BCG

เพิ่มคุณภาพชีวิต เป็นมิตรกับสิ่งแวดล้อม

Enhancing Our Quality of Life and the Environment

BIO-CIRCULAR-GREEN ECONOMY

ACTION PLAN

2021-2027

SUMMARY

ENDORSED BY THE CABINET ON 8 FABRUARY 2021

On 19 January 2021, the cabinet endorsed the proposal to declare the Bio-Circular-Green Economy or BCG model the national agenda from 2021 onwards. As a result, this BCG Action Plan 2021-2027 is formulated to serve as a framework for organizations to work collaboratively in order to drive the agenda to the success.

Thailand's past economic development has drastically depleted natural and biological resources, resulting in pollution, environmental degradation and public health problems. The economic system emphasized production quantity over value creation, created uneven wealth distribution, and was vulnerable to external factors. Economic expansion in the past decade has been slow, registering an average annual growth of 3%. This growth rate is not sufficient to free Thailand from the middle-income trap.

The BCG model was therefore introduced as a strategy to drive sustainable development, ensuring a balance between social, environmental and economic objectives. It places emphasis on turning Thailand's comparative advantage in biological and cultural diversity into competitive advantage. Science, technology and innovation - along with a quadruple helix approach - are employed to create value to resources and culture.

I. CHALLENGES AND OPPORTUNITIES

Ecological, Biological and Cultural Diversity

Over the past forty years, the economic development without proper environmental and resource management has destroyed over 67 million rai (10.7 million hectares) of forest land, caused the contraction of the rich coastal area from 2.3 million rai (0.37 million hectares) to 1.7 million rai (0.27 million hectares) and left the ecosystem in a vulnerable state. Climate change only exacerbates these problems, driving several species to extinction and causing extreme weather disasters. The environmental imbalance can negatively affect economic activities such as agriculture, and thus leading to the rise in poverty. It is therefore imperative that a new paradigm is introduced to preserve ecosystem and biological resources and create a balance between conservation and sustainable utilization.

Thailand is blessed with cultural richness. Thai cuisine is famous for its balanced taste and use of medicinal herbs and spices. Thai identity is also infused in massage and spa, adding significant value to the wellness industry. Not only should this cultural heritage be preserved, it should be utilized to create a unique identity and add economic value to goods and services.

Agriculture and Food

While one-third of the total employment, or more than 12 million people, work in agricultural sector, this sector contributes only 8% of GDP, or THB 1.3 trillion. Over 90% of arable land are used for growing 6 crops which are rice, rubber tree, cassava, sugarcane, corn, and oil palm tree – all of which are farm commodities vulnerable to price volatility. This is the main reason for farmers' low income. Boosting farm productivity requires an increase in resource use, causes more environmental and resource degradation and is unrealistic considering population ageing in Thai farming sector. Therefore, it is necessary to move the farm production from low-price commodity to premium products, i.e., shifting from "more for less" to "less for more" production, by placing emphasis on standards for high quality and safety. Internet of things (IoT) technology enables precision agriculture by allowing farmers to optimize input (water, fertilizer, etc.) application to achieve high crop yields and reduce operational costs. Other farm products, e.g., herbal plants, fruits, seeds, ornamental plants, bamboo, insect and goat, can add diversification to Thai agricultural products and lessen price volatility. Herbal extract and natural products are examples of high-value products derived from farm commodities. Rice extract is sold at THB 2,400/kg or capsaicin from chili at THB 30,000/kg.

In 2018, the food and beverage industry contributed 4% to Thai GDP, equivalent to THB 625 billion. There are 53,642 food processing and beverage factories in Thailand, generating a combined income of THB 3 trillion, one-third of which were export income. The country is the 11th largest food exporter in the world, and the 2nd in Asia after China, with top export products including rice, canned and processed seafood, fresh and processed fruits, chicken meat and processed chicken and cassava products. Demand for Thai food products overseas continues to rise despite the pandemic due to its reputation for quality and safe food products.

There are over 100,000 operators of local food and street food in Thailand. This segment requires an improvement in quality and safety. Some operators have turned to health food business. Health food and beverage is a fast-growing sector, with a market value of THB 200 billion in 2017. Functional foods that can enhance brain function and improve immune system are in high demand.

Wellness and Medicine

In 2017, Thailand's healthcare spending was THB 400 billion. This number is expected to reach THB 1.4 trillion when the country becomes a fully aged society. Each year, the country imports drugs and pharmaceutical products at a combined value of THB 100 billion, three-fourths of which are medicine. Local pharmaceutical manufacturing capability is limited to producing generic drugs - 90% of the total volume of drugs manufactured in Thailand - from imported active pharmaceutical ingredients (APIs). The country has 161 GMP-certified pharmaceutical manufacturers but only one is capable of producing biosimilars. As a result, Thailand imports THB 20 billion worth of biopharmaceuticals such as vaccines, therapeutic proteins and antibodies. To illustrate how expensive and yet necessary these imported biopharmaceuticals are, pembrolizumab is used as an example. Pembrolizumab is an antibody used in cancer immunotherapy. The drug costs THB 150,000/treatment in Thailand.

Thailand medical and wellness tourism is doing remarkably well thanks to high quality medical services and healthcare professionals, and affordable price tags. 70% of foreign patients in Thailand are medical tourists. The country ranked 13th in the wellness tourism destinations by the Global Wellness Institute, generating over USD 9.4 billion income. The International Healthcare Research Center (IHRC) placed Thailand at the 6th position in medical tourism. These records reflect the strength of Thailand's health service sector. Clinical research is another high potential area for Thailand. In 2015, clinical research activities generated THB 8.8 billion revenue to the Thai economy. With a good management system, this number can potentially be doubled.

The growth of medical service sector has contributed to the expansion of medical device industry. In 2019, Thailand achieved medical device trade surplus, with THB 100 billion export value against THB 70 billion import value. The country holds the largest medical device market in ASEAN with an average annual growth of 8-10%, compared to the 5.2% world's average. There are 1,586 medical device manufacturers in Thailand, most of which are joint-venture SMEs with foreign partners. While 84% of export products are medical supplies such as alcohol, surgical masks and safety goggles, import products are mostly medical equipment

such as ultrasound machines, x-ray machines and ophthalmology equipment. Top countries of import medical devices are the US, Germany and China.

The cosmetic market is worth THB 300 billion. In 2019, Thailand had over 1,800 cosmetic manufacturers. 90% of these companies are SMEs and therefore have multiple disadvantages, including technological capacity, against big or multinational companies. Moreover, local cosmetic companies are faced with challenges in the quality and quantity of domestic herbal plant supply.

Energy, Materials and Biochemicals

Prior to the 2008 Renewable Energy Development Plan, 60% of total energy consumption in Thailand was imported. This proportion continued to rise, despite the country's high potential in renewable energy. Thailand has abundant biomass, agricultural waste and by-product to produce renewable energy. The volume is sufficient to meet the 30% renewable energy target set by the Alternative Energy Development Plan 2018-2037, up from 16.5% in 2019.

An increase in renewable energy production requires highly efficient technologies that can convert a wide range of biomass - municipal, industrial and agricultural waste - to renewable energy such as refuse-derived fuel and biogas. With advancement in renewable energy technologies, a community-based power plant from renewable sources can be established with blockchain-based smart microgrid to efficiently supply electricity to community members and manage the transaction. To promote smart energy networks based on renewable energy, more R&D is needed in the area of energy storage system to stabilize power supply from renewable sources.

With growing concern for the environment, biobased products are gaining public attention with worldwide market value expected to reach USD 487 billion by 2024, up from USD 400 billion in 2020. This trend presents ample opportunity for Thailand to create additional value to its commodity crops and biomass. By employing advanced technology and innovation in biosciences and biotechnology, value of crops and biomass can be multiplied. Bagasse worth THB 1/kg can be turned into bioactive compounds for cosmetic application or functional food ingredients worth THB 260/kg. If the bioactive compounds are used in pharmaceutical application, the price can even be driven up to THB 1,000/kg. Another potential utilization of bagasse is as feedstock for bioplastic production. Carbon dioxide emitted from industry or biogas production can serve as a building block to produce chemicals and high-value biochemicals.

Tourism and Creative Economy

Bountiful natural resources and diverse ecosystems make Thailand one of the world's top tourism destinations. In 2019, Thailand's tourism revenue was THB 3 trillion, two-thirds of which were contributed by 40 million foreign tourists. However, 80% of the revenue was concentrated in only 8 provinces. This could mean that these cities are exceeding their tourism carrying capacity which can lead to environmental destruction and other social problems. It is therefore vital to rehabilitate the damaged environment and resources, and at the same time, develop secondary cities, embrace sustainable tourism and start building tourism based on local identity and the country's strength. New types of tourism such as agrotourism, low-carbon tourism and knowledge tourism have potential to redistribute tourists and income not only to communities, but to other sectors as well, enabling sustainable income throughout the whole system. Tourism management system can be enhanced by technology which can potentially increase tourist spending.

A public payment gateway for tourism businesses is a strategic tool to increase tourism revenue. The one payment system offers convenience for tourists to pay for entrance fees, public transportation and other services through a single platform, and at the same time, enables the acquisition of tourist spending insights which can be used for the analysis and planning of tourism management and the design of marketing campaign.

Circular Economy and Green Economy

In 2017, Thailand's circular economy amounted to only THB 100 billion, suggesting that the country was at an early stage of circular economy. However, due to escalating demand for resources against limited supply, the global trend is moving towards resource use reduction, waste minimization, and sustainable production and consumption as a strategy to achieve the Paris Agreement commitment to lower greenhouse gas emissions and at the same time build a new economy. Circularity is expected to contribute at least THB 200 billion to the Thai economy, equivalent to 1% of GDP, by 2030. For Thailand, challenges in transitioning to the circular economy include low natural resource use efficiency, poor waste management, low waste segregation and massive food loss and food waste.

While Japan recycles 83% of its plastic waste and Germany 94%, Thailand's plastic recycle rate is less than half. Public awareness and engagement are also integral part of the circular economy transformation. Changes in the mindset and behavior are required in both firms and consumers to embrace and practice the responsible production and consumption.

While the transition to the green economy is still in an early stage, Thailand needs to accelerate the effort to maintain and expand its participation in the global supply chain and international trade which are increasingly dictated by stringent environmental policies. The transition will also help Thailand attract investment from international firms committed to green growth.

II. BCG MODEL FOR SUSTAINABLE AND INCLUSIVE GROWTH

Conceptual Framework

The BCG model has the following objectives:
1. Conservation, rehabilitation, management and utilization of bioresources and culture
2. Value creation from bioresources and culture
3. Development of self-reliance

Key activities of BCG model consist of:
1. Conservation, rehabilitation, development and replenishment of bioresources and culture
2. Sustainable utilization and consumption
3. Waste minimization and utilization
4. Value creation
5. Building self-reliance and resilience

The success of BCG model hinges on the following paradigm shifts in the government's approach:
1. Change from public-led investment to enterprise-led investment by creating an ecosystem to boost investment portion from the industry
2. Change from cash-aid policy, e.g., farm subsidy, to investment policy
3. Change from an annual funding to multi-year budgeting
4. Change from funding individual projects to integrated projects - encompassing the entire process from research to development, innovation and manufacturing - that will advance research to market
5. Change from traditional industry to s-curve industry, enabling Thai industry to rely less on comparative advantage in labor cost and resources and earning more with innovation
6. Change from externally dependent growth to strengthening the local economy and connecting it to the global economy
7. Change from individual actions to collective actions, employing the quadruple helix model that engages all sectors - government, industry, academia and people

Economic Potential of BCG Model

The BCG model will accelerate the development of target industries identified in Thailand 4.0 – a national policy aiming to transform Thailand into an innovation-driven economy – by directing resources and effort of all sectors towards a common goal. The BCG Action Plan 2021-2027 focuses on five strategic sectors, namely agriculture and food; health and wellness; energy, material and biochemicals; tourism and creative economy; and circular economy. The action plan intends to utilize “nature”, “culture” and “nurture” and employ a quadruple helix approach to add THB 1 trillion to the GDP.

Agriculture and Food

Agricultural production system can greatly benefit from the following concepts and solutions: agricultural products diversification, a decision supporting system, consumer behavior study, a real-time production monitoring and traceability system, and Good Agricultural Practices (GAP). The contribution of agriculture to GDP can potentially be raised from THB 1.3 trillion to THB 1.6 trillion.

The GDP from food products can also be increased from THB 0.6 trillion to THB 0.9 trillion by improving the product quality and safety, adopting green manufacturing practices, creating novel products especially healthy food products and food for specific population groups, and developing functional ingredients.

