

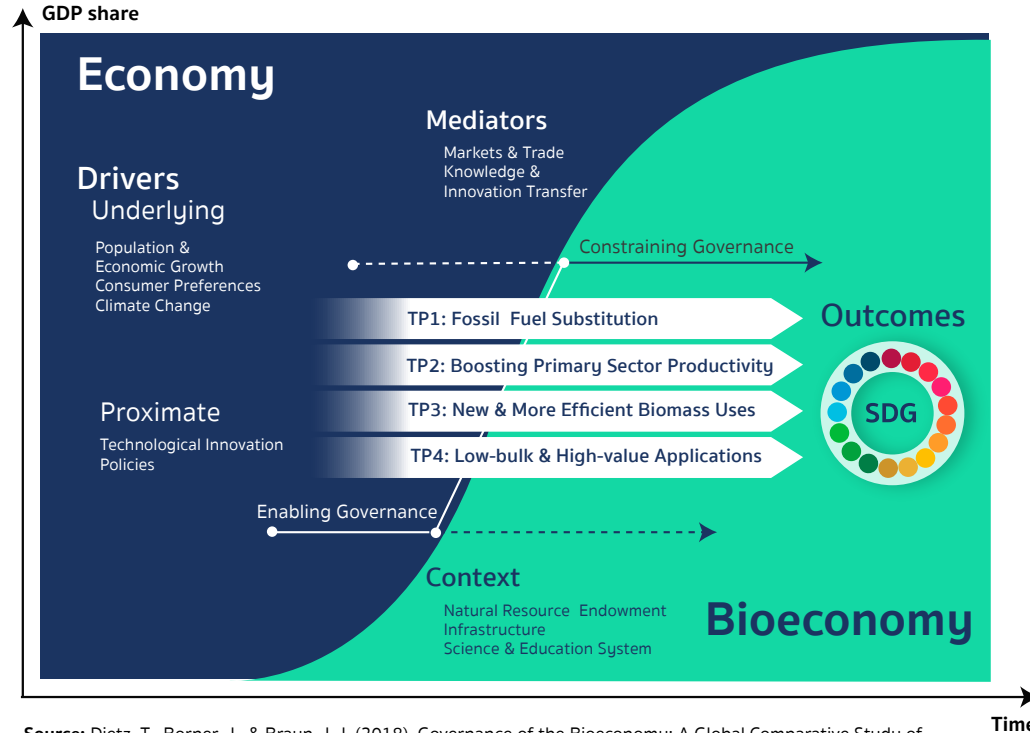


ADVANCED AGRICULTURE AND BIOTECHNOLOGY



The Concept of Four Bio-Based Transformation Paths

The course and effects of bioeconomic transformation processes depend, among other aspects, on the development level, resources and political system of a given state.



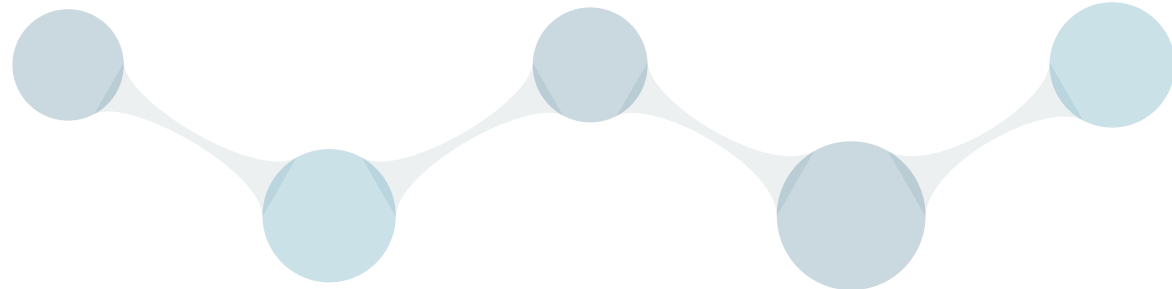
Source: Dietz, T., Borner, J., & Braun, J. J. (2018). Governance of the Bioeconomy: A Global Comparative Study of National Bioeconomy Strategies. Sustainability.



