Bioeconomy in the Grand Strategy of Indonesian Agricultural Development

Robert Manurung

Head of Research Group: Agricultural and Bioproducts Technology – Bandung Institute of Technology
Expert Team for Grand Strategy of Indonesian Agricultural Development (2015-2045), Ministry of Agriculture

Workshop on innovations in food and agriculture system:
Policies to foster productive and sustainable solutions.
Outline

1. Bioeconomy in Indonesia
2. Grand Strategy of Indonesian Agricultural Development
4. Closing Notes

BIOECONOMY IN INDONESIA
The biosciences could produce the next wave of innovation in products and services, across a range of economic activities in:

- Health
- Agriculture
- Industry
- Energy
Biobased Economy

- A biobased economy uses renewable green resources to produce chemicals, materials, products and transport fuels as well as to generate energy that contributes to sustainable economic development. (Ministry of Agriculture, NL).

- The biobased economy focuses on biological tools and products from renewable resources to create wealth and sustainability in the production of medical treatments, diagnostics, more-nutritional foods, energy, chemicals, and materials, while improving the quality of the environment. (William Pellerin and D. Wayne Taylor INDUSTRIAL BIOTECHNOLOGY)

- A biobased economy relies on effective collaboration between the agrofood sector, the chemical industry and logistics.
Development of Agriculture in Indonesia-New Horizons

A Mega-diverse Country
It is estimated that Indonesia contains the second greatest biodiversity on Earth.

2/3 OF BIODIVERSITY CONCENTRATED IN THE TROPICS

Challenges to Agricultural Development:
Indonesian Territory is Located in the Tropical Belt of the World

- Tropical areas are the most challenging to agriculture -
  Intense biotic (pests) and abiotic (drought, soil acidity, low nutrients, etc) stresses.
  All these challenges will be intensified with the global climatic changes.
Biomass (*starches*) Resources-Indonesia

Cassava (starch: 20 - 40 ton/ha/yr)

Sorgum (starch and sugar: 20 - 40 ton/ha/yr)

Switch Grass (starch and sugar 30 ton/ha/yr)

Sugar cane (sugar: 10 ton/ha/yr)

Biomass (*Lipids*) Resources-Indonesia

Palm Oil  (lipids: 4 - 6 ton/ha/yr)

Rubber seeds (lipids: 0.02 – 0.04 ton/ha/yr)

Jatropha curcas (lipids: 1-2 ton/ha/yr)

Reutealis trisperma (lipids: 4 – 6 ton/ha/yr)

Why algae?

- **High productivity**
  - Oil content: 20-60%
  - 20,000-50,000 liter/ha/year oil
  - Palm oil: 6,000 liter/ha/year

- **No ‘competing claims’**
  - Grow on seawater
  - Use of residual nutrients (CO₂, N, P)
  - Co-products have value (e.g. starch, proteins)

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René Wijffels - Wageningen UR

Integrated Production of Pure Plant Oil, Ethanol and Biodiesel Fuels

- Jatropha plantation
- Lipid extraction and purification
- Pure Plant Oil
- Biogas
- Cassava field
- Composting
- Pressed cake
- Biodiesel
- Continuous esterification
- Ethanol
- Waste
- Minerals
- Leaves
- Stalks
- Pyrolysis
- Combustion
- Starch extraction, fermentation and distillation
- Biodigester
- Minerals
- Waste
- Source: SPIN KNAW Project
Top 10 Richest People in Indonesia (2015)

- Indonesian population in 2015 was 255708785
- GDP in 2014 was 888.54 USD billion.
- GDP per capita 3,475.25 USD in 2015
- The wealth of the 10 richest people is 55.5 billion USD (Forbes)
- Richest people (3.9 ppm) to GDP = 6.2% of GDP
- 0.2% of richest people own 52% of the plantation and properties lands
- 1% of Indonesian population own 70% of the National wealth
Grand Strategy of Indonesian Agricultural Development
### CHALLENGES AND PERSPECTIVE OF FUTURE AGRICULTURES

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<th>CHALLENGES</th>
<th>CONSEQUENCE AND PERSPECTIVE</th>
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<td>• Scarcity of fossil fuels</td>
<td>• Transformation to <em>bioenergy</em></td>
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<td>• High demand for food, feed, fuels, fibre, fertilizer.</td>
<td>• Urgency for the development of sustainable biobased products</td>
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<td>• Global climate change</td>
<td>• Adaptation - mitigation capacity</td>
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<td>• Scarcity and competition for land and water resource</td>
<td>• Efficiency &amp; conservation</td>
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<td>• Demand for ecosystem services</td>
<td>• Ecofarming and bioservices</td>
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<td>• Population growth and marginal farmers</td>
<td>• Pluriculture and income generation for farmers</td>
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<td>• Innovation in <em>bioscience and bioengineering</em></td>
<td>• Development of <em>Bioeconomy</em></td>
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CONCEPTUAL DESIGN : Tiered Strategy

1. Development at the level of National Economy:
   - *Transformation of economy from fossil-based economy to bio-based economy*
   - *Paradigm of Agriculture for Development*: agriculture as the basis for stimulating the national economy; and *Development for Agriculture*: agricultural sector should be supported by various sectors and the national development should consider a wider and higher scale of interest than just agriculture. Agricultural sector needs a high level of backing because this sector is a leading sector for food security and has multi-functions for solving various environmental and social issues.

2. Development at the level of Agricultural Sector:
   - *Development of Sustainable Agriculture-Bioindustrial System*
Objectives of Grand Strategy of Indonesian Agricultural Development:

1. Provide a reference in the preparation of all documents of national and regional development plans
2. Produce an instrument for the coordination, integration, synergy and synchronization of the government's plan, the community and business
3. Generate political energy to realize a national consensus for long-term agricultural development plan,
4. Encourage national discourse about the direction and road map of long-term agricultural development that is most suitable for Indonesia
5. Provide a reference for engineers, scientists, educators and community
Basic Principles

1. Good governance
2. Good policy and programs
3. Inclusive sustainable development
4. Paradigm of agriculture for development
5. Development of sustainable agriculture based on community, environment, agri-business stakeholders
6. Development of agriculture based on the development of community farming
7. Local resources basis
8. Bio-business environment as a public infrastructure
9. Healthy and fair market system

Pre-Requisites

1. Politic for development and public policy that emphasizes on biondustrial-agriculture
2. Decision making based on innovation, science and bioengineering
3. Efficient system connectivity, logistic and value chain
4. Quality and trustable human resources.
Vision

“To realize sustainable agriculture – bioindustry system which produce various healthy foods and high added value bio-based products from tropical agricultural and marine bio-resources.”
Mission

To develop and carry out:

1. Spatial plan and agrarian reform.
2. Inclusive and sustainable agriculture – bioindustrial system.
3. Economic activities for agricultural production, information, and technology.
4. Agriculture processing system for post harvest and bioindustry within rural areas.
5. Domestic and global agricultural value chain management system.
6. Financing system for agriculture activities.
7. Agricultural research, innovation and human resources development.
8. Rural and agricultural infrastructure.
Direction and Targets

1. All the villagers are freed from poverty by 2030;
2. Annual income per capita of farmer at $ 7,500 by 2040;
3. Indonesia economic prosperity status as high income country with annual per capita GDP of $ 20,000 by 2040;
4. National food self-reliance status by 2020, national food sovereignty by 2025, and community food sovereignty by 2035;
5. Self-reliance in energy through the implementation of integrated bio-energy for the total rural areas nationwide by 2035;
6. Substituting of imported carbohydrates at least 50 % by 2025 and 100 % in 2030 and substitution of 75 % of national fossil based products by 2030;
7. Improved bioservices sector throughout the total rural areas by 2040;
8. Sustainable integrated bioeconomy throughout rural areas by 2045;
9. Reduced agriculture labor from 39 % in 2010 to 7 % by 2045, and declining share of GDP from 15.3 % in 2010 to 3 % by 2045;
10. Increased bioindustry workforce sector from 6 % in 2010 to 12 % by 2045, while share of GDP increased from 13 % in 2010 to 14% by 2045
Road map towards Dignified, Independent, Developed, Just and Prosperous Indonesian Agriculture

Characteristic of farmers: Towards industrial farmers
Food security: National food self-sufficiency
Establishment of an integrated agricultural foundation

2015

Characteristic of farmers: Towards agro-service farmer
Food security: Food sovereignty
Self-reliance in agriculture and Food

2020

Characteristic of farmers: Industrial and agro-service farmers
Multi-function agriculture
Realization of Equitable Life and Quality

2025

Characteristic of farmers: Industrial and agro-service farmers active in farmer’s organization
Realization of independent, developed, just and prosperous agriculture

2035

Characteristic of farmers: Industrial and agro-service farmers active in farmer’s organization
Realization of independent, developed, just and prosperous agriculture

2045

SUSTAINABLE AGRICULTURE-BIONDUSTRIAL SYSTEM
Agriculture:

Traditional → Mechanization → Automization
The flow of energy from the sun through the Earth’s ecosystem and the recycle of matter by ecosystem

- Food & fodder
- Photosynthesis
  - CO₂
  - H₂O
  - Minerals

Biomass

Sust. products:
- Materials
- Chemistry
- Pharma

Non usable and manure

By-products and waste processing, compost, fermentation (energy)

Non usables and manure

Mobile Rice Mills in Yogyakarta

Processsing of Cassava: Conventional vs. biorefinery concept

(a) Conventional supply chain of starch

(b) Improved supply chain of starch
Agriculture-bioindustrial system for Citronella oil

Citronella oil

Fresh leaves

Residue

Biogas

Lipid

Protein

Compost

CO₂ dan H₂O

Citronella plant
Scheme of Integrated Redfruit Plantation and *Trigona* sp. in Papua

Redfruit oil

Redfruit oil

Residue

Kohe

Meat

Biogas

CO₂ dan H₂O

Fresh fruits

Compost

Propolis

Honey

Pollen

Redfruit

*Pandanus conoideus* L

“Vision without action is merely a dream. Action without vision just passes the time. Vision with action can change the world!”

Nelson Mandela

Thank you