Mahidol University
Institute for Population and Social Research

# Thailand Food System Study Project

## Institute for Population and Social Research, Mahidol University

# 7-dimensional food system indicators

This edition of the Thailand Food System Indicators was developed from the selection of food system indicators by the Food and Agriculture Organization of the United Nations (FAO) and the International Dietary Data Expansion Project. The set of indicators was submitted to a panel of experts for consideration and approval through use of three rounds of the Delphi technique.

After adjusting each indicator to correspond with the context of Thailand, the indicators can be classified across the following seven dimensions:

1) Food nutrient adequacy (12 indicators)
2) Ecosystem stability (9 indicators)
3) Food affordability and availability (10 indicators)
4) Sociocultural wellbeing (9 indicators)
5) Resilience or recovery (10 indicators)
6) Food safety (7 indicators)
7) Waste and loss reduction (5 indicators)

**Total: 62 indicators**

This set of indicators was developed using different assessment methods at the individual, local, and national levels, depending on the suitability of each indicator. Currently, the project is in the process of compiling the data for each indicator by searching various documents and databases in Thailand. The final set of indicators, values, and targets will be the basis for policy recommendations provided to the relevant agencies.

## Definitions and Scope

*"Area"* refers to the geographic or administrative domain which is selected for studying food system indicators. The area can be adapted according to the objectives of that study and according to the role and responsibility of the project administrator. The area to be studied may be national or sub-national, e.g., region, province, district, sub-district (Tambon), municipality, or village. Program administrators can adapt the indicators according to the context and area of interest.

### 1) Food Nutrient Adequacy (FN): 12 indicators, 38 sub-indicators

| Order | Indicator | Assessment Method |
|---|---|---|
| **Consumption Behavior** | | |
| 1.1 | Food consumption sufficiency of households according to income group, age range, occupation group and area | **Individual Level (for analysis at the local and national levels)**<br>- Amount of rice/starch (staple food) consumed per person per day (grams) (classified by age group, income, region)** |
| | | - Amount of food that provides protein consumed per person per day (grams) (classified by age group, income region) |
| | | - Amount of vegetables and fruits consumed/person/day (grams) (classified by age, income, region)**<br>Note: Institute of Nutrition, Mahidol University, recommends that, for children aged 6-14 years, eat at least 250 grams of fruits and vegetables per day, and the World Health Organization (WHO) recommends adults 15 years or older to eat at least 400 grams of fruits and vegetables per day. (Phulkerd, S., Chamrasritthirong, A., Gray, R., Thepsuwan, S., and Thongcharoenchupong, N., 2019) |
| | | **Household Level (for analysis at the local and national levels)**<br>- Adequacy level of rice/flour food consumed in the household (classified by income, region) |
| | | - Adequacy of protein foods consumed in the household (classified by income, region) |
| | | - Sufficiency of vegetables and fruits consumed in the household (classified by income, region)<br>Note: The level of sufficiency is assessed from opinions of household members (e.g., 'high,' 'medium,' 'low') |
| 1.2 | Food consumption and household spending patterns on processed and fast food | **Individual Level (by urban/rural)**<br>- Frequency per week of consuming fast food and processed food |
| | | **Household Level (by urban/rural and level of household income)**<br>- Proportion of expenditure on fast food and processed food (baht) to total household food expenditure (baht) |
| | | **National Level** |

| Order | Indicator | Assessment Method |
|---|---|---|
| | | - Annual sales of fast food and processed food products (classified by region)<br>*Note:* 'Fast food' or 'processed food' refers to food that can be prepared and cooked quickly. Since the food has been processed, the food may be refrigerated or frozen. These are foods that are high in saturated fat, cholesterol, calories, or energy. They usually contain high levels of processed sugar, sodium, preservatives, and artificial substances to enhance taste. They are also inexpensive and can be easily accessed. These fast or processed foods include hamburgers, deep-fried potatoes/meatballs/chicken, and these can be found in convenience stores, drive-thru outlets, delivