

**ERIA Discussion Paper Series****Chained to Sustainable Development Goals?  
The Changing Role of Entities for Enhanced  
Resilience along Agriculture Food Value Chains in  
Thailand**

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**Abstract:** *The operation period of the Millennium Development Goals (MDGs) ended in 2015, and the Sustainable Development Goals (SDGs) will be in operation in 2016–2030. The sustainable development agenda contained 17 goals and covered a broad range of quantitative and qualitative objectives across social, economic, and environmental dimensions of sustainable development. These include (i) ending poverty and hunger, (ii) sustainable consumption and production, (iii) improving health and education, (iv) making cities more sustainable, (v) combating climate change, and (vi) protecting oceans and forests. Sustainable food production, marketing, and other post-harvest management practices are important to achieving majority of the SDGs.*

*This paper examines the required changing roles of private and public organisations, as well as international organisations, in 2016–2030 to enhance resilience of agricultural food value chains in Thailand. The Sufficiency Economy Philosophy (SEP) of Thailand is a growth and development model characterised by its universality and inclusiveness; people-centred approach; moderation, moral values, and reasonableness; and knowledge and integrity. The SEP encourages a holistic farm management system to promote sustainability, food security, water conservation and biodiversity, development of human resources, risk management, investment, and expansion of businesses, thereby creating self-sufficiency at the household, community, organisational, and national levels. These objectives of the SEP are somewhat consistent with Goals 1, 2, 8, 9, 12, 13, 14, and 15 of the SDGs. The required roles of organisations to enable Thailand to achieve the SDGs towards enhancing the resilience of agricultural food value chains are presented, and the policy implications are highlighted.*

**Keywords:** Sustainable Development Goals, food value chains, risks, role of entities, resilience, and Thailand.

**JEL Classification:** Q5, Q120, Q130, O21, O22

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## **1. Introduction**

The concept of sustainable development was established at the United Nations with the objective of achieving a set of applicable goals that balance the three dimensions of sustainable development: environmental, social, and economic. The Millennium Development Goals (MDGs) were established following the Millennium Summit of the United Nations in 2000 and the adoption of the United Nations Millennium Declaration. The MDGs consisted of eight goals with measurable targets for tackling the indignity of poverty. They established measurable, universally agreed objectives, e.g. income poverty, access to improved sources of water, primary school enrolment, and child mortality. Given the fact that the objectives have not been fully achieved and the operation period of the MDGs ended in 2015, a new development structure is going to take over to scale up the progress recorded under the operation of the MDGs (Martens, 2016).

The new development agenda is the Sustainable Development Goals (SDGs). The SDGs contained 17 goals with 169 targets. The agenda seeks to (i) promote peaceful and inclusive societies; (ii) create better jobs; (iii) tackle the environmental challenges of our time, especially climate change; and (iv) strengthen global partnership by including non-governmental organisations and private sectors (Kumar, Kumar, and Vivekadhish, 2016). The SDGs cover a broad range of sustainable development agenda, which can be categorised as (i) ending poverty and hunger, (ii) improving health and education, (iii) making cities more sustainable, (iv) combating climate change, and (v) protecting oceans and forests (Boelt, 2012).

Thailand's development cooperation, in collaboration with development partners, is working in line with the United Nation's SDGs, and focuses on sharing Thailand's successes in various sustainable development ranging from agriculture and food security, education, public health to tourism and rural development. Thailand is delighted to share the core of development experiences and best practices, known as the Sufficiency Economy Philosophy (SEP). The SEP was introduced by His Majesty King Bhumibol Adulyadej in 1974 to improve the lives of the Thai people over the past 40 years. It can be applied as a growth and development model to achieve the 17 SDGs because of its universality and inclusiveness, using a people-centred approach

based on the five key words in the SEP definition of the Middle Path: moderation, reasonableness, self-immunity, knowledge, and moral honesty.

The objective of this paper is twofold: (i) to explore the SEP that has successfully provided a sustainable development model in Thailand consistent with the ambitious Goals 1, 2, 9, 12, 13, and 14 of the SDGs, which are related to food value chains and (ii) to explore the required changing role of private and public organisations, as well as international organisations, to enable Thailand to achieve the SDGs towards enhancing the resilience of agricultural food value chains. The rest of the paper is structured: Section 2 presents the relationship between the SEP and the SDGs; Section 3 focuses on the roles of organisations to enable Thailand to achieve the SDGs towards enhancing the resilience of agricultural food value chains; Section 4 presents the discussions; and Section 5 presents the conclusions and policy recommendations.

## **2. Relationship between SEP and SDGs**

In Thailand, the SEP has been adopted as the guideline in formulating the national economic and social development plans which is in line with the SDGs to create balanced and stable development at the individual, family, community, and society levels. It also promotes the sustainability of natural resources and environment by enhancing efficient, transparent, and equitable natural resources and environmental management system (U-tantada, et al., 2006; TICA, 2016).

In the 1990s, Thailand experienced economic crisis. The economic pain prompted a nationwide soul-searching and quest for balanced development. Businesses and organisations began to put in place measures to ensure good governance. People on the ground across the country especially welcomed the SEP due to the bottom-up decision-making processes. Since then, the SEP has become Thailand's development compass. Thailand's SEP experience has proven that the UN's 17 SDGs can be attained when people, environment, and future generations are considered in decision-making (Ministry of Foreign Affairs [MOFA], 2015).

### **2.1. Goal 1 of SDGs – Ending poverty: The SEP strategy for eradicating poverty**

Thailand's development experience is considered one of the world's greatest success stories in poverty reduction. From a low-income country in the 1950s,

Thailand has become a middle-income country within a few decades (Pramudwinai, 2016). Alleviating hardship among the poor and the vulnerable has always been the central goal of the SEP. By promoting knowledge, moderation, and prudent decision-making, the SEP enabled individuals and communities to become more self-reliant and resilient in the context of volatile world.

The following projects have demonstrated how the SEP was applied to eradicate poverty:

- (1) Living museums. These are learning and agricultural research centres on how nature works. These centres help local people learn and apply holistic SEP-based techniques in areas like integrated soil and water resource management, land development, and animal husbandry.
- (2) One Tambon One Product. This is the government's scheme to support local entrepreneurship and community enterprises. Each community is encouraged to find local identity by producing its specific goods and building a brand to effectively generate more income. The government supported these community enterprises through technical and marketing assistance. Many products of this scheme have become popular internationally, often through online marketing.
- (3) The Doi Tung Development Project. This is another programme which has become one of the country's biggest success stories in sustainable development in the northeast highlands. It has successfully tackled opium cultivation and deforestation in the mountainous region by substituting Arabica coffee trees for opium (MOFA, 2015).

## **2.2. Goal 2 of SDGs – Ending hunger: SEP promotes food security from the grass roots**

Hunger was a daily problem for Thailand population for the past 2 decades. To end hunger, the SEP and King Bhumibol's new theory of agriculture advocate integrated farming that both encourages self-reliance for the farmer and addresses larger environmental concerns. This theory advises farmers to divide their lands into four sections: (i) 30% for reservoir; (ii) 30% for rice cultivation; (iii) 30% for growing

more rice or horticultural crops; and (iv) 10% for building a house, constructing paths for ditches, growing household vegetables, and raising livestock. It has three stages: (i) to achieve food security; (ii) to get organised to improve irrigation systems and farm productivity and to produce, process, and market their goods, preferably as cooperatives; and (iii) to set fair trade relationships between the local organisations and the private sector. The theory advocates integrated farming that encourages self-reliance for the farmer, and addresses larger environmental concerns. When implemented properly, these models will improve the diversity and resilience of farms, and reduce poverty.

Other government programmes designed to end poverty are:

- (1) School food bank. This aims to provide free lunch to students to improve their nutrition.
- (2) Pid Thong Lang Phra Foundation. This aims to solve issues on land clearing of the mountainous region for corn plantation to benefit the animal feed industry, although this destroys the rain-catchment areas of the Chao Phraya River in Thailand. The foundation uses the SEP to listen to the hill tribe people's problems and support their bottom-up decision-making to suggest change based on moderation, rationality, and self-immunity.