Health and Wellness

The GDP from drugs and medical supplies is merely THB 40 billion due to the lack of technological development and shortage of personnel in medical science and technology. Thailand needs to accelerate manpower and technological capacity building in order to promote R&D in drugs, vaccines, biopharmaceuticals and medical devices, as well as clinical research and product registration. The focus will also be on preventive medicine and personalized medicine, making use of genetic data. With this direction, the GDP from drugs and medical supplies can be raised to THB 90 billion.

Energy, Material and Biochemicals

At present, the GDP from energy, material and biochemicals stands at THB 110 billion. This sector possesses high growth potential as the government has upped the target for renewable energy consumption to 30% by 2037. For energy production, additional value can be created from high efficiency energy production technology; renewable energy such as refuse-derived fuel (RDF), biogas and solar energy; and community-based power plants with smart microgrid and blockchain technology and energy storage research. For material and biochemicals, the potential lies in the conversion of biomass and agricultural by-products to high-value materials and chemicals such as bioplastics, fiber, pharmaceuticals and oleochemicals. Overall, the GDP in this sector has potential to reach THB 260 billion.

Tourism and Creative Economy

Prior to the COVID-19 pandemic, tourism contributed around THB 1 trillion to the Thai GDP. Despite the significant drop in tourism revenue due to the pandemic, the BCG model has potential to increase the tourism GDP to THB 1.2 trillion with the promotion of secondary cities, improvement of communication infrastructure and digital system, employment of technology and innovation in tourism and ecosystem

management, establishment of carrying capacity, environmental rehabilitation, adoption of sustainable tourism and preparing industry to minimize the impact caused by climate change. The development of creative economy is based on the utilization of knowledge, ingenuity and cultural heritage to create high-value goods and services. The previous three strategic sectors – agriculture and food; health and wellness; and energy, material and biochemicals – can be linked to tourism via the creative thinking to offer unique travel experience such as culinary tourism, sport tourism, wellness tourism, cultural tourism and agrotourism. The creative economy can also support tourism industry by designing souvenirs with Thai identity and organizing international sports events.

Circular Economy

Thailand is currently undergoing the circular economy transformation to enable the country to create a balance between people and the environment and meet the Paris Agreement targets. In addition to lowering greenhouse gas emissions, the circular economy also offers business opportunities to build a new economy and create green jobs. The circular economy is expected to make at least 1% contribution to the GDP in 2027.

III. VISION, STRATEGIES, ACTIONS AND MANAGEMENT

Vision

To create sustainable and quality growth with science, technology and innovation, enabling higher income, better quality of life and a good balance of utilization and conservation of biological and natural resources.

Objectives

1. Conservation, rehabilitation, management and utilization of bioresources and culture
2. Value creation from bioresources and culture
3. Development of self-reliance

Goals and KPIs

Goals	KPIs
Sustainable economic growth	• Raise the 2018 GDP by THB 1 trillion • Increase the proportion of high-value products and services by at least 20% • Generate at least 50% more income to the grassroots
Social equality	• Improve income inequality of at least 10 million people • Reduce the proportion of undernourished population to below 5% • Increase access to quality healthcare during crisis of at least 300,000 people • Increase the number of energy self-sufficient communities by 20%
Sustainability of resources and the environment	• Reduce natural resource consumption by one-fourth • Cut back 2005 greenhouse gas emissions by at least 20-25% • Add at least 3.2 million rai (0.5 million ha) of forest land
Self-reliance	• Improve skill of at least 1 million workers • Create additional 1,000 BCG startups and innovation-driven enterprises (IDEs) • Improve negative technology balance of payment by at least 20% (THB 88 billion) • Reduce imports of medical and health supplies by at least 20% (THB 20 billion)

Strategies and Actions

Strategy 1 : Promote sustainability of biological resources by balancing conservation and utilization

This strategy focuses on applying knowledge, technology and innovation to create a balance between conservation and utilization of biological resources and introduce a paradigm shift from “nature as resource” to “nature as source”- i.e., reinforcing the perception on nature that it is not just a provider, but a source of all living organisms. Actions to be taken are:

1. Develop a database system containing biological and cultural data for a balanced management of conservation and utilization
2. Conserve and rehabilitate resources with technological and social innovations
3. Conserve forested watersheds and develop a platform to support water use reduction, water recycling and water quality improvement
4. Increase the number of young scientists working in the areas related to biological resources and improve resource management skills among people in the communities and young generations

