Environmental Policy

Sustainable Environmental Technology & Management



Smart Healthcare

Assistive Technology for the Aged, Disabled and Rehabilitation

Logistics and Management

Medical Diagnostics

Medical Treatment and Prevention



Innovative Materials, Manu. & Const.

Advance Materials, Design and Manufacturing

Smart Construction



Sustainable Mobility

Next Generation Aerial Vehicle

Next Generation Vehicle

Rail System

Supply Chain Management

Transport Policy and Planning



Creative & Learning Society

Art and Design Innovation

Community Dev. and Management

Future Learning

Future Society



Digital Transformation

Data Science for Business

AI and Robotics

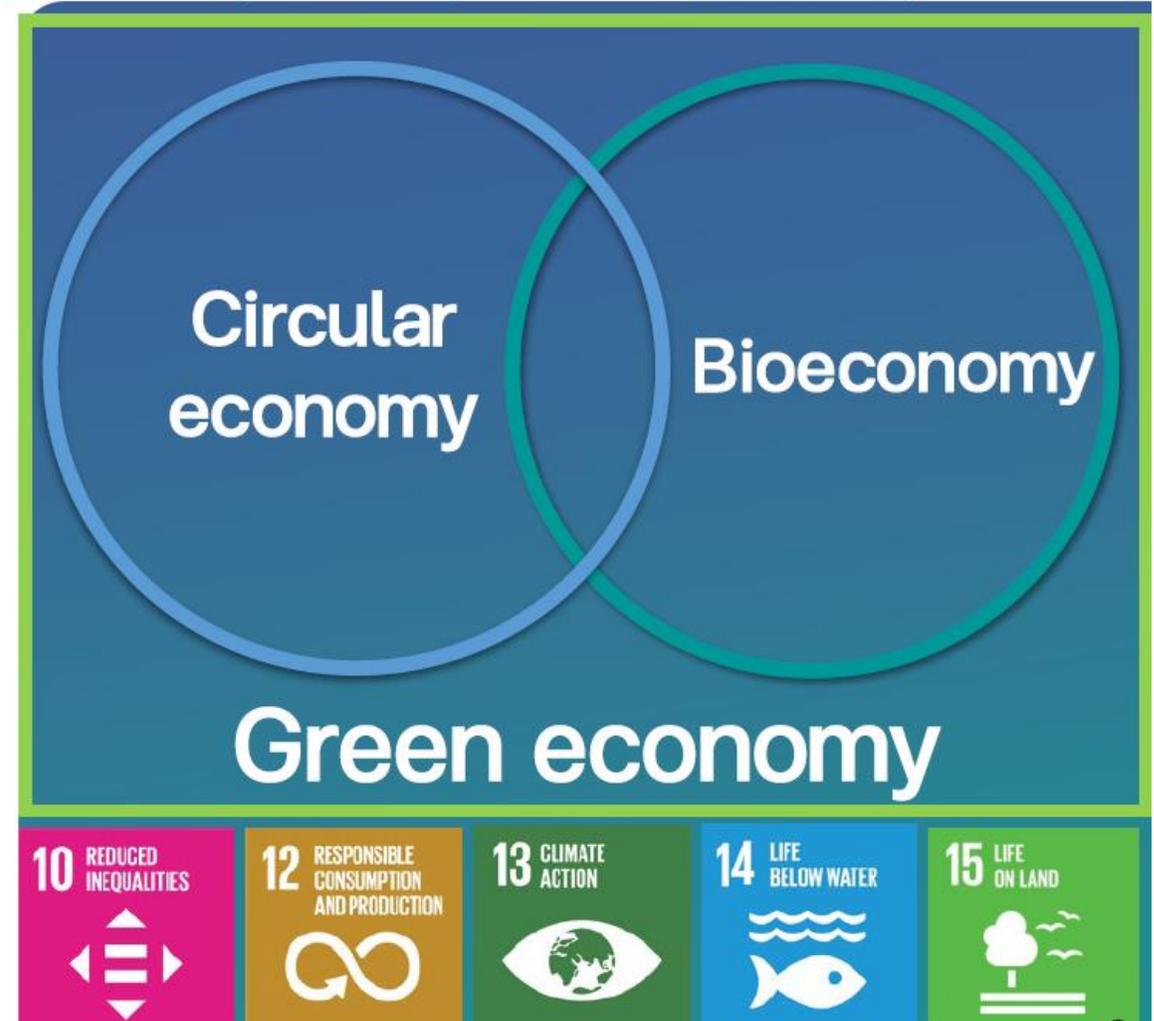
Education Technology

Digital transformation application

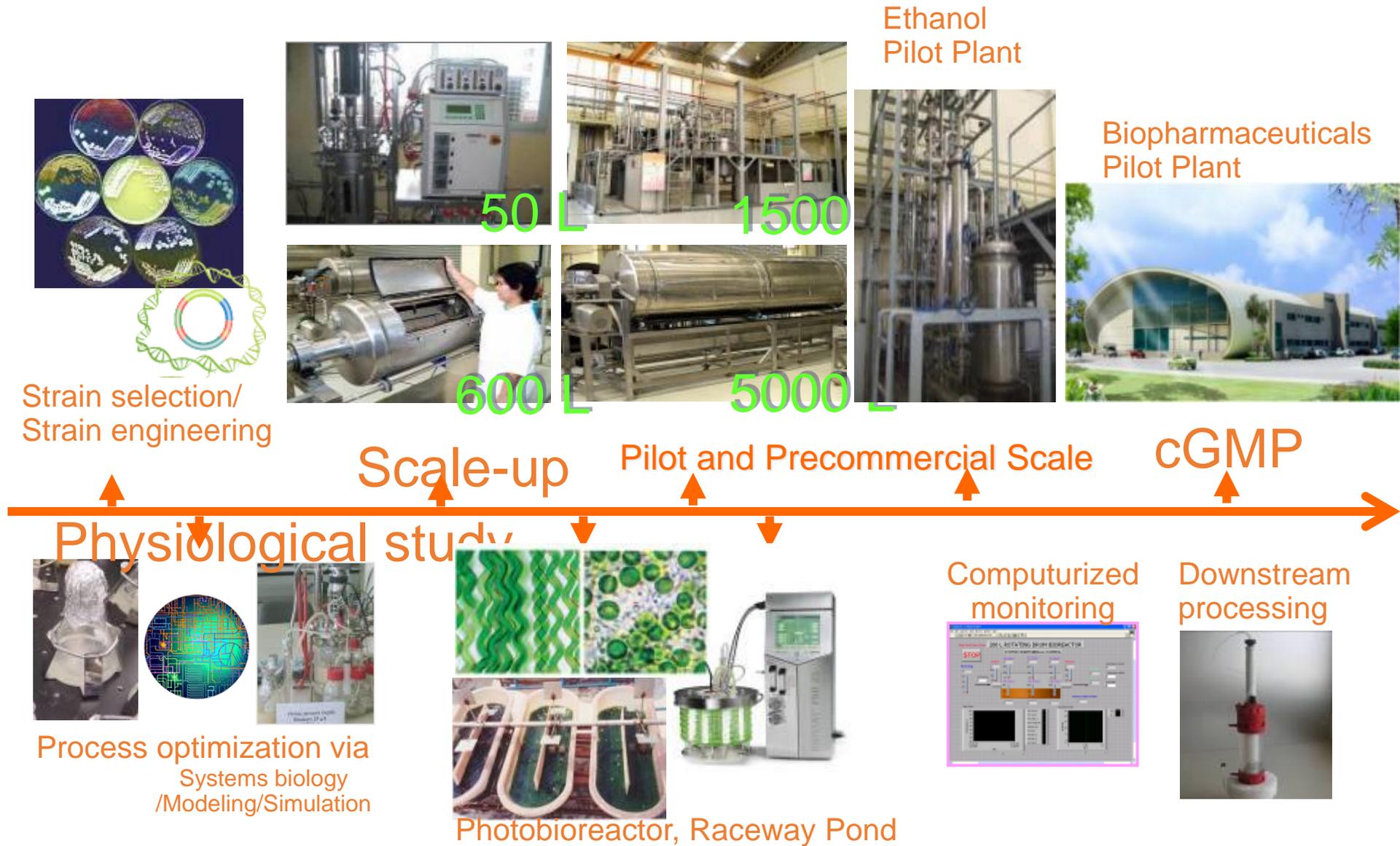


Area-based Sustainability and Inclusive research: Area-based research that impact the community

BIOECONOMY សំរេចរូប SDG



Translational R&D Chain





Precision Agri.
Smart Farm



Functional
Ingredients



Nutraceuticals



Bio-Energy
& Biorefinery

Synthetic Biology

Bioprocess

Metabolic modeling

Data management and analysis (in Plant)

Gene editing

Omics

Microbiomes

Bioinformatics

Next Generation Sequencing

Agricultural

Food-Agro
industry

Herbs

Renewable
energy, Bio-
energy

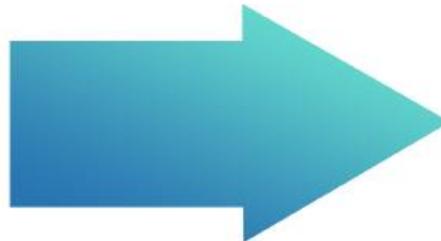
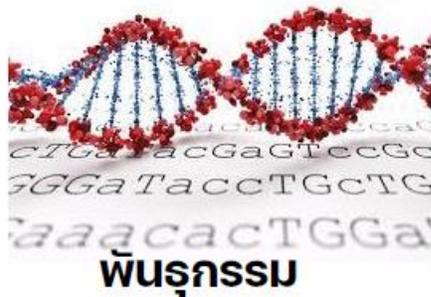
Technology



Center for Agricultural System Biology (CASB)



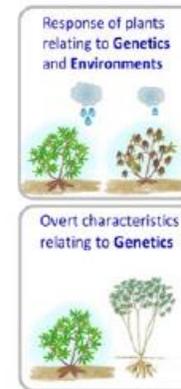
- Bioinformatics
- High-throughput and high-dimensional data analysis
 - Microbiome data analysis (Main focus)
 - Next-generation and third generation sequencing data analysis for genomics
 - Gene expression data analysis
- Machine learning for biological data
- Biomarkers identification
- Database and web-application for biological data



Facilities

- Computer server system
- High-performance computer

Partners

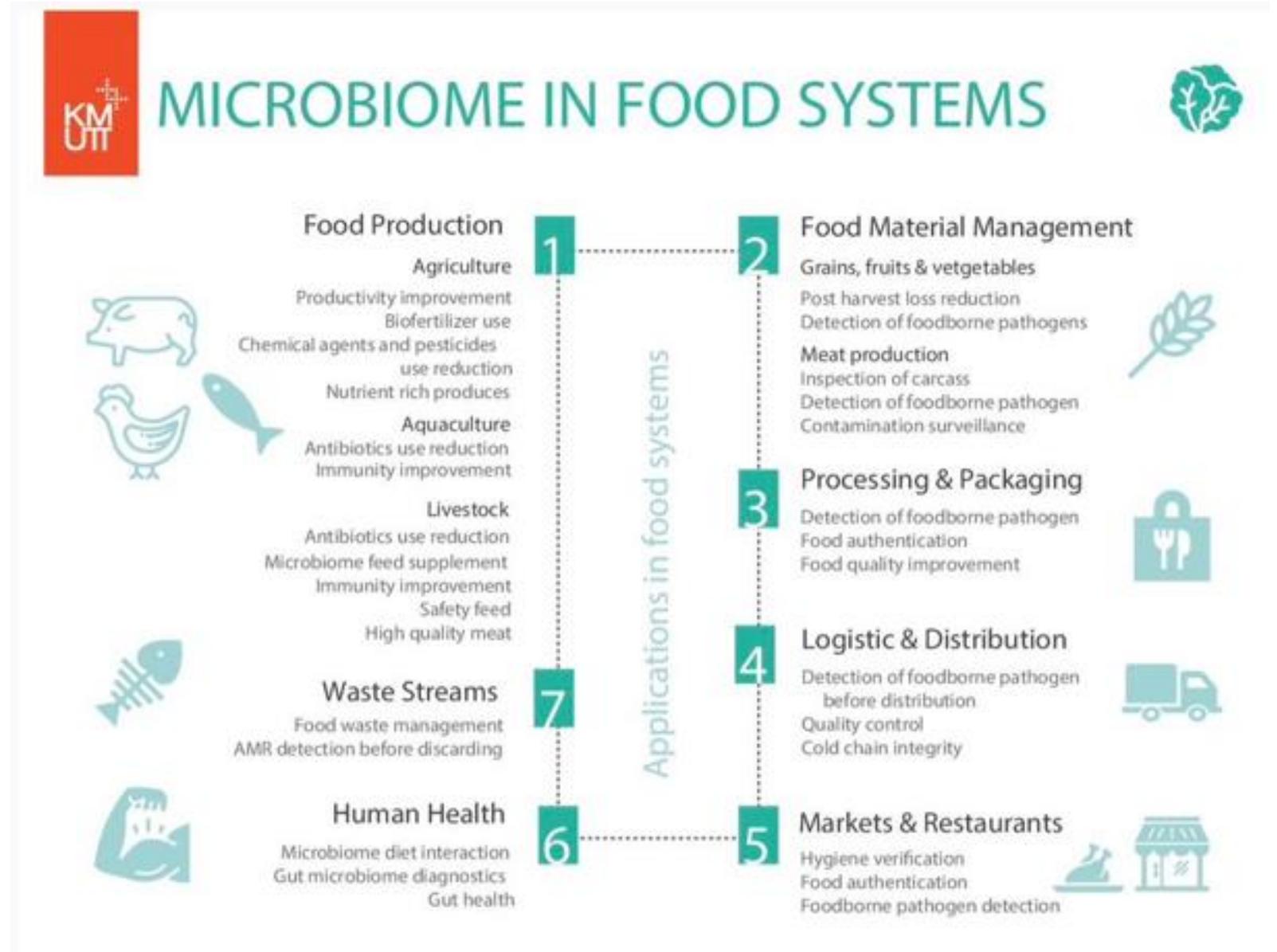


มันสำปะหลัง



ลักษณะที่พืชแสดงออก

System Biology and Bioinformatics (SBI)



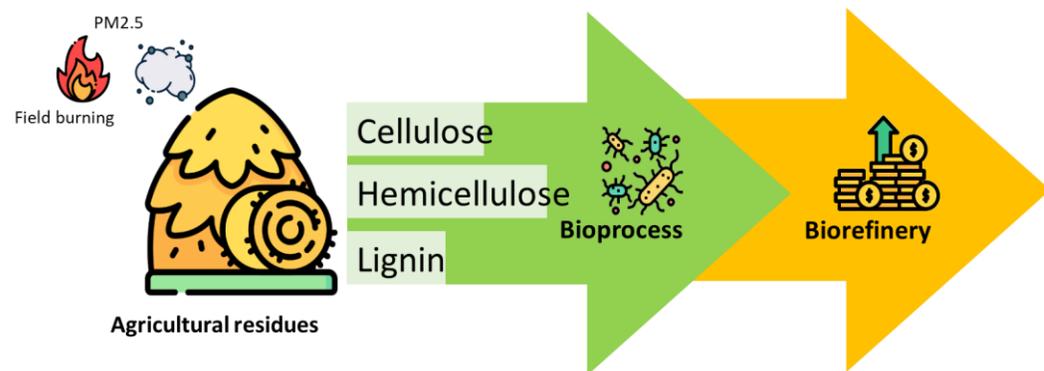
ENZYME TECHNOLOGY LABORATORY

(EXCELLENCE CENTER OF ENZYME TECHNOLOGY AND MICROBIAL UTILIZATION)



Focus on the enzymes and microbial utilization in the biotechnology industry to produce alternative energy and high-value biorefinery from all parts of biomass.