Doi Kham. This is a business offshoot of the Royal Project Foundation that has won worldwide recognition for its success in the eradication of opium cultivation through crop substitution programmes. It aims to support the highlanders to grow crops and have improved life (MOFA, 2015).

### **2.3. Goal 9 of SDGs – Industry, innovation, and infrastructure: SEP transforms industry through creativity**

Thailand's industrial sector benefits from modern infrastructure, an open business atmosphere, and the country's geographical advantages. However, the growth of the industry is putting heavy pressure on the infrastructure and environment. The goal is not only to grow but also to make industrial development eco-friendly, sustainable, and equitable. The following are some government programmes to achieve the goal: (i) green transport, which is used to pursue many green transport policies based on eco-friendly technology with long-term economic benefits and system resilience; (ii)

new urban freight centres, which are built to improve logistics infrastructure; (iii) Thailand Industrial Standard 9999, which is the industrial standard to using the SEP to foster good governance and sustainability; (iv) ESG 100, which is Thailand's first sustainability index launched by the Thaipat Institute, a public interest group that promotes socially responsible business; (v) Institute of Directors, which was set up after the Asian economic crisis in 1997 due to lack of good corporate governance; (vi) green manufacturing, which encourages corporations to change to green manufacturing to ensure sustainability, e.g. Toshiba Semiconductor (Thailand) Co., Ltd, Siam Cement Group, and Mitr Phol); (vii) small and medium enterprises (SMEs), which assist smaller business to increase its resilience (In this respect, state policies under the SEP help SMEs reduce business risks and become sustainable, thereby minimising the effects of global economic uncertainty on Thailand); and (viii) green financing or green loans, which are loan offerings with lower rates to entrepreneurs, SMEs, and individuals engaging in eco-friendly projects. Among the banks offering green loans are Kasikorn Bank, Bangkok Bank, and Krung Thai Bank.

#### **2.4. Goal 12 of SDGs–Responsible consumption and production: SEP advocates ethical and efficient use of resources**

The Government of Thailand has promoted the integration of the SEP into the corporate policy, value chains, and governance since 1997:

- (1) The Royal Development Projects Board organised two national competitions to identify top SEP businesses.
- (2) The Mahidol University developed the 'sufficiency economy business standard', which is being used as a tool to promote the adoption of the SEP.
- (3) The National Economic and Social Development Board established a network of large Thai companies to implement the SEP throughout their value chains. It has promoted sustainable consumption and production through various labelling and certification schemes, such as (i) foundation for consumers, which is a programme working directly with consumers to do policy and advocacy work, has a complaints and legal assistance centre to help consumers fight their cases, and publishes a popular bi-monthly consumer magazine *Smart Buyer*; (ii) green building, which encourages companies to produce much less solid waste and carbon dioxide while

providing a healthier environment for staff (The companies setting precedents in this regard are Kasikorn Bank, Toyota, and Park Ventures Ecoplex); (iii) green label and green leaf, which gives certifications to products that have minimum negative impact on the environment and to hotels that meet required standards in energy efficiency and reduction in water use, waste, and toxic chemicals; and (iv) Sampran model, which encourages farmers to practise organic farming by supporting them with technical know-how and marketing channels, and to stop using toxic farm chemicals.

## **2.5. Goal 13 of SDGs – Climate action: SEP inspires sincere action on climate change**

Climate change is a global crisis without boundaries. The SEP provides an idea of acting with knowledge and with virtue, which means being judicious and planning in preparation for future risks and shocks. This type of prudent and moderate resource management can help Thailand to minimise the effects of climate change (Chinvanno and Kerdsuk, 2011). In addition, on the national level Thailand also announced its intention to reduce greenhouse gas emissions (Office of Natural Resources and Environmental Policy and Planning, 2015). In this respect, Thailand's Climate Change Master Plan (2013–2050) and the National Disaster Prevention and Mitigation Plan (2015) promote climate and disaster preparedness initiatives that are in line with the SEP. The SEP-inspired endeavours to attain this goal are:

- (1) Monkey's cheeks reservoir. This uses nature to solve natural problems. It is built to store water to prevent flooding during the rainy season and to supply farm water during prolonged dry season. This approach is accessible to ordinary villagers and reduces the adverse impacts of climate change.
- (2) Royal rains. This provides artificial rain to help Thai farmers address drought problems caused by climate change. The programme centre has become the Artificial Rainmaking Research and Development Center.
- (3) Mangrove reforestation. This uses bottom-up efforts to alleviate the damages to mangroves brought by tsunamis and commercial shrimp farms. The government lends support through academic studies to speed up mangrove reforestation and biodiversity while strengthening laws and regulations to better protect mangroves.

- (4) Refuse-derived fuel. This is the latest innovation from Wongpanit, a forward-thinking waste-sorting company producing fuel from waste (MOFA, 2015).

## **2.6. Goal 14 of SDGs – Life below water: SEP balanced management of marine resources**

The destruction of mangroves, overfishing, and development and encroachment by the tourism industry are putting the future of Thailand's majestic seas and coasts at risk, also the use by fishermen of harmful bottom-trawling nets that damage the corals and scoop up everything in their path. The following are some efforts in line with the SEP for sustainable use of the oceans and seas:

- (1) Fisheries reform. This is to ensure sustainable use of the seas and marine resources. Thailand enacted the new Fisheries Act to increase penalties for illegal, unreported, and unregulated fishing and to limit the number of fishing vessels to prevent overfishing.
- (2) Organic Agriculture Certification Thailand. This gives certification to seafood that meets the criteria on safe, sustainable, and socially responsible catches.
- (3) Mangrove rehabilitation. This inspires coastal villages nationwide to rehabilitate their mangrove forests, the habitat of young marine lives.
- (4) Coral reef transplant. This is a simple technique using PVC water pipes to be installed in the seabed. Once the corals grow back, the fish and other marine life return.
- (5) Thai Sea Watch Association. This is a conservation association that works closely with fishing communities in the southern part of Thailand to fight against bottom trawling, which destroys the seabed and wipes clean the seas. The association uses social media to raise consumer awareness against destructive fishing, bringing about legal amendments to better protect the seas (Prachathai English, 2015).

### **3. Policy development and strategic framework for efforts on food value chain**

This section provides a brief background on policy development in Thailand. This includes the current framework, strategies, and programmes related to agriculture, food systems, and nutrition.

#### **3.1. Agriculture and food policies and strategies**

In Thailand, agriculture and food policies and strategies can be categorised into two levels: national and ministerial. The current agriculture and food policies and strategies are tabulated in Table 1.

##### *3.1.1. National level*

The principal institutional policy and strategic framework that guide planning and define areas for national development for all related sectors are the National Economic and Social Development Plan (NESDP), and the Strategic Framework for Food Management (SFFM).

##### a) National Economic and Social Development Plan

Thailand formally integrated nutrition into the country's fourth NESDP (1977–1981). Nevertheless, significant progress in nutrition began in the fifth NESDP (1982–1986) under the jurisdiction of the National Committee on Rural Development, which focused more on provincial, sub-district, and community levels (Tontisirin, Kachondham, and Winichagoon, 1992). The emphasis was on improving nutrition and basic minimum needs at the local level. The poverty alleviation plan considered malnutrition as a symptom of poverty and nutrition indicators. However, the plan also included programme for rural job creation, village development, provision of basic services, and agricultural production. In addition, the food and nutrition plan targeted vulnerable populations. Food production for improving nutrition under a subsistence economy, supplementary food for pregnant mothers, and community-based complementary food for infants and young children were emphasised, resulting in a

marked reduction in the prevalence of underweight among children under 5 in rural communities (Tontisirin, Kachondham, and Winichagoon, 1992).

**Table 1. Selected Agricultural and Food Policies and Strategic Framework in Thailand**

<b>Agriculture and food policies and strategies</b>	<b>Time frame</b>
<b>National level</b>	
1. National Economic and Social Development Plan	2012–2016
2. Strategic Framework for Food Management (SFFM) in Thailand	2012–2016
<b>Ministerial level</b>	
1. Ministry of Agriculture and Cooperatives	
1.1. Eleventh Agricultural Development Plan	2012–2016
1.2. Strategic Framework for Food Security	2013–2016
1.3. Agricultural Commodity and Food Safety Standards Strategy	2010–2013
2. Ministry of Public Health	
2.1. Eleventh Health Development Plan	2012–2016
2.2. Thailand Healthy Lifestyle Strategic Plan	2011–2020
2.3. National Nutrition Plan	2010–2013
2.4. Food Safety Strategy	2012–2016
3. Ministry of Industry's Master Plan	2010–2014
4. Ministry of Commerce	2013–2016
5. Ministry of Social Development and Human Security	2012–2016
6. Ministry of Education	
6.1. School Lunch Programme	Annual plan
6.2. School Milk Programme	Annual plan
<b>Secondary policies</b>	
7. Village and Urban Community Fund Act (2004)	-
8. Women's Development Fund (2011)	-
9. Research and development supporting the implementation of the SFFM	-

Source: Tontisirin, et al. (2013).

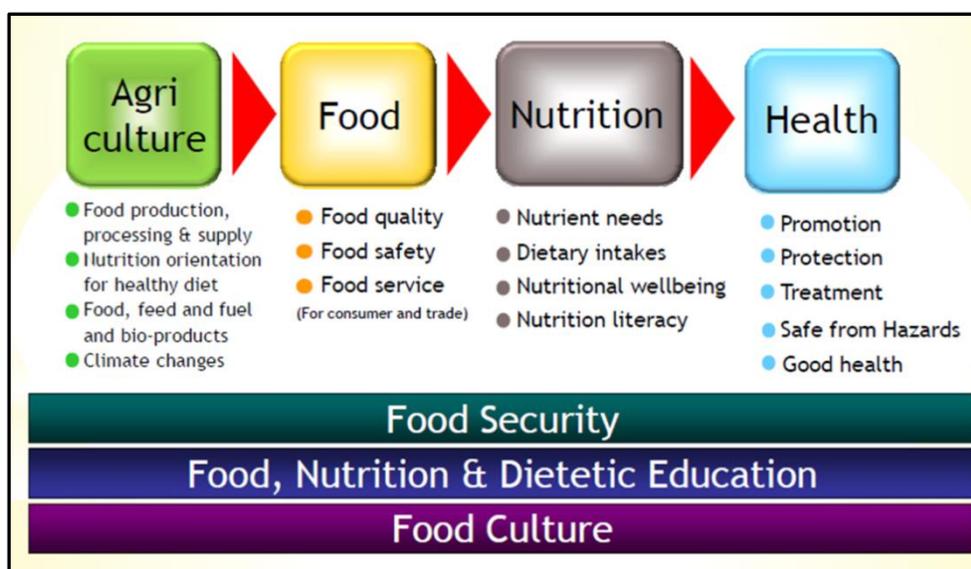
#### b) Strategic Framework for Food Management in Thailand

In 2008, the National Food Committee (NFC) Act was enacted to address national food management. It was the first time the country had an authorised agency to integrate the works of over 10 agencies and over 30 Acts relevant to the food value chain. The NFC is a high-level legitimate forum that allows multisectoral cooperation and stakeholder engagement. It is chaired by the Prime Minister or a designated Deputy Prime Minister. Its members are experts from relevant organisations, including 11 ministries and four executive administrators. The NFC is responsible for proposing

national policy frameworks and strategies as part of a master plan for food management. The Cabinet approved the Strategic Framework for Food Management (SFFM) in 2010, which was integrated into the eleventh NESDP thereafter (Tontisirin, et al., 2013).

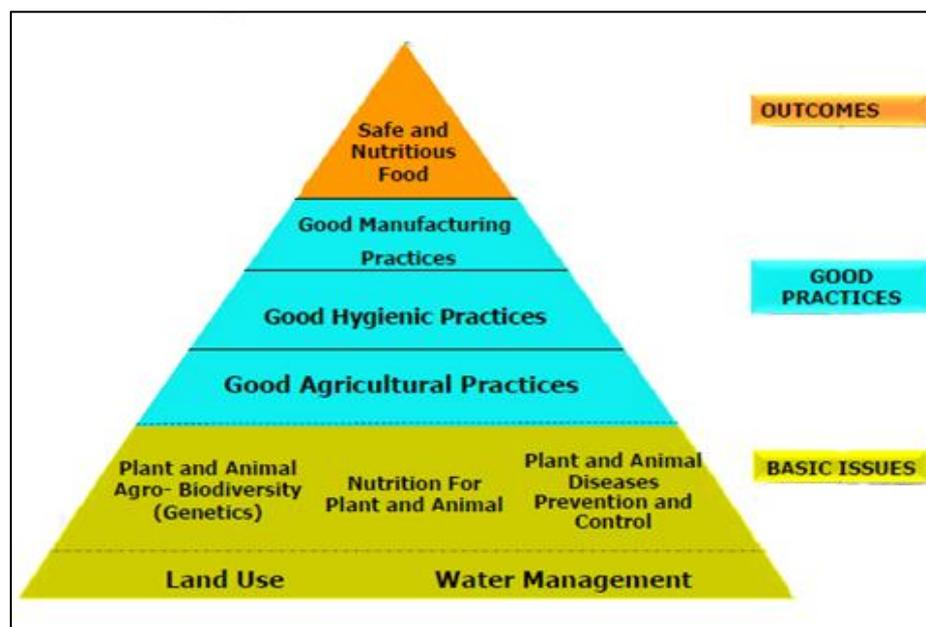
The principles underlying the establishment of the SFFM centred on (i) serving as a guideline for relevant agencies to generate their work plans; (ii) encouraging inter-sectorial participation; (iii) increasing capacity to integrate operations; (iv) undertaking a risk assessment based on scientifically sound evidence; and (v) promoting sustainable benefits for the country (Tontisirin, et al., 2013). The activities of the SFFM include reviewing relevant national and international food strategies and related research, as well as conducting a strengths-weaknesses-opportunities-threats or SWOT analysis to formulate the strategic framework for food management across the entire food value chain as shown in Figures 1 and 2. The concept covers agricultural production requiring proper land use, water management, genetic resources of plants and animals, prevention and control of plant and animal diseases, good agricultural practices (GAPs), good hygienic practices, and good manufacturing practices.

**Figure 1. Agriculture, Food, Nutrition, and Health**



Source: Thai National Food Committee (2011).

**Figure 2. Food Chain Approach**



Source: Thai National Food Committee (2011).

The SFFM comprises four themes: food security, food quality and safety, food education, and food management:

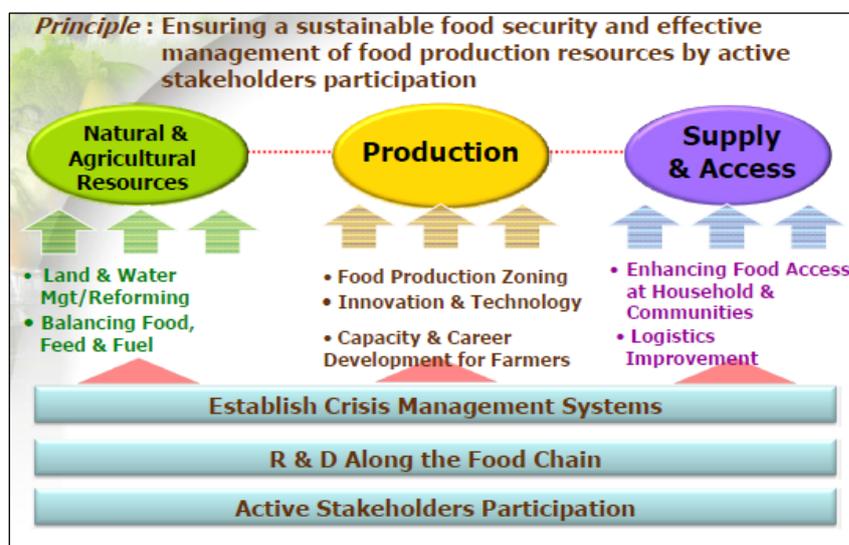
- Theme 1: Food security

This first strategic theme aims to ensure food security at the national, community, and household levels which is the basis for nutrition security. Under this theme, zoning for food and energy crops, improving production efficiency for safe and high quality food, promoting food access by communities and households, conducting research, and improving logistics for food distribution systems are areas of emphasis (Thai NFC, 2011).