Strategy 2 : Strengthen communities and grassroots economy by employing resource capital, identity, creativity and advanced technology

This strategy aims at understanding and recognizing the potential of each community – resources, culture, and nurturing spirit – and utilizing it to create high-value goods and services by employing technology and creativity. Inclusiveness – the concept of leaving no one behind – is also emphasized. Actions to be taken are:

1. Develop a regional economic corridor with the BCG model
2. Employ biological and cultural capitals as well as identity to strengthen the grassroots economy
3. Cultivate the community economy by utilizing the concept of bioeconomy, circular economy and green economy
4. Promote the development of high-value biobased goods and services by raising quality and safety standards, supporting innovation and employing circular design
5. Employ technology, innovation and quadruple helix model to drive the grassroots economy with mechanisms such as the University to Tambon (subdistrict) or U2T project, science parks and a cluster approach
6. Create market demand and increase access to market with identity, creativity and market linkage platforms
7. Raise quality and safety standards of street food and local food products with food machinery and Good Hygiene Practices (GHP) compliance
8. Strengthen human capital and develop skills that support the grassroots economy such as production efficiency improvement, quality control, creativity and quality assurance

Strategy 3 : Enhance sustainable competitiveness of Thai BCG industries

This strategy focuses on enhancing the competitiveness of manufacturing and service industry by employing knowledge, technology and innovation to improve efficiency, reduce waste and enable circularity. Emphasis is placed on enhancing quality, safety and eco-friendliness of goods and services to meet international standards. Advanced technology will be developed and introduced for commercial use. Examples include plant factory system and personalized medicine.

Agriculture and Food

The focus is on transforming the production system to enable product diversification and high-value products. Actions to be taken are:

1. Transform an agricultural system into a system of high efficiency, high standard and high value and diverse products by employing science, technology and innovation
2. Employ an area-based approach to drive agriculture with the BCG principles
3. Turn agricultural products into high-value goods such as healthy food products, medical food, bioactive compounds, functional ingredients, plant-based and insect proteins
4. Enhance production and logistics efficiency with digital platforms, advanced technology, and automation
5. Adopt green and sustainable manufacturing that minimizes waste and upgrade manufacturing process with advanced technology
6. Strengthen Thai cuisine brand by promoting the use of authentic ingredients and cultural identity and linking with tourism
7. Strengthen food innovation infrastructure such as functional ingredient testing lab and GMP pilot plant for the production of functional food and ingredients

Health and Wellness

Emphasis is placed on building capability in medical innovation in order to support health security, improve the quality of medical and wellness services, and integrate Thai industry into the regional value chain. Actions to be taken are:

1. Develop capability in the research and production of vaccines, drugs and biopharmaceuticals to prevent and control viral diseases and bring these products to international markets
2. Advance medical treatments to precision medicine by promoting genomic medicine services and advanced therapy medicinal products (ATMPs)
3. Accelerate the development of medical supplies and equipment via a reverse engineering approach
4. Promote clinical research to support product registration of drugs, vaccines, healthy food products, medical food, cosmetics, medical devices and supplies
5. Create market demand with the government procurement program, Thai Innovation List, and multiyear procurement
6. Develop manpower and skills to drive the health and wellness industry

Energy, Materials and Biochemicals

The focus is on creating value from farm products and wastes with technology and innovation and ensuring energy security. Actions to be taken are:

1. Increase market competitiveness of biobased products by removing legal barriers and introducing instruments such as carbon pricing and carbon credit
2. Promote value creation of biomass, farm products and agricultural wastes
3. Support SMEs to employ biotechnology to add value to products and services, build innovation businesses and participate in the global value chain

Tourism and Creative Economy

The focus in on transforming the tourism industry into green and high-value tourism. Actions to be taken are:

1. Introduce new tourism campaigns to promote secondary cities, reduce inequality and support sustainability
2. Promote sustainable and green tourism
3. Employ cultural identity, storytelling and digital technology to promote secondary cities
4. Establish and promote the one payment system to offer convenience to travelers and facilitate data collection for analysis and development of content for digital marketing
5. Promote high-quality tourism with MICE and sports events

Circular Economy

The circular economy is a strategy to achieve sustainable development, enhance competitiveness and build a new economy from recycling and upcycling. The concept is applied to three target sectors: plastics, agriculture and food, and construction. Actions to be taken are:

1. Promote investment opportunity and market in the circular economy
2. Support research, technology and innovation to create new goods and services from recycling and upcycling
3. Establish platforms and infrastructure to drive the circular economy
4. Design management systems that support the circular economy
5. Build a critical mass of experts and raise awareness of sustainable production and consumption

Strategy 4 : Build resilience to global changes

This strategy aims at creating immunity and building capacity to adapt to global changes, seize opportunities arising from global trends and invest in science and technology and quality infrastructure in order to support new economic engines and strengthen the grassroots. Science, technology and innovation will be employed to enhance the capacity of local communities and entrepreneurs and enable them to offer products and services to fulfil new market trends and achieve quality growth, as well as to develop a low-carbon society. The strategy also addresses manpower development to support future industry derived from the BCG model, as well as frontier research to lessen dependency on foreign technology. Actions to be taken are:

1. Manpower development in the BCG areas:

- Entrepreneurs
- Technology managers to facilitate the diffusion of knowledge, technology and innovation for area-based economic and social development
- Researchers, engineers, technicians to support knowledge and innovation creation
- Workers to have their skills upgraded to meet new industrial requirements due to changes in technology and business operation

2. S&T infrastructure development:

- Biobank
- Science park
- Omics center
- Genomics Thailand
- High performance computing (HPC) facility
- Sustainable Manufacturing Center (SMC)
- Biorefinery pilot plant
- Pilot plant and demonstration plant
- OECD-GLP compliant animal testing facility for evaluating the toxicity, safety and efficacy of vaccines
- GMP pilot plant for manufacturing drugs and active pharmaceutical ingredients (APIs)

3. Quality infrastructure development:

- Clinical research
- Toxicity assessment
- Residue testing of farm products
- Foodborne pathogen testing
- Bioactivity testing
- Medical device testing

4. Frontier technology development:

- Complex microbiota to support animal and human health research
- Omics technology to accelerate agricultural and medical research
- Bioprocess engineering to support the conversion of biomass to high-value products
- Gene editing and synthetic biology to redesign living organisms
- Terahertz technology for applications in testing, medical diagnosis and product inspection
- Decarbonization to support the circular economy and green growth
- High performance computing (HPC) and artificial intelligence (AI) to support agricultural and food research and precision medicine
- Advanced digital technology platform such as next-generation network and AI system
- Molecular sensory to support food innovation

BCG Objectives, KPIs, Strategies and Actions

Objectives	KPIs	Strategies	Actions
Conservation, rehabilitation, management and utilization of bioresources and culture	Sustainability of resources and the environment • Reduce natural resource consumption by one-fourth • Cut back 2005 greenhouse gas emissions by at least 20-25% • Add at least 3.2 million rai (0.5 million ha) of forest land	Strategy 1: Promote sustainability of biological resources by balancing conservation and utilization	1. Develop a database system containing biological and cultural data for a balanced management of conservation and utilization 2. Conserve and rehabilitate resources with technological and social innovations 3. Conserve forested watersheds and develop a platform to support water use reduction, water recycling and water quality improvement 4. Increase the number of young scientists working in the areas related to biological resources and improve resource management skills among people in the communities and young generations
	Social equality • Improve income inequality of at least 10 million people • Reduce the proportion of undernourished population to below 5% • Increase access to quality healthcare during crisis of at least 300,000 people • Increase the number of energy self-sufficient communities by 20%	Strategy 2: Strengthen communities and grassroots economy by employing resource capital, identity, creativity and advanced technology	1. Develop a regional economic corridor with the BCG model 2. Employ biological and cultural capitals as well as identity to strengthen the grassroots economy 3. Cultivate the community economy by utilizing the concept of bioeconomy, circular economy and green economy 4. Promote the development of high-value biobased goods and services by raising quality and safety standards, supporting innovation and employing circular design 5. Employ technology, innovation and quadruple helix model to drive the grassroots economy with mechanisms such as the University to Tambon (subdistrict) or U2T project, science parks and a cluster approach 6. Create market demand and increase access to market with identity, creativity and market linkage platforms 7. Raise quality and safety standards of street food and localfood products with food machinery and Good Hygiene Practices (GHP) compliance 8. Strengthen human capital and develop skills that support the grassroots economy such as production efficiency improvement, quality control, creativity and quality assurance
Value creation from bioresources and culture	Sustainable economic growth • Raise the 2018 GDP by THB 1 trillion • Increase the proportion of high-value products and services by at least 20% • Generate at least 50% more income to the grassroots	Strategy 3: Enhance sustainable competitiveness of Thai BCG industries	Agriculture and Food 1. Transform agricultural system into a system of high efficiency, high standard and high value and diverse products by employing science, technology and innovation 2. Employ an area-based approach to drive agriculture with the BCG principles 3. Turn agricultural products into high-value goods such as healthy food products, medical food, bioactive compounds, functional ingredients, plant-based and insect proteins 4. Enhance production and logistics efficiency with digital platforms, advanced technology, and automation

BCG Objectives, KPIs, Strategies and Actions

Objectives	KPIs	Strategies	Actions
			5. Adopt green and sustainable manufacturing that minimizes waste and upgrade manufacturing process with advanced technology 6. Strengthen Thai cuisine brand by promoting the use of authentic ingredients and cultural identity and linking with tourism 7. Strengthen food innovation infrastructure such as functional ingredient testing lab and GMP pilot plant for the production of functional food and ingredients **Health and Wellness** 1. Develop capability in the research and production of vaccines, drugs and biopharmaceuticals to prevent and control viral diseases and bring these products to international markets 2. Advance medical treatments to precision medicine by promoting genomic medicine services and advanced therapy medicinal products (ATMPs) 3. Accelerate the development of medical supplies and equipment via a reverse engineering approach 4. Promote clinical research to support product registration of drugs, vaccines, healthy food products, medical food, cosmetics, medical devices and supplies 5. Create market demand with the government procurement program, Thai Innovation List, and multiyear procurement 6. Develop manpower and skills to drive the health and wellness industry **Energy, Materials and Biochemicals** 1. Increase market competitiveness of biobased products by removing legal barriers and introducing instruments such as carbon pricing and carbon credit 2. Promote value creation of biomass, farm products and agricultural wastes 3. Support SMEs to employ biotechnology to add value to products and services, build innovation businesses and participate in the global value chain **Tourism and Creative Economy** 1. Introduce new tourism campaigns to promote secondary cities, reduce inequality and support sustainability 2. Promote sustainable and green tourism 3. Employ cultural identity, storytelling and digital technology to promote secondary cities 4. Establish and promote the one payment system to offer convenience to travelers and facilitate data collection for analysis and development of content for digital marketing 5. Promote high-quality tourism with MICE and sports events

BCG Objectives, KPIs, Strategies and Actions

Objectives	KPIs	Strategies	Actions
			Circular Economy 1. Promote investment opportunity and market in the circular economy 2. Support research, technology and innovation to create new goods and services from recycling and upcycling 3. Establish platforms and infrastructure to drive the circular economy 4. Design management systems that support the circular economy 5. Build a critical mass of experts and raise awareness of sustainable production and consumption
Development of self-reliance	Self-reliance • Improve skill of at least 1 million workers • Create additional 1,000 BCG startups and innovation-driven enterprises (IDEs) • Improve negative technology balance of payment by at least 20% (THB 88 billion) • Reduce imports of medical and health supplies by at least 20% (THB 20 billion)	Strategy 4: Build resilience to global changes	1. Manpower development in the BCG areas 2. S&T infrastructure development 3. Quality infrastructure development 4. Frontier technology development

Proposed actions are consolidated into the following 13 measures:

1. Create digital repository of bioresources, cultural capital and local wisdom
   - Develop a database system for collecting and integrating qualitative and quantitative data of various assets and capitals – ranging from genetic and ecosystem information to products and services, as well as culture and traditional knowledge
   - Employ big data analytics for the planning and management of conservation, restoration and utilization program to strengthen the local economy and tourism industry
2. Replenish national resources through a quadruple helix approach
   - Establish a program offering carbon credit to enterprises engaging in the forestry carbon projects on the government's land with the credit splitting between the government and enterprise at a ratio of 10:90
   - Accelerate research and development into plant and animal breeding and resource monitoring and management
3. Develop BCG corridors
   - Build a regional economic corridor in each part of the country by matching demand and supply in the region
   - Employ BCG approaches – e.g., modern agriculture, processing, tourism, trade and investment and inkage between the domestic and global economy - to develop and improve products and services
4. Transform an agricultural system into a system of high efficiency, high standard and high value
   - Focus on premium and safe products by emphasizing plant breeding research, safety and quality standards, good farm management and logistics management systems
   - Raise the agricultural GDP by diversifying agricultural products with options such as seeds, fruits, ornamental plants, timber, herbal plants, insects and livestock
   - Increase farmers' access to knowledge and technology
   - Promote sustainable agriculture
5. Improve quality and safety of street food and local food products with food machinery and Good Hygiene Practices (GHP) compliance
6. Build a biobased economy by employing advanced technology to develop and manufacture high-value products such as functional ingredients, functional food, biochemicals such as oleochemicals, biomaterials such as carbon-based materials, drugs and vaccines
7. Create demand for innovative goods and services derived from the BCG model
   - Implement the government procurement program to promote BCG innovative products manufactured by local enterprises
   - Promote BCG-related labeling schemes such as carbon footprint labeling, green labeling and environmental labeling
   - Introduce instruments such as carbon pricing and polluter pays principle to increase market competitiveness of biobased products
   - Deregulate energy trading
8. Promote sustainable and green tourism
   - Launch new tourism campaigns such as Happy Model
   - Develop sustainable and green tourism with the BCG concept and carbon neutrality
   - Form tourism clusters of primary and secondary cities
   - Establish the one payment system for tourism

9. Promote the development and manufacturing of sustainable goods and services by employing green technologies, green finance and circular concept

10. Raise the standards of products and services to comply with international requirements by investing in infrastructure
    - R&D infrastructure
    - Scale-up infrastructure such as pilot plants
    - Quality infrastructure system to support standardization, testing, certification and accreditation of products/services such as organic products, biochemical products, drugs, vaccines, and medical devices and supplies
    - Revise laws and regulations

11. Support BCG startups
    - Improve technological and business skills of entrepreneurs
    - Increase access to technology, innovation and government infrastructure
    - Provide access to government experts and financial sources

12. Develop manpower to support the BCG model in all levels
    - Communities and grassroots
    - SMEs
    - Deep tech
    - Startups and tech entrepreneurs

13. Promote international collaboration in all facets, including knowledge creation and talent mobility
    - Establish research, trade and investment networks at the national, regional and global levels
    - Enrich Thailand's innovation ecosystem with measures such as incentives to attract foreign investment and international talent and SMART visa program

Management and Monitoring Mechanisms

The BCG model involves all sectors in the society, including the government, industry, academia and research, communities and international alliances. In the public sector, the work falls under the responsibility of multiple ministries and therefore, cross-ministerial and inter-agency coordination is vital. In addition, the BCG model is closely linked to the National Development Plan as set out by the 20-year National Strategy, the national reform initiative and others. Based on these interconnections, the following mechanisms have been established.

1. **Policy.** The BCG Policy Board has been established to set and drive the policy and promote the integration and cohesiveness among organizations to move in the same direction in orderto reach the common goal. The Prime Minister serves as the board chairman and the National Science and Technology Development Agency (NSTDA) is assigned the role of the board secretariat.

2. **Implementation.**
   - **The BCG Implementation Committee** is responsible for deploying the policy to the action plan and devising measures and mechanisms to promote BCG development, infrastructure investment, manpower development, ecosystem development, regulatory framework to facilitate BCG development, and monitoring and evaluation system. The Minister of Higher Education, Science, Research and Innovation is the chairman of the BCG Implementation Committee with NSTDA serving as the committee secretariat.
   - **The BCG Implementation Subcommittee**, consisting of experts from the public, private and people sectors, is established to drive the work in each target sector. There are 11 subcommittees responsible for each of the following sector: law; tourism & creative economy; agriculture; biodiversity; food; medical devices; human resource development; innovation, infrastructure and facilities; energy, materials and biochemicals; drugs and vaccines; and circular economy.

3. **Evaluation and Monitoring.** The evaluation and monitoring process is put in place to ensure that the implementation proceeds according to the action plan and timeframe to achieve the goals. Data and information obtained from the process will be reviewed and analyzed for performance improvement. As part of the national strategy, outputs, outcomes and impact of the BCG model will be monitored and evaluated through the Electronic Monitoring and Evaluation System of National Strategy and Country Reform or eMENSCR implemented by the Office of the National Economic and Social Development Council (NESDC).


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