Enzyme for agricultural residues valorization



Collaboration and Partner

Thailand



World



Companies



ENZYME TECHNOLOGY LABORATORY

(EXCELLENCE CENTER OF ENZYME TECHNOLOGY AND MICROBIAL UTILIZATION)

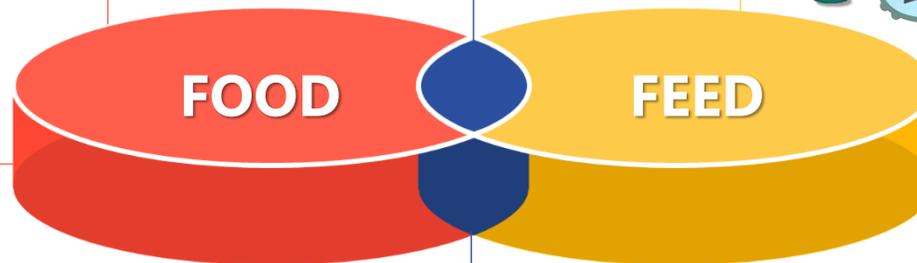
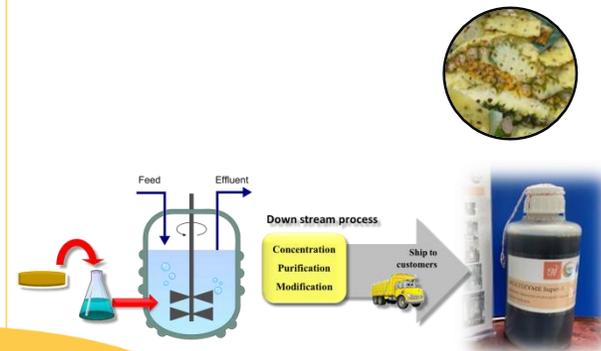


Functional ingredients

- Biosurfactant
- Cellulose / hydrogel



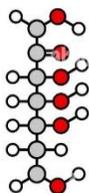
Enzyme for Feed



- Oligosaccharide
 - xylooligosaccharides (XOS)
 - mannoooligosaccharides (MOS)
 - Isomaltooligosaccharide (IMOS)



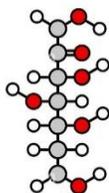
- D-tagatose
- D-psicose
- Lactulose
- Low calories sugar



D-psicose



D-fructose



D-sorbose



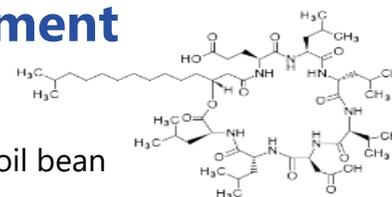
D-tagatose

Supplement

- Probiotic
 - Fermented soil bean
 - Value-added in feed

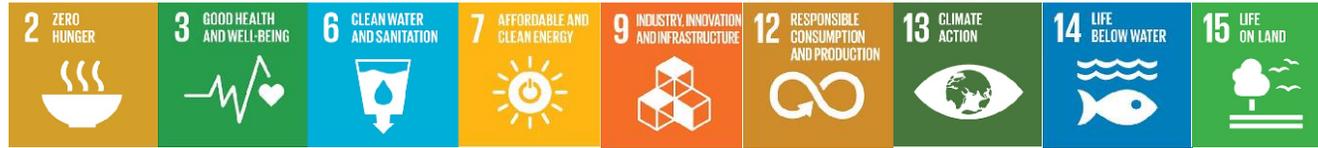


Lipopeptide

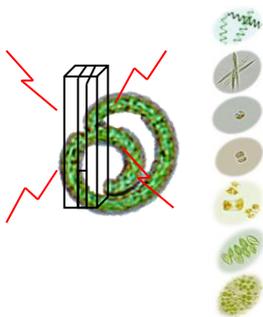


Algal Biotechnology Research Group

Goal: Sustainable Algal Biomass & Bioproducts



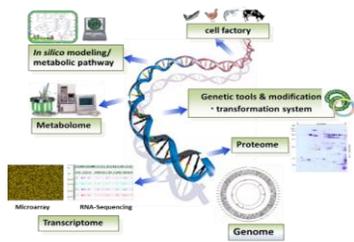
Strain Selection & Development



- Natural isolation
- Classical method
- GMO (Transformation development)
- others

- High performance strains
- Techniques for selection and strain development that meet market demands

Integration OMICs technologies with systems biology



- Omics technology: Genome, Transcriptome (Microarray, RNA-seq.), Proteome (LC-MS/MS), Metabolome, etc.
- In silico modeling
- Data base /Web based app.

Platform for productions of peptides, lipid and bioactive fatty acids for aquaculture industry and development of functional food products, etc.

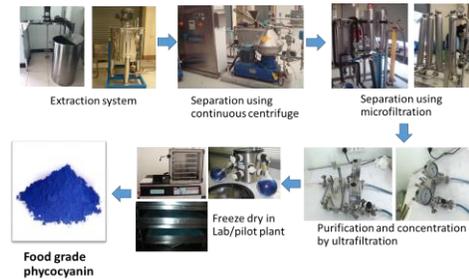
Cultivation System & Optimization



- Resource use efficiency
- Integrated waste for algal cultivation
- Integration of algae production with Agri-PV
- Smart algal cultivation facilities

Microalgae cultivation system for eco-friendly and sustainable production

Algal Biorefinery



- Extraction, separation and purification process
- Value-added products: Phycocyanin (blue pigment) & Polysaccharides
- Encapsulation for protein hydrolysates

Platform for extraction and separation of bioactive compounds from algae and agricultural waste for functional ingredients and functional food.