The 10 major strategies under this theme are (i) accelerating land reformation and agricultural area protection; (ii) managing water and land resources for agricultural and community forests; (iii) balancing food crop and energy crop production; (iv) improving food production efficiency; (v) creating motivation for agriculture as an occupation and increasing the number of young agriculturalists; (vi) promoting food access at the household and community levels; (vii) developing and improving logistical systems for agriculture and food production; (viii) creating collaboration between governmental agencies, the private sector, and the Thai people regarding food

security protection; (ix) researching and developing technologies and innovations at every step of the food production process; and (x) creating an emergency plan for food security during crises (Thai NFC, 2011). The promotion of household food accessibility can be achieved by encouraging local people to grow local crops of high nutritional value and to raise local fish and animals to create a local ‘food bank’, which can also be used in emergency situations. This agricultural practice follows the SEP. Figure 3 shows the process of promoting food security.

**Figure 3. Strategic Theme 1: Food Security**



mgt = management, R & D = research and development.

Source: Thai National Food Committee (2011).

- Theme 2: Food quality and safety

This second strategic theme entails ensuring food production standards at the community and food industry levels (Figure 4).

**Figure 4. Strategic Theme 2: Food Quality and Safety**



GAP = good agricultural practice, R & D = research and development.  
Source: Thai National Food Committee (2011).

The aim is to produce high-quality and safe foods to protect consumers' health and to facilitate domestic and international trade. Thematic strategies include (i) standardising food safety and promoting implementation; (ii) improving the production of primary food products to meet quality and safety standards and increase their nutritional value; (iii) supporting and overseeing food production at the community level to prevent losses and increase product value; (iv) supporting and overseeing food production at all industrial levels; (v) promoting trade and marketing of standard products at the community and industrial levels; and (vi) strengthening control and monitor mechanisms for national food quality and food safety (Thai NFC, 2011).

Initiatives under this theme include (i) promoting research on breeding and disease control for plants, animals, and other resources to increase their quality and nutritional value, and GAPs; and (ii) increasing the number of farms using GAPs through knowledge transfer and through support for healthy agricultural practices, such as organic agriculture and integrated pest management system. To prevent food and nutritional losses and increase value, food preservation and processing are promoted through research and best practices, such as GAPs, good hygienic practices, good

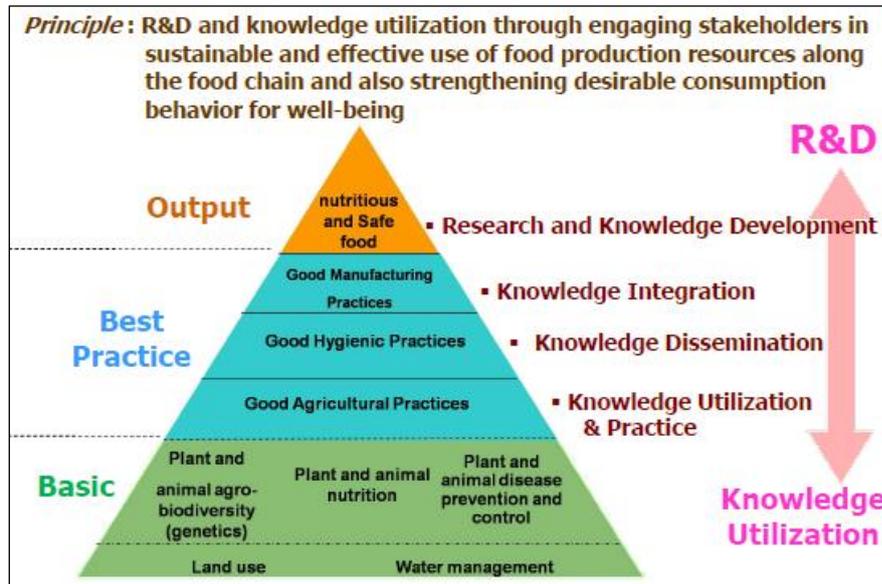
manufacturing practices, and hazard analysis critical control points. Food quality and safety assurance systems are required for both domestic and export foods to ensure consumer protection and facilitate food trade (Thai NFC, 2011).

- Theme 3: Food education

This third strategic theme focuses on knowledge and research promotion, utilisation of research for creating awareness, and resource management for food production and desirable consumer behaviours. Figure 5 shows knowledge management from production processes to output. The theme's major strategies include (i) promoting collaboration and integration of all agencies involved in food education; (ii) supporting applied food research; (iii) creating knowledge management in food education and promoting continual knowledge dissemination; (iv) promoting appropriate food education among agriculturalists and communities; and (v) promoting appropriate individual and community consumer behaviours.

One key strategy under this theme being implemented by the Ministry of Agriculture and Cooperatives (MOAC) is to promote a group called 'food educators of smart farmers'. This group is defined as those persons who are proficient at their jobs; have adequate knowledge and information for decision-making on food production and marketing; are responsible for consumer safety and cognisant of social and environmental concerns; and feel proud to be good farmers. Moreover, developing suitable consumer behaviour indicators for nutrition and health is also emphasised under the food education programme.

**Figure 5. Strategic Theme 3: Food Education**



R & D = research and development.

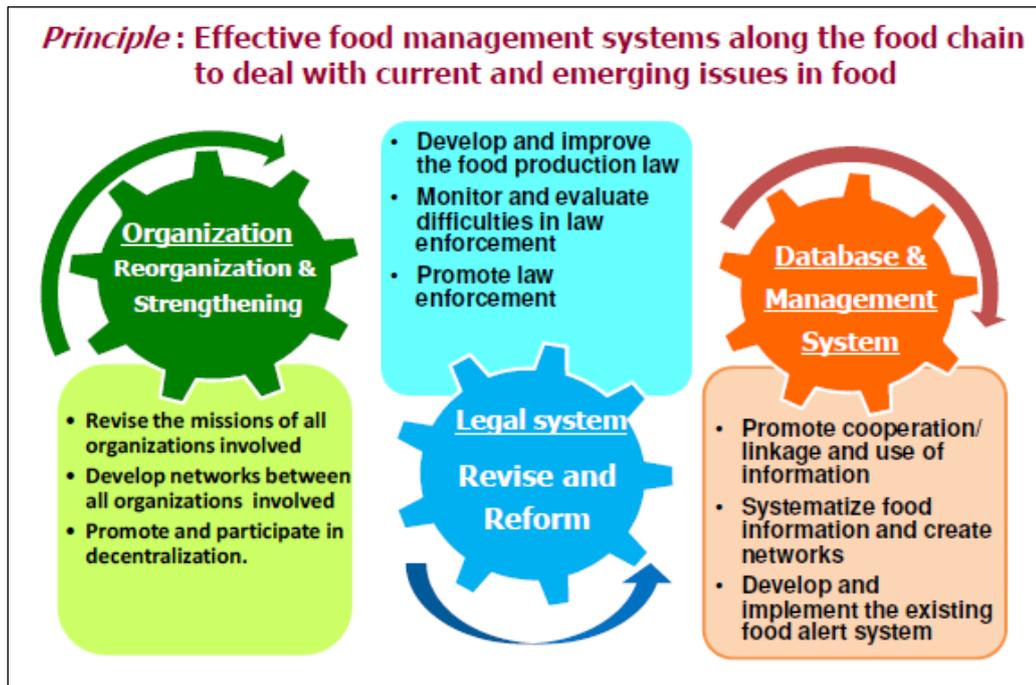
Source: Thai National Food Committee (2011).

- Theme 4: Food management

The fourth strategy aims at systematic improvement in the nation's food value chains during normal times and during crises. Figure 6 shows the schematic presentation of the food management theme.

Food management can be achieved through the following strategies: (i) strengthening the organisational structures of involved sectors and developing networks and cooperation; (ii) improving relevant laws and regulations and their enforcement within the food production chain; (iii) improving database and reducing gaps in national management; and (iv) improving capacity development and decentralisation of authoritative monitoring and evaluation systems. Nevertheless, political influence is a major challenge in managing the food system at a national level since many issues need political approval before they can be addressed. To facilitate decision-making, the SFFM emphasises harmonisation, coordination, and facilitation among key sectors with active participation from academia, the private sector, and non-governmental organisations (Thai NFC, 2011).

**Figure 6. Strategic Theme 4: Food Management**



Source: Thai National Food Committee (2011).

### 3.1.2. Ministerial level

The relevant ministries in Thailand have integrated the NESDP and the national SFFM into their operational guidelines to address food security, food quality and safety, nutrition, and health needs. This section presents the policies of the MOAC and the Ministry of Public Health (MOPH), which are the two main agencies overseeing the food value chains and consumer protection.

#### *Ministry of Agriculture and Cooperatives*

The following are the strategic policies and frameworks related to agriculture and food systems under the MOAC: (i) The Eleventh Agricultural Development Plan, 2012–2016; (ii) Strategic Framework for Food Security, 2013–2016; and (iii) Agricultural Commodity and Food Safety Standards Strategy, 2010–2013 (MOAC, 2009, 2011, 2012).

The purposes of these policies are to (i) increase agricultural productivity to meet domestic and international food demands, (ii) ensure national food security, (iii) develop quality and safety standards for agriculture and food products for consumer

protection, (iv) sustain natural resources, and (v) improve the quality of life of farmers (MOAC, 2009, 2011, 2012).

#### (1) Eleventh Agricultural Development Plan, 2012–2016

This plan aims to support the eleventh NESDP and the SFFM. It consists of three main strategies:

- Strategy 1: Promote the quality of life of farmers

This approach is to encourage farmers to be self-reliant and to be smart farmers; to encourage a new generation to get involved in farming; and to support agricultural institutes and networks in policy development. The concept is that smart farmers should be proficient in all aspects of agriculture and be competent in their work. The farmers are supported by ‘smart officers’ to apply new technologies to farming, thereby promoting a green-economy or zero-waste agricultural initiatives.

- Strategy 2: Increase efficiency in production, management, and food security

The objectives of this strategy are to (i) strengthen the agricultural structure, (ii) develop and improve the quality of agricultural products and food, and (iii) promote agricultural research for development to enhance food security. The important initiatives are to (i) promote food and energy security by balancing production between food crops and energy crops through agricultural zoning for suitable commodities and promoting agricultural research and development; (ii) promote green production and green technology for agriculture; (iii) recycle and reduce agricultural waste and implement GAPs, as well as organic farming and chemical reduction, and include policies to disseminate knowledge and information related to the impact of climate change to reduce carbon emission; (iv) conduct research and development for value-added agricultural products with diversification and quality improvement along the entire food value chain; (v) enhance good-quality and safer production; (vi) encourage farmers to produce in compliance with the standards, as well as appropriate food utilisation and value creation; and (vii) develop agricultural trade and logistical systems to support economic growth.

- Strategy 3: Efficiently develop and balance agricultural resources for sustainability

This strategy focuses on the efficient use and management of sustainable production resources and infrastructure. The initiatives involve (i) developing water

resources, (ii) increasing water reservoirs and irrigation facilities, (iii) rehabilitating fishery resources, (iv) improving land use and soil quality for agriculture, and (v) conducting risk assessments in relation to flood and drought due to climate change and natural disasters (Tontisirin et al., 2013).

## (2) Strategic Framework for Food Security, 2013–2016

This framework's strategic theme was developed based on the concept of food security as defined by the Food and Agriculture Organization (FAO) in 2009, i.e. food availability, food access, food utilisation, and food stability. The main strategies are:

- Strategy 1: Produce adequate food for sustainable domestic demand

This strategy involves (i) increasing productivity, (ii) developing production infrastructure, (iii) minimising the effects of climate change, (iv) enhancing the role of farmer-based organisations in food production, and (v) encouraging investment in the agricultural sector to provide food for domestic consumption.

- Strategy 2: Encourage all Thai people at all times to access good quality and nutritious food

This strategy aims at (i) achieving the target of food access through facilitating local production and self-sufficiency, (ii) restoring the food reserve culture at the household level, (iii) facilitating food logistics within the country, (iv) promoting a social safety net for vulnerable groups, and (v) supporting preventive measures to be prepared for crises.

- Strategy 3: Enhance good quality and safe food production, reduce food waste, and promote appropriate food utilisation

This strategy includes (i) promoting food safety and food standards throughout the food value chain, (ii) enhancing consumer access to nutritious foods, (iii) reducing food loss and waste, and (iv) developing an agricultural database system.

- Strategy 4: Promote sustainable use of natural resources for food production

This strategy focuses on supporting sustainable resource management through participatory approaches and allocating land for farmer ownership, including land tenure rights for sustainable use.

### (3) Agriculture Commodity and Food Safety Standards Strategy, 2010-2013

This strategy focuses on (i) developing standards for the safety of agricultural products and food, (ii) aiming for consumer protection and market and trade competition, and (iii) enhancing demand-driven initiatives, including integration of operations. The main strategies are:

- Strategy 1: Develop quality agricultural products, e.g. crops, fisheries, and livestock

This strategy aims to (i) select target products to develop quality standards within an agricultural safety zone; (ii) create a network model that connects farmers, manufacturers, and distributors to ensure quality standards and prices; and (iii) develop and establish a production structure pattern focusing on enhancing the potential of SMEs.

- Strategy 2: Encourage entrepreneurs to implement safety standards and compliance

The initiatives under this strategy are (i) promoting opportunities for small farmers to abide by the standards through advocacy and group certification; (ii) supporting farmers who are prompt to implement and to comply with the standards; (iii) promoting GAPs implementation; and (iv) establishing a certified body and farm auditors.

- Strategy 3: Conduct research and development for high-quality food products and their markets

The initiatives under this strategy focus on research and development to increase the value of target products along the food value chains. In addition, agricultural and food products certified as quality products are promoted together and linked to markets.

- Strategy 4: Create a food education system and standards to support information, promote education, and improve communication methods

This strategy highlights the importance of food education and knowledge management system. The initiatives involve are (i) providing all stakeholders with knowledge in the food value chain, (ii) strengthening their understanding of and commitment to implementing food safety standards, and (iii) upgrading the quality of food.

- Strategy 5: Ensure confidence in Thai agricultural commodities and food product standards

The initiatives under this strategy emphasise (i) developing a food system monitoring mechanism; (ii) improving the certification of laboratories; (iii) creating a rapid alert system for unsafe agricultural products, food, and feed products; and (iv) encouraging SMEs to implement a traceability system, including promotion of closer cooperation among relevant agencies.