Possible Opportunities and Risks of Bioeconomic Transformation

Sustainability Dimension (SDG)	Opportunities	Risks
Food Security (SDG 2)	Increase via higher yields and new production methods	Reduction due to food price increases
Poverty/Inequality (SDG 1, 10)	Reduce via transfer of technology and leapfrogging	Increase via exclusion from technical progress
Natural Resources (SDG 7, 14, 15)	Conserve by improving production methods	Degrade/loss through inefficient production and overuse
Health (SDG 3)	Improve through new and refined forms of therapy	Risk/damage through improper use of risky technologies
Climate Change (SDG 13)	Mitigate through emission reductions	Exacerbate through direct and indirect land use change

Source: Dietz, T., Borner, J., & Braun, J. J. (2018). Governance of the Bioeconomy: A Global Comparative Study of National Bioeconomy Strategies. Sustainability.



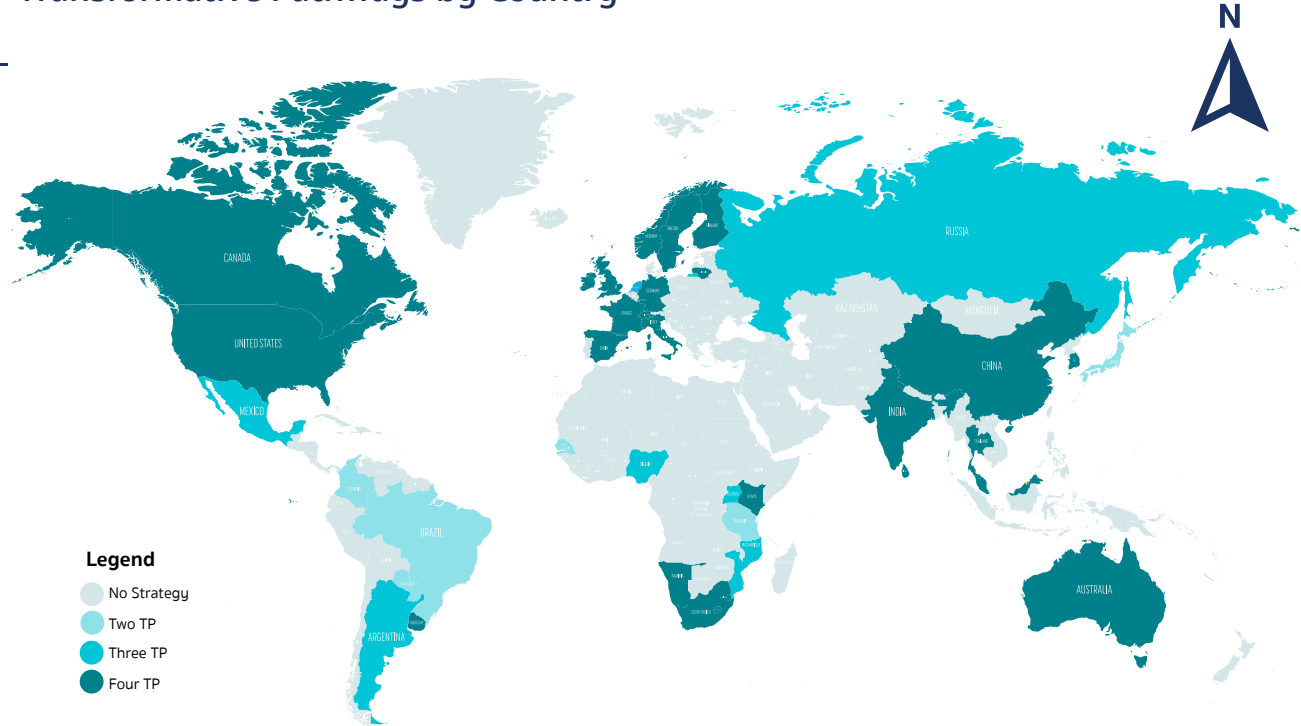
Transformative Pathways by Country

Global Market

Industry
in Thailand

Investment
Incentives
in EEC

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All countries with explicit bioeconomy strategies aim to foster transformation processes along at least two of the pathways. The majority of industrial nations, as well as some emerging economies, envisage or currently implement more diversified strategies along all four transformative pathways.

Source: Dietz, T., Borner, J., & Braun, J. J. (2018). Governance of the Bioeconomy: A Global Comparative Study of National Bioeconomy Strategies. Sustainability.

Thailand's Bioeconomy Timeline

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PHASE 1 (2017-2018)

Further Develop Bioenergy

- Improve seedstocks and procure machinery needed
- Extend projects in existing areas: Bioenergy, Biopharmaceuticals
- Prepare for the development of biorefinery to make high-valued bioproducts

PHASE 2 (2019-2021)

Develop Biorefinery Complexes and Biopolis



- Expand cultivation areas
- Construct integrated biorefinery complex that handles not only production but also research and development and environmental protection, heading to biopolis
- Develop and expand high-valued bioproducts with cooperation from all stakeholders in bioeconomy

PHASE 3 (2022-2026)

Move Towards Regional Hub: a Model for Future Industries

- Upgrade Thailand into a regional hub for bioproducts
- Construct prototype factory and pharmaceuticals production facility for commercial purpose



Source: BOI

Thailand's Bioeconomy Industry

The Royal Thai Government recognizes the importance of sustainable economic development.

Various policies have been introduced to address technological, economic and institutional challenges to move the country towards a sustainable bio-based economy



2004-2021

**Thailand's Bio-technology
Framework**

The framework includes a policy of Green Innovations for Economic Security, Competitiveness and a Healthy Society and targets 4 critical sectors: Food and Agriculture, Medicine and Health, and Bioenergy and Bio-based Industries

2008-2015

National Bioplastic Roadmap

A national agenda to establish a complete supply chain for the bioplastic industry in Thailand. The policy focused on the development of R&D, supporting infrastructure and innovative businesses for bioplastics

2012-2036

**Alternative Energy
Development Plan**

This plan aims to replace the country's dependence on imported fossil fuels with domestically produced renewable energy

2015-NOW

**Thailand 4.0 &
the new S-curve**

The new "Thailand 4.0" growth model focuses on the concept of inclusive, productive and green growth to enhance the country's competitiveness and economic development.

Source: BOI

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Three's Company: The Thailand Bioeconomy

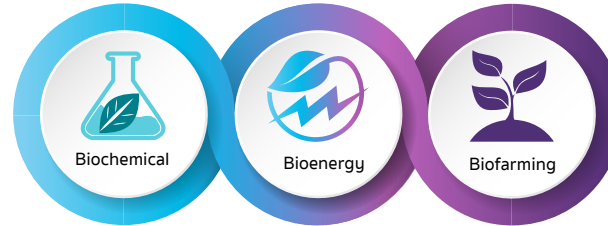
Thailand's bioeconomy can be broken down into 3 groups

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- Bioplastics (using extracted plant starches – lysine)
- Biopharmaceuticals (medicine herbs, extracts, Chinese medicines)
- Bio-additives (starches, antioxidant, vitamin powders to enrich food/feed)

- Bioethanol
- Biodiesel
- Bioelectricity

- Improved farming methods – (precision farming-co-developed with other industries)
- Bio-based agricultural inputs – (herbicides, fertilizers and pesticides)
- Germplasm improvement – (disease/drought resistance)
- Bio-control (using soil micro-organisms and fungi to treat crops against pests)

Raw materials

Excellent source of raw materials

- Sugar
- Starch (rice, cassava and sugarcane)
- And for the future: biomass

Local government bodies

Support from government authorities

- Board of Investment, Ministry of Commerce, Office of Sugarcane and Sugar Board, Industrial Estate Authority of Thailand
- Co-funded R&D (government and private sector)

Well developed country

The country has well developed:

- Government
- Education
- Infrastructure
- Utilities

Logistics

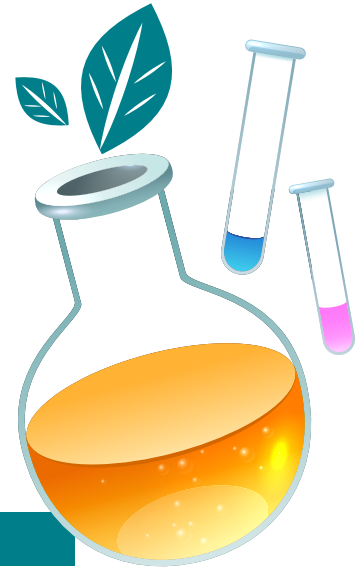
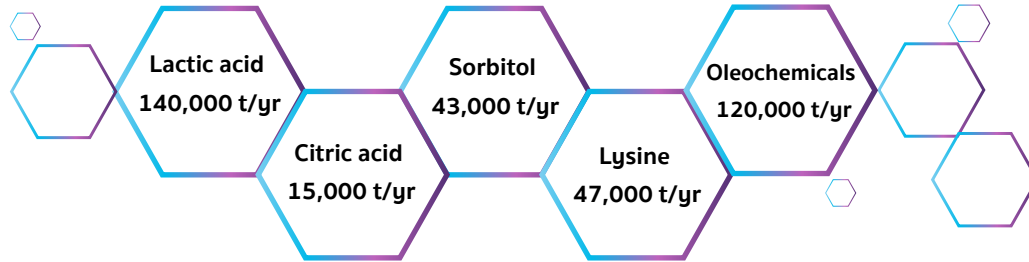
Strategic location

- Close to two main seaports
- Air links regionally and globally

It all started with the Big Bang!

The biochemical industry remains one of the most important sectors for the Thai economy due to its ability to add significant value to raw agriculture products.

Biochemical Production in Thailand



Stage	Year	Goal
1	2017-2021	Full Production for Biopharmaceutical Product
2	2022-2026	Performance Improvement
3	2027-2031	International Recognition for Production and Quality Control of Biopharmaceutical Products
4	2032-2036	Top 5 Biopharmaceutical Production in Asia

Source: BOI

Investment incentive package for investment projects in the Eastern Economic Corridor (2020-2021)

Key features	Investment Incentives	Targeted activities			
		Section 8	A1	A2	A3
1. Standard tax package	Tax holidays	10 Years (no cap)	8 Years (no cap)	8 Years	5 Years

Human resource development programs (additional tax incentives)

2. Investment projects which are engaged in human resource development programs	Tax holidays	2 Years (no cap)	-	-	-
	50% reduction of CIT	-	3 Years	3 Years	3 Years

Projects located in the four promoted zones for specific industries (EECi, EECd, EECA and EECmd) OR industrial estates and promoted industrial parks

3. Investments located in EECi, EECd, EECA and EECmd	Tax holidays	1 year (no cap)	-	-	-
	50% reduction of CIT	-	2 Years	2 Years	2 Years

OR

3. Investments located in industrial estates and promoted industrial parks.	Tax holidays	1 year (no cap)	-	-	1 Year
	50% reduction of CIT	-	-	-	-

Remarks:

- A1 : Knowledge-based activities focusing on R&D and design to enhance the country's competitiveness.
A2 : Infrastructure activities for the country's development, activities using advanced technology to create value-added, with no or very few existing investments in Thailand.
A3 : High technology activities which are important to the development of the country, with a few investments already existing in Thailand.
Section 8 : Technology and Innovation Development includes targeted core technology development such as development of biotechnology, nanotechnology, advanced materials technology and digital technology.

New investment promotion measure in EEC

- Starting January 2, 2020

According to the announcement of the Board of Investment No.2/2563, announced on January 15th, 2020,

- Applications must be submitted by the last working day of 2021.

- Projects located in the four promoted zones for specific industries (EECi, EECd, EECA and EECmd) are eligible for the incentives without application deadline.

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Associations and Institutions



Department of Science Service (DSS)
Operating under the auspices of the Ministry of Science and Technology, DSS has a mandate to conduct R&D and product testing through innovative technologies



Plastics Institute of Thailand (PITH)
Supports the Thai plastics industry and offers R&D and product testing for the industry.



National Innovation Agency (NIA)
Advocates for R&D for innovative products whilst simultaneously providing strategic support to relevant companies.



Thailand Institute of Scientific and Technological Research (TISTR)
Supports innovations in science and technology through R&D.



National Science and Technology Development Agency (NSTDA)
The Agency supports R&D activities in five core areas including: food and agriculture, energy and environment, health and medicine, bioresources and the community, and manufacturing and service sectors.



The National Center for Genetic Engineering and Biotechnology (BIOTEC)
Conducts policy research, outreach programs and training as aligned with Thailand's National Biotechnology Policy Framework.



Petroleum Institute of Thailand (PTIT)
Promotes the Thai petroleum market through R&D activities that are related to the Thai petrochemical and petroleum industries.



Thailand Center of Excellence for Life Sciences (TCELS)
Support life sciences R&D management and commercialization in Thailand and Oversea and empower of manpower in related sector

Research Centers



Biochemical Engineering and Pilot Plant Research and Development Laboratory King Mongkut's University of Technology, Thonburi



Marine Biotechnology Laboratory
Faculty of Science, Chulalongkorn University



MU-OU: CRC Collaborative Research Center for Bioscience and Biotechnology,
Faculty of Science, Mahidol University



National Biopharmaceutical Facility:
- Stated owned contract manufacturing facility for promotion of biopharmaceuticals
- Collaboration between BIOTEC and KMUT