Biomass & Bioproducts: Foods and Functional Ingredients



- *Spirulina* products: Biomass, Phycocyanin, Polysaccharides, Lipids, Bioactive peptides, etc.
- Polysaccharides from *Caulerpa* waste

Arthrospira Genome
The Genome Database for Arthrospira

CyanoCoG
A Database of cyanobacterial orthologous proteins

SpirPep Bioactive Peptide Prediction Tool
by KMUTT

SpirPro: Spirulina-Proteome Repository

Web services:
Arthrospira Genome,
CyanoCoG,
SpirPro, SpirPep



Training Workshop
Consultation



Biochemical analysis

Algae

Biotechnology/Engineering

Products

Services

Animal Cell Culture

Focus on the platform for production of biologically active medical compounds, including the production of vaccines. Antibiotics from chicken eggs taking probiotics and development of viral infection diagnostic kits for animals.

Production Platform :

- Baculovirus Expression system
- Adenovirus Expression system
- Bacillus subtilis-based vaccine
- Egg-derived IgY

Prediction Platform :

- antibody epitope using a genetic tool ;immunoinformatics for Design and development of vaccines in the form of epitope-based vaccine

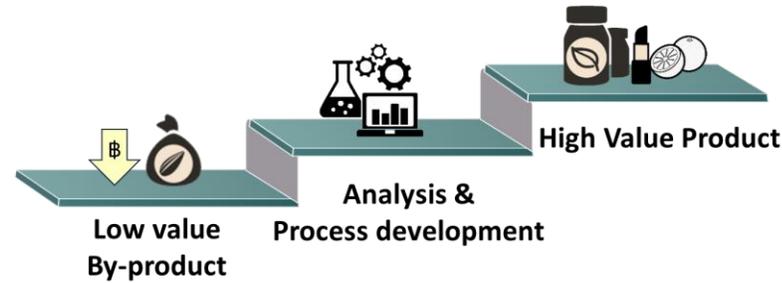


Lipid Technology LABORATORY



Fat and Oil Research Center for Excellency (FORCE)

Division of Biochemical Technology,
School of Bioresources and Technology
King Mongkut's University of Technology Thonburi



Extraction



- Wax
- γ -Oryzanol
- Steryl glucosides
- Phenolic acids

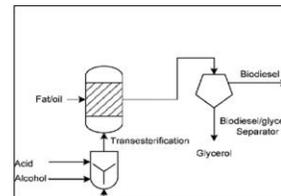
Preparation



- Policosanol
- Wax ester
- Ethyl ferulate
- Phytosterols
- CLA
- Ferulic acid

Rice bran oil & Palm oil

Process



- Biodiesel
- Refining loss
- Green solvent
- Partial extraction

Analysis



Method

Acylglycerols
FFA, Biodiesel
Vitamin E, Wax,
Policosanol
Conjugated fatty acid
MCPD

Mathematical Relationship

- Predicted retention time
- Biodiesel properties

Applications



- **Food**
margarine/shortening
oil powder
blended oil
- **Coating**
(Fruit/Seed)
- **Cosmetics**
(Lip balm/Soap/Cream etc.)

Microbial Bioprocess Development (MBD) Platform – Submerge Fermentations



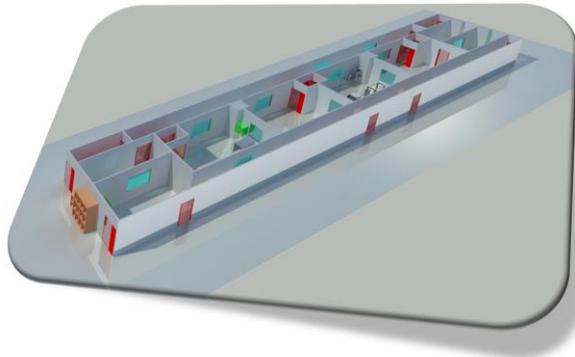
2L (1),



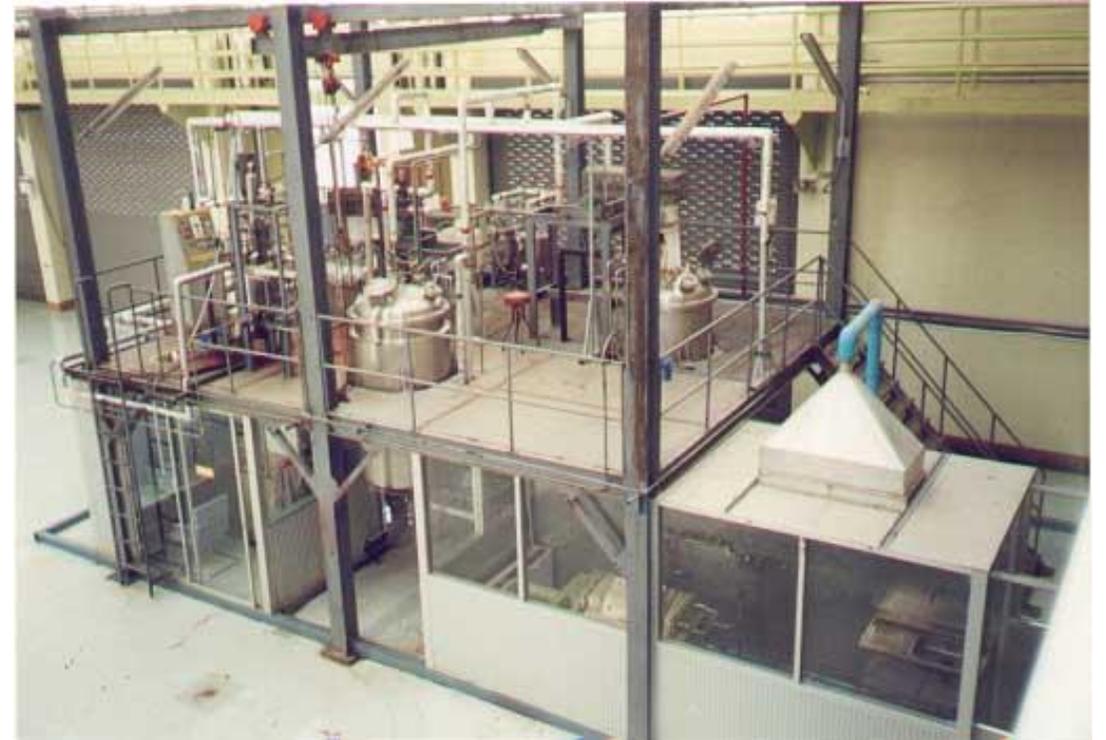
10L (1),



15L (2)



0



Microbial Bioprocess Development (MBD) Platform – Solid State Fermentation using Horizontal Rotating Drum Bioreactor



Solid State Fermentation Pilot Plant

Total Area 240 m²

- Production area 120 m²
- Inoculum Room 30 m²
- Chemical Room 30 m²
- Office & Meeting area

Pilot Scale Equipment

- Rotating drum bioreactor 200L, 500L, 600L
- Dryers 100 Kg



Electrical Steam Boiler



Rotating Drum Bioreactor (RDB)

500 L

Electrical Steam Boiler (100 kg/h)



Air Dryer



Chiller

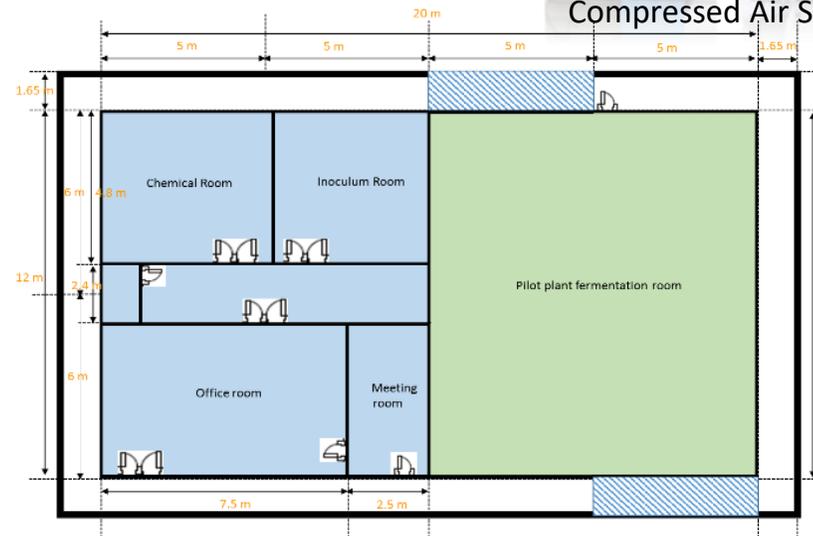
Air Storage Tank

Air Compressor

Compressed Air System (8 BAR,G)



KMUTT (Bang Khun Thian)



Microbial Bioprocess Development (MBD) Platform – Microalgae Mass Cultivation

Microalgae Production

Biomass, Lipid, Phycocyanin, Polysaccharide and Biopeptides etc.

(*Arthrospira* sp., *Ankistrodesmus* sp., etc.):

Physiological study on abiotic stresses and mixing



Outdoor cultivation systems (2562)

Integration of algal cultivation with biogas plant (2022)

2560

2561

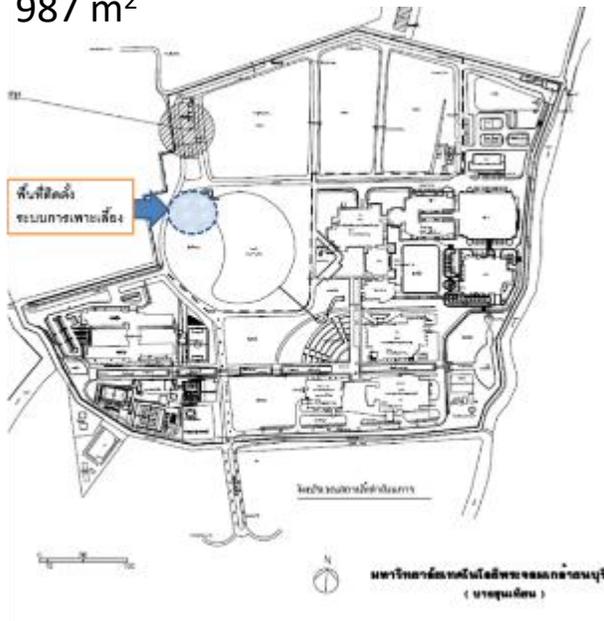
2562

2563

2564

22565

987 m²



- Fiberglass open raceway pond 1.5 m² X4 ponds
- Photobioreactors

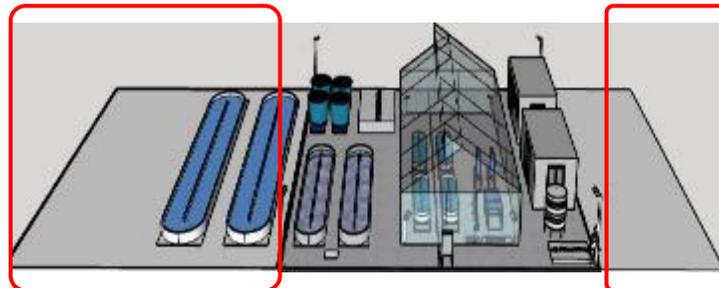


Concrete raceway ponds 7.2 m³ X 2 ponds

Concrete raceway ponds 20 m³ X 2 ponds

Pilot facilities for algal production (2560-2567)

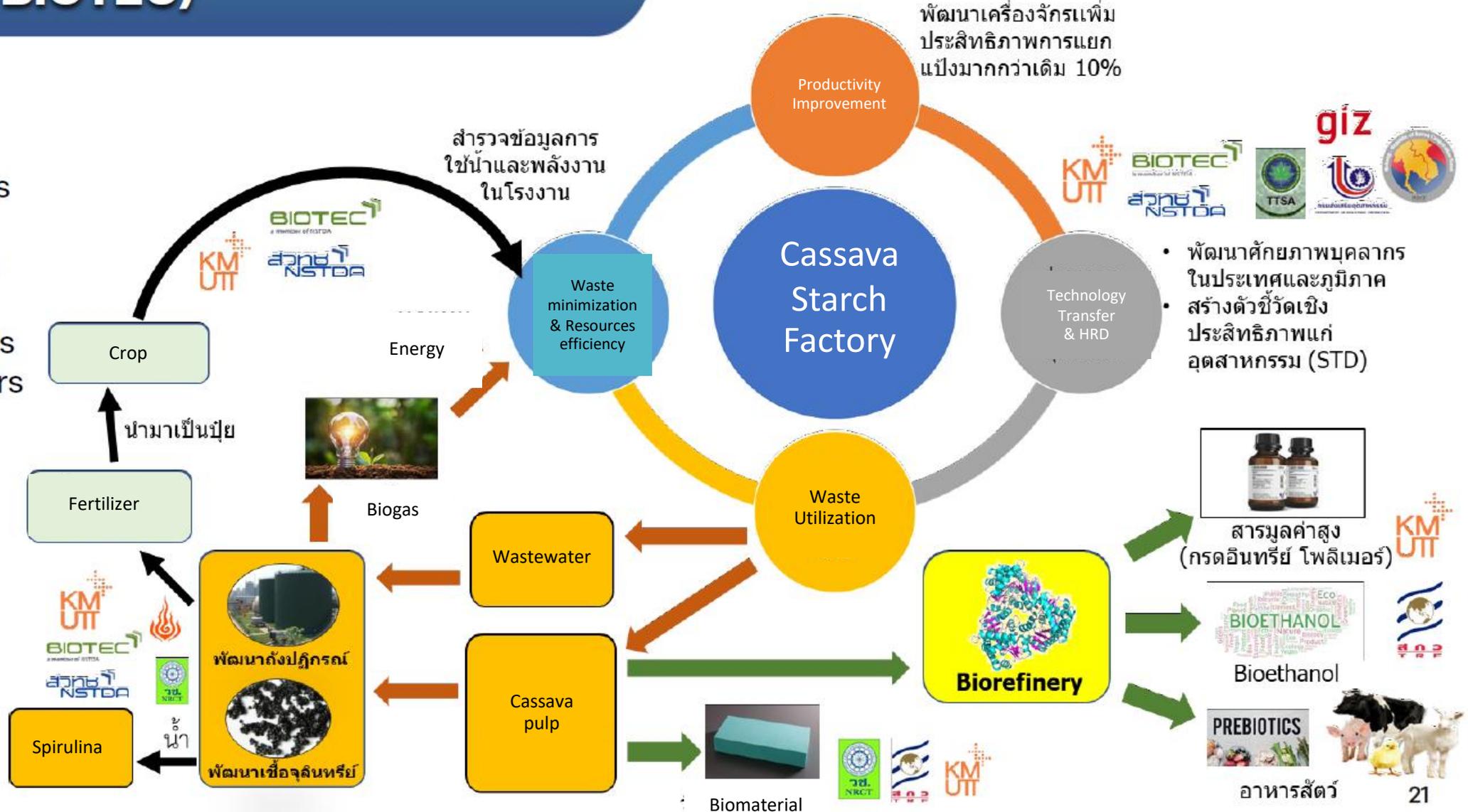
- Open raceway pond
- Photobioreactors
- Harvesting unit
- Smart Control System (2567)



BCG in Tapioca Starch Industry (KMUTT-BIOTEC)



- Stakeholders :
- Industries & Companies
 - Communities
 - Farmers
 - Academia & Research organizations
 - Policy makers



Overcoming Policy, Market and Technological Barriers to Support Technology Innovation and South-South Technology Transfer



THE PILOT CASE OF ETHANOL PRODUCTION FROM CASSAVA



Capacity Building on Circular Economy, Resource and Energy Efficiency for Productivity and Sustainability of Cassava Chain to High Value Products: Cassava Root, Native Starch, and Biogas in Mekong Countries (abbreviation: CCC)

Countries From Thailand to Cambodia, VietNam, Myanmar, Lao PDR

Duration 2 years (2563-2565)

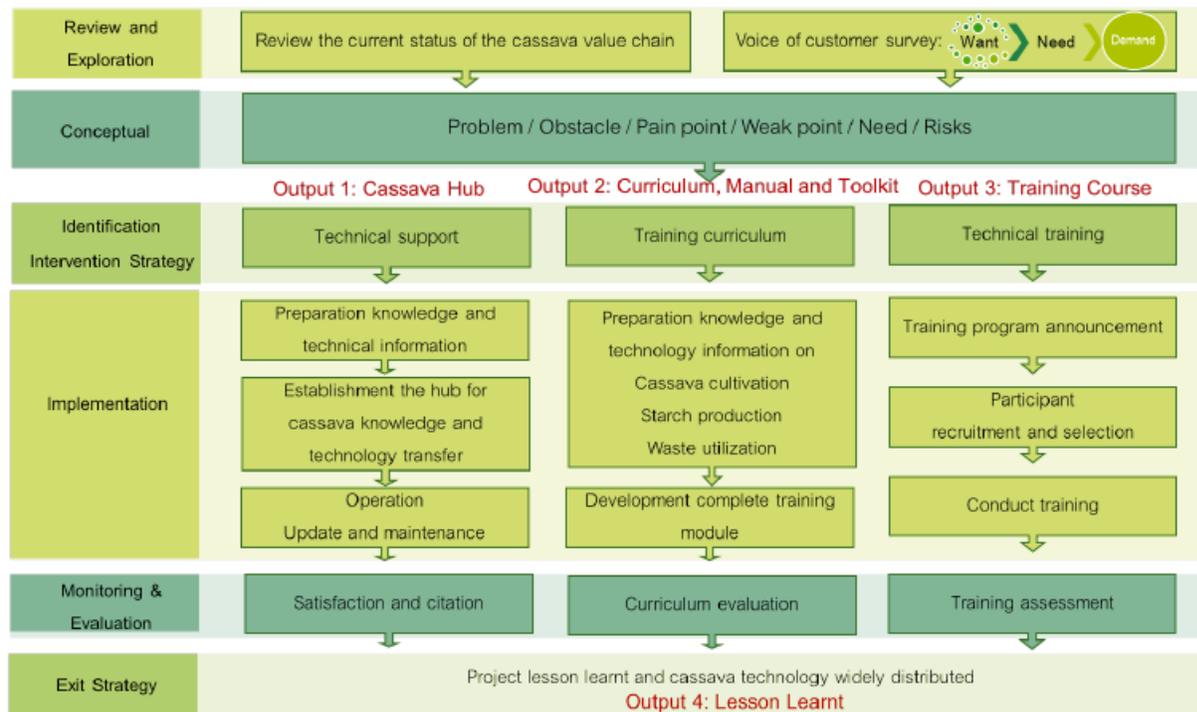
Budget USD 394,005 (12,960,105 Baht)

Fund Mekong-Republic of Korea Cooperation Fund (MKCF)

วัตถุประสงค์:

เพื่อพัฒนาศักยภาพบุคลากรในอุตสาหกรรมมันสำปะหลัง (ระดับปฏิบัติการ) จำนวน 90 คน จากประเทศกัมพูชา ลาว เมียนมาร์ เวียดนาม และไทย ผ่านการอบรม 3 หลักสูตร

- (1) การปลูกมันสำปะหลัง
- (2) การแปรรูปแป้งมันสำปะหลัง
- (3) การจัดการและใช้ประโยชน์จากของเสียกระบวนการผลิต (ก๊าซชีวภาพ) หลักสูตรละ 30 คน



* ขณะนี้ดำเนินการถึงขั้นตอนพัฒนาหลักสูตรแต่ละ Module เพื่อทำคู่มือ สื่อการสอน และ Outline course เสร็จมอครบปี 2565

Train-the-Trainer Program under Lancang - Mekong Cooperation to Enhance Production Capacity and People's Livelihood by Improving the Value Chain for Cassava Cultivation and Application: Clean Cassava Chips, Native Starch, Modified Starch, Ethanol and Biogas Production

Countries From Thailand to China, Cambodia, Vietnam, Lao PDR

Duration 3 years (2563-2566)

Budget USD 467,700 (13,732,488.11 Baht)

Fund Lancang - Mekong Cooperation Special Fund (LMC)

วัตถุประสงค์:

เพื่อพัฒนาศักยภาพบุคลากรในอุตสาหกรรมมันสำปะหลัง (ระดับผู้เชี่ยวชาญ หรือ Trainer) จำนวน 120 คน จากประเทศจีน กัมพูชา ลาว เวียดนาม และไทย ผ่านการอบรมหลักสูตร (1) การปลูกมันสำปะหลัง (2) การแปรรูปแป้งมันสำปะหลัง (3) การจัดการและใช้ประโยชน์จากของเสียกระบวนการผลิต (ก๊าซชีวภาพ) และ (4) การผลิตเอทานอลจากมันสำปะหลัง หลักสูตรละ 30 คน

Training Module #1:
Cassava Root: Techniques for Sustainable Production

Training Module #2:
Cassava Product: Processing Technology (Chip, pellet, native and modified, starch)

Training Module #3:
Cassava Waste: Biogas Production and Management

Training Module #4:
Cassava to Energy: Bioethanol Technology