#### *Ministry of Public Health*

The MOPH determines nutrition and health policies and strategies, develops health service and management systems, promotes nutrition and health, controls and prevents diet-related non-communicable diseases (NCDs), and strengthens food safety and quality control systems. Under this ministry, the government's public health policies aim to (i) invest in healthcare services and enhance capacity building; (ii) provide health promotion measures aimed at reducing the morbidity, mortality, and impact of NCDs; (iii) strengthen public health volunteers' potential; and (iv) improve the quality of life of all age groups, including vulnerable groups and the disadvantaged. Moreover, a national health information monitoring system exists that assesses the situation of target groups to formulate evidence-based development guidelines (MOPH, 2009, 2011). The MOPH's major strategic policies and frameworks related to nutrition and food systems are the (i) Eleventh Health Development Plan, 2012–2016; (ii) Thailand Healthy Lifestyle Strategic Plan, 2011–2020; (iii) National Nutrition Plan, 2010–2013; and (iv) Food Safety Strategy, 2012–2016.

#### (1) Eleventh Health Development Plan, 2012–2016

Thailand's health partners have adopted the Eleventh Health Development Plan as a national guideline, which is aligned with the Eleventh NESDP. It has a vision of 'all people being in good health and together building a fair and sufficient health system, leading to a healthy society'. The ministry's main policies are to (i) strengthen health partners and self-reliance in health based on Thai wisdom; (ii) develop a monitoring and response system, especially for disaster management and major health risks; (iii) encourage health promotion, disease control and prevention, and consumer protection;

(iv) strengthen and standardise the health service system to respond to the needs of all target groups; and (v) strengthen a national mechanism to regulate health services and develop a resource management system (MOPH, 2009, 2011).

#### (2) Thailand Healthy Lifestyle Strategic Plan, 2011–2020

The Thailand Healthy Lifestyle Strategic Plan launched in 2012 provides overall guidance for achieving a healthy life. The project emphasises the risks of today's changing lifestyles and unhealthy eating habits that contribute to overweight, obesity, and NCDs. It promotes a sufficiency lifestyle, balanced diet, physical exercise, and suitable emotional management (Bureau of Policy and Strategy, 2011; MOPH, 2012).

#### (3) National Nutrition Plan, 2010–2013

Thailand's national nutrition plan promotes a healthy diet for all age groups and consists of three main areas: (i) obesity prevention, (ii) iodine-deficiency prevention and control, and (iii) optimal growth and development of Thai children.

The first strategy responds to the nation's rising rates of overweight and obesity. Policies focus on a balanced diet for each age group. The national mechanism for the second strategy is the National Committee for Iodine Deficiency Disorder Prevention, which is composed of four subcommittees that work to eliminate iodine-deficiency disorder. The third strategy includes measures to facilitate healthy child growth and development: (i) promoting breastfeeding; (ii) providing supplementary food for pregnant women, complementary food for infants and young children; and (iii) implementing food-based dietary guidelines and encouraging greater consumption of vegetables and reduced consumption of foods high in sugar, fat, and salt.

In responding to NCDs, the ministry has intensified the implementation of public policies on 'less sweet, fat, and salty diets to prolong life'. In addition, it promotes health and nutrition in all hospitals under it through, for example, healthy menus, and encourages consumers to purchase agricultural products certified as quality products from organic farms. Moreover, a project on 'nutrition suitable for all ages' was launched for infants, preschool, and school-aged children so they have sufficient nutrition for their growth and development; and a suitable environment was created in day care centres and schools (MOPH, 2009, 2011).

#### (4) Food Safety Strategy, 2012–2016

This strategy focuses on defining food standards and regulating and monitoring national food safety for consumer protection. Its operations include (i) law enforcement, (ii) system development to control and standardise food products in line with relevant laws, (iii) monitoring and examination of product standards, (iv) conduct of research to gain new knowledge for consumer protection, and (iv) encouragement of related agencies to fully participate in consumer protection (Thai Food and Drug Administration, 2004).

#### *World Health Organization*

Nutrition information, education, and communication strategy under the World Health Organization also plays a vital role in consumer protection in Thailand. This includes knowledge management, as well as holistic food and nutrition promotion involving all parties at all levels (i.e. organisational, local, national, international), and the application of information technology to monitor the nutrition situation of the entire nation. The aim is to create a knowledge centre on agriculture, food systems, and nutrition to promote good agricultural and manufacturing practices, along with dietary behaviours and healthy consumption practices. In addition, undertaking research and development through academic institutions, and training entrepreneurs in technology and quality control of production and distribution of healthy food are aspects of the information, education, and communication strategy.

#### *Other ministries*

Other ministries also play significant roles in supporting food and nutrition system in Thailand. Some of these roles are played within their respective ministries, while others require cooperation with other ministries.

One objective of the Ministry of Industry's (MOI's) Master Plan (2010–2014) is to promote Thai food in terms of its quality and nutritional value. The ministry is also working to standardise Thai food internationally, with the expectation that over half of food processing factories in the country will be guaranteed by international standards. Its vision is for Thailand to be a world leader in the food industry. Its strategies also include (i) creating value in the food industry through research and development, (ii)

upgrading agriculture and food production standards for quality and safety, (iii) raising consumer awareness on food safety and standards, and (iv) increasing competitiveness within the food industry (MOI, 2011).

The Ministry of Commerce (MOC) plays an important role in terms of food prices and distribution. It monitors the fluctuation in food prices to ensure that low-income or disadvantaged groups are not adversely affected. The MOC also monitors the behaviours of entrepreneurs for them to not to take advantage of or harm the consumers. It is involved in regulations and law enforcement in trade and distribution systems to ensure fair trade and food accessibility, especially among low-income households. In addition, the MOC designs consumer protection measures and works to raise public awareness.

The Ministry of Social Development and Human Security supports the nation's welfare system to disadvantaged groups, helping them to meet their basic needs, including food. Food can be provided to vulnerable groups, especially during crises. The ministry supports human security at all levels, including ensuring food security to the needy, especially the disadvantaged and vulnerable groups.

The Ministry of Education (MOE) provides basic nutrition education and promotes a healthy diet among students by integrating relevant knowledge into their regular courses and subjects. In particular, the Department of Elementary Education is in charge of the school lunch and school milk programmes that provide nutritious food and milk to students. School teachers, as well as parents, are encouraged to monitor the growth of students and participate in nutrition and growth promotion activities.

### *Secondary policies*

These secondary policies aim at community development and income generation, and may provide resources for supporting household food security and the health of family members. Some of these policies include the Village and Urban Community Fund Act (2004), the Women's Development Fund (2011), and specific social protection policies, such as universal healthcare coverage.

National research organisations have also created an alliance for food research and development, which is an integral part of the SFFM. The term 'food education' used in the SFFM means researching, developing, and promoting appropriate knowledge,

awareness, and behaviours associated with food production chain and consumption. Key strategies in food education include (i) supporting applied food research, (ii) creating knowledge management on food and facilitating continual knowledge dissemination, (iii) promoting appropriate food education among agriculturalists and communities, (iv) encouraging appropriate individual and consumer behaviours, and (v) promoting collaboration and integration of all agencies involved in food education. In addition, research into expanding opportunities for food production, supply, and marketing in the ASEAN Economic Community (AEC) is emphasised (Tontisirin, et al., 2013).

The National Research Council and other research funding agencies have been working together to promote and support national research. The Agricultural Research Development Agency is charged with managing these issues. The research findings will be disseminated and used to support the implementation of the SFFM (Tontisirin, et al., 2013). The following are the priority food research issues:

- (1) Opportunities and linkages with AEC in the food production and supply chain in the following areas: (i) food marketing research in the AEC; (ii) food production and supply, investment, and logistics in Thailand and other ASEAN countries; (iii) business models for each major food product; (iv) efficient or effective approaches for food distribution or marketing in the AEC; (v) policies, measures, and regulations to strengthen investment and trade in the food sector; and (vi) information technologies for improving food trade logistics (Tontisirin, et al., 2013).
- (2) Food security issues: (i) management and innovative technologies for increasing food productivity in small-scale farming; (ii) early warning and surveillance systems for specific food issues and food insecurity; (iii) adoption of the SEP for strengthening farmer job security; (iv) mechanisations for food production and supply; (v) strengthening of agricultural communities, cooperatives, and SMEs for sustainable growth in food production and supply; (vi) GAPs for high-quality and safe food production employing environment-friendly agricultural technology; (vii) life cycle assessment of food crops or animals and carbon, forest, or water footprints and clean technologies at the farm and industrial levels; (viii) by-product management at the farm and industrial levels; and (ix) information

technology and innovative management for improving logistics in the food value chain (Tontisirin, et al., 2013).

- (3) Food quality and safety issues: (i) utilisation of herbs in controlling diseases in plants, livestock, and fish; (ii) rapid and practical tests for additives and chemicals in foods; (iii) strengthening of quality assurance and food safety surveillance at the local and national levels; (iv) risk assessment of certain foods for consumer protection and trade; (v) functional ingredients in herbs, fruits, and vegetables, and mechanisms of physiological actions; (vi) development of herbal drinks for health promotion; and (vii) strengthening of high-quality and safe food production in the food production and supply chain (Tontisirin, et al., 2013).
- (4) Food education issues: (i) food and food products for different age groups and patients; (ii) mechanisms and functions of specific food components; (iii) conservation and utilisation of local plants and animal foods for biodiversity and food culture; and (iv) strengthening of desirable eating behaviours at the household and community levels in rural and urban settings (Tontisirin, et al., 2013).
- (5) Food management issues: (i) early warning system in food supply chains; (ii) capacity development needed in food and agro-food industry; and (iii) government and academic support in providing regulations and technologies to business sectors for domestic and international food trade (Tontisirin, et al., 2013).

## **4. Discussion**

### **4.1. SDGs related to resilience of food value chains**

Global development towards sustainable growth and shared prosperity requires concerted efforts in which all nations and peoples can be engaged, and no one is left behind. In 2015, the United Nations adopted the 17 SDGs as key development indicators, which all nations should attain by 2030. For Thailand, the SEP has been adopted as guideline in formulating the NESDPs, which are somewhat in line with sustainable development. The SDGs and the SEP will influence development policies

of Thailand over the next 15 years. Clearly, SDG 1 (i.e. ending poverty) and SDG 2 (i.e. ending hunger) are very important for improving the livelihoods and ensuring resilience in food supply chains. Thailand is rightly proud of the country's remarkable record of poverty reduction. Its hunger issue was a daily problem for millions of people 2 decades ago. However, today the problem, although not completely gone, has almost disappeared and the standard of living of the inhabitants has improved considerably. Moreover, SDG 12 (i.e. responsible consumption and production) also aligns well with the pressing need for sustainable consumption and crop production; SDG 14 (i.e. conservation and sustainable use of oceans, seas, and marine resources for sustainable development) will protect natural resources below water, while producing seafood for the country's growing population. Furthermore, SDG 13 (i.e. urgent action to combat climate change and its impacts) is the most effective means to reduce the emissions of greenhouse gases and slow down global warming.

#### **4.2. Mechanisms for promoting food value chains**

The SEP advocates integrated farming that encourages self-reliance for the farmer, addresses larger environmental concerns, and serves to improve the diversity and resilience of farms thereby reducing poverty among farmers. For nearly a decade now, Thai farmers have been advised to choose crops that best suit their soil. For instance, in drought-prone areas, this means moving away from water-intensive crops like rice. Farmers can mitigate risks and help protect against the likelihood of crop failure. With the SEP guiding the way, the Thais are working hard to make the agriculture sector more sustainable and eco-friendly by eliminating dependence on chemical pesticides, herbicides, and fertilisers, and curbing harmful practices like monocropping and slash-and-burn farming (U-tantada, et al., 2006).

#### **4.3. Ensuring responsible consumption and production**

Thailand is raising awareness regarding the need for more sustainable lifestyle. The SEP of moderation and reasonableness can help individuals to be responsible consumers, and guide businesses to implement sustainable production practices. On the consumer side, those who abide by the SEP are more likely to make ethical, knowledge-based decisions. In this respect, they may recycle to avoid wasteful

practices. Manufacturers that incorporate the SEP into their business processes also tend to be more conscious about the effects of their businesses on the environment. They may strive to reduce their carbon footprints, use ethically sourced labour and material, and prioritise sustainability over maximising profits. An example is Doi Chang Coffee Company, an excellent small, community-based enterprise that achieved responsible production by following the SEP. From humble beginnings in the 1970s, the company has grown to become an internationally recognised brand known for high-quality Arabica coffee produced through methods that are eco-friendly, providing much-needed livelihood and preserving indigenous culture (Sue, 2013).

Thailand has promoted the integration of the SEP into corporate policy, value chains, and governance since 1997. The Royal Development Projects Board organised two national competitions to identify top SEP businesses. Mahidol University developed the ‘sufficiency economy business standards’, which are being used as a tool to promote the adoption of the SEP. The National Economic and Social Development Board also established a network of large Thai companies to implement the SEP throughout the companies’ value chains (College of Management, Mahidol University Research Center, 2016).

The government has promoted sustainable consumption and production through various labelling and certification schemes. The oldest, Green Label Thailand, distinguishes the products that cause the lowest environmental impacts in their respective sectors; the list included 450 products in 24 categories from 59 companies. Green public procurement (GPP) policies have also gained momentum; Thailand’s first GPP plan (2008–2011) resulted in carbon dioxide reduction of about 25,685 tons, with the Pollution Control Department spending 62% of its budget on eco-friendly products. The second GPP plan (2014–2016) aims at stimulating more green production; encouraging government implementation of the GPP; improving, monitoring, and promoting sustainable consumption in the public and private sectors and among the public (Pollution Control Department, 2015).

#### **4.4. Balanced management of oceans, seas, and marine resources**

The excessive exploitation of Thailand's marine ecosystem and coastal resources for economic purposes is a major problem in the country. For instance, it is recognised that practices, such as shrimp farming, destruction of mangroves, overfishing, and development and encroachment by the tourism industry are putting the future of Thailand's seas and coasts at risk. The SEP is helping address this problem by encouraging moderation in all productive activities. For fishermen, this may imply abandoning the use of harmful bottom-trawling nets that damage the corals and scoop up everything in their path. Over the years, the spirit of unity inspired by the SEP has helped bring together like-minded talents focused on protecting and rehabilitating the country's marine resources (MOFA, 2015).

For Thai seafood supply chain, Thailand has reforms to deal with illegal fishing, illegal labour practices, and human trafficking. The laws have been enforced and victims are being protected and rehabilitated; criminals are being brought to justice. All relevant agencies in Thailand are now working under one umbrella, the Command Center for Combating Fishing, which has led to better coordination, quicker decision-making, more integrated actions across line agencies, and less bureaucracy. The command centre has also pushed ahead with a range of measures, such as mandatory installation of satellite-tracking vessel monitoring system devices on fishing vessels and at-sea inspection (Prachatai English, 2015).

The new Fisheries Law enforced in 2015 is an important milestone, making a fundamental change from an open to a managed access system to ensure long-term sustainability. The new law will also enhance control over Thai fishing vessels in the high seas through better oversight measures. In the meantime, Thailand is building a traceability system for seafood value chain through a computerised system that is in line with international standards. The Government of Thailand is now ready to expand and strengthen cooperation with all interested stakeholders, including foreign governments, international organisations, private sector, civil society groups, the media, the Environmental Justice Foundation, the Labor Rights Promotion Network Foundation, and the Thailand Department of Fisheries (2015).

#### **4.5. Action to combat climate change and its effects**

Climate change represents one of the most complex challenges in history, since this phenomenon is a global crisis without boundaries that will severely affect agriculture and the entire food system, including fisheries and biodiversity. The SEP provides the mindset and strategy to help minimise the threat of climate change by encouraging the idea of acting with knowledge and virtues. This means being prudent and planning to prepare for future risks and shocks. As a consequence, Thailand's largest companies are addressing this issue through corporate visions that consider business's impact on environment or local communities. Thus, rather than acting as powerful lobbyists against regulation, private sector practitioners of the SEP are involved in the development of 'clean energy' technology and the adoption of 'green manufactory' practices and environmental protection mechanism (MOFA, 2015).

### **5. Conclusions and Recommendations**

Thailand has been implementing a growth and development model based on the SEP. The SEP focuses on transforming the economics of exploitation into the economics of moderation and resilience. It fosters a rational decision-making that is practical and simple to implement, and flexible to different challenges, irrespective of whether one is a consumer choosing what to buy, a businessman deciding on operation procedures, or politicians making a call on public policies. The SEP requires that human decisions should be inclusive, cost-effective, and environment-friendly. For example, when Thailand was under the threat of economic crisis in 1997, moderation is the SEP's overriding principle. When globalisation brings with it economic uncertainties and risks, the SEP advocates prudence and built-in self-immunity to cope with external shocks; when uncertainties and risks are very high, the SEP's advice is to persevere and strive on.

The SEP can also be used as a means of achieving the SDGs. For example, the SEP supports SDG 12 (i.e. responsible consumption and production). Thus, it encourages a holistic farm management system that aims to minimise farmers' vulnerability and promote sustainability, food security, water preservation, and biodiversity. This also aligns with SDG 1 (i.e. ending poverty) and SDG 2 (i.e. ending

hunger). At the macroeconomic level, practising the SEP in these times of global economic volatility will also help Thailand to boost its resilience to internal and external shocks, especially in food value chains. Thailand has been sharing its experience and best practices in the application of the SEP as a growth and development model with interested developing countries through various cooperation frameworks.

Following the tsunami in 2004, the flood in 2011, and the increasing frequency of violent storms and floods, the most effective way to slow down global warming is to cut the emission of greenhouse gases. This is in relation to SDG 13: Thailand intends to reduce greenhouse gas emission by 20% by increasing the forest cover. The SEP programmes in this regard are (i) Monkey's cheeks method, (ii) royal rain, (iii) mangrove reforestation, (iv) refuse-derived fuel, and (v) alternative energy policy support.

The ocean, coastal, and marine resources play an essential role in human well-being and social and economic development in Thailand. To achieve SDG 14 (i.e. conservation and sustainable use of oceans, seas, and marine resources for sustainable development), the Government of Thailand is working assiduously based on the SEP to stop coastal erosion and to rehabilitate the mangroves and coral reef. Thailand has improved the nationwide ban on commercial trawlers. The ban is part of the government's attempts to restore marine ecology. The new Fisheries Law enacted in 2015 is the reform of the fisheries sector to ensure sustainable use of sea and marine resources. The new law increases the penalties for illegal, unreported, and unregulated fishing, and limits the number of fishing vessels to prevent overfishing.

Now the questions: Chained to Sustainable Development Goals? What would be the changing role of entities for enhanced resilience along agriculture food value chains in Thailand?

It can be concluded that Thailand is not fully chained to the SDGs since the country is already implementing a sustainable development strategy within the context of the SEP. The political actors and organisations within Thailand are working diligently to achieve sustainable development in all dimensions. However, to some extent, not all dimensions within the SDGs are fully captured by the SEP. Hence, more work is required from the political actors and organisations to enhance resilience along

agriculture food value chains. In this respect, additional roles are required from the institutions. Therefore, the study provides the following policy directions for ensuring resilience and reducing risks in food value chains in Thailand:

- (1) The development policies and plans being implemented in Thailand should be continued. For instance, the NESDP and the SFFM are laudable programmes, and continuing the implementation of these programmes with active participation of all responsible organisations (i.e. MOAC, MOPH, and MOI) would not only enhance resilience but also reduce risks of food shortage, contamination, and poisoning in Thailand. Furthermore, the sufficiency economy programmes established by His Majesty The King to eradicate poverty and hunger should be continued and replicated across the country.
- (2) The MOAC should be more proactive in its functions against floods, droughts, and other disasters affecting farms and the entire food system. Its additional role to provide early warning and forecasting of natural disasters would help to mitigate the effects of these destructions on farms and other entities, such as processing factories and agricultural food warehouses. For instance, early warnings on floods and drought would provide information for the adoption of strategies regarding crop zoning and type across the country, thereby ensuring sufficient supplies of food at all times.
- (3) The MOPH should continue to determine nutrition and health policies and strategies, and strengthen food safety and quality control systems. It is important that it should work closely with the MOI to ensure that standards on food are followed in all stages of the food value chain to reduce risk of food contamination and poisoning. Food production, preservation, and processing practices, such as GAPs, good hygienic practices, good manufacturing practices, and hazard analysis critical control points should be strictly adhered to by entities in the food value chains. In this respect, MOPH, MOI, and MOE should play a significant role to ensure compliance by the organisations. Likewise, the law enforcement agencies on food should be active in their functions. The MOC should continue to monitor food distribution and price fluctuations, and should be more proactive. Cooperation among the MOC, MOAC, MOPH, and MOI is critical to strengthening the agricultural food value chains and to reducing food market and

food contamination risks and poisoning in Thailand. This cooperation would facilitate quick information flow from the farm level to the processing, wholesale, and retail stages of food value chains, thereby ensuring the adoption of quicker response strategies to minimise the risks due to potential food contamination and volatilities in prices.

- (4) Research institutions and relevant departments in the universities have critical roles to ensure resilience and risk reduction in food value chains. Research into the following areas on food production and supply chain linkages are paramount: (i) food production and supply; (ii) investment, logistics, and efficient ways of distribution and marketing of agricultural products; (iii) business models for each major food product; (iv) measures and regulations to strengthen investment and trade in the food sector; (v) information technologies for improving food trade logistics; (vi) management and innovative technologies for increasing food productivity; (vii) early warning and surveillance system for specific food crops and food insecurity; (viii) GAPs for high-quality and safe food production; (ix) employment of environment-friendly agricultural technology; (x) life cycle assessment of food crops and animals; (xi) carbon footprints and clean technologies at the farm and industrial levels; (xii) by-product management at the farm and industry levels; (xiii) utilisation of herbs in controlling diseases in plants, livestock, and fish; (xiv) strengthening of quality assurance and food safety surveillance at the local and national levels; (xv) risk assessment of certain foods for consumer protection and trade; (xvi) functional ingredients in herbs, fruits, and vegetables, and mechanisms of physiological actions; (xvii) food and food products for different age groups and patients; (xviii) mechanisms and functions of specific food components; (xix) conservation and utilisation of local plants and animal foods for biodiversity and food culture; (xx) strengthening of desirable eating behaviours at the household and community levels in rural and urban settings; (xxi) early warning system in food supply chains; (xxii) capacity development needs in the agro-food industry; and (xxiii) government support in providing regulations and technologies to businesses in the agricultural food sector. Furthermore, the relevant departments in Thai universities should develop a course on enhancing resilience and reducing risks in food value chains under the

SDGs. Similarly, it is imperative that the universities offer periodic short-term training programmes to officials of organisations, such as the MOAC, MOPH, and MOI, on the aforementioned course. Also, the distribution of bulletins derived from high-level scientific research by universities and research institutions to the stakeholders in the food industry and the public at large, on specific ways of enhancing resilience and reducing risks in food value chains, would be a step in the right direction.

- (5) International organisations, such as the FAO, United States Agency for International Development (USAID), World Bank, and Asian Development Bank, should continue playing their respective active roles and undertake further responsibilities when needed to enhance the resilience of food value chains. For instance, the continued provision of grants by the USAID to undertake research on food value chains, and the assistance by the FAO, World Bank, and Asian Development Bank on the development of food value chains are worthy of emulation by other international organisations operating in Thailand.

These recommendations would be operational only with the support of political actors in Thailand. Hence, the cooperation of people in the offices of His Majesty The King, the Prime Minister, and other high-ranking officials in Thailand is needed to ensure effective implementation of these proposals.

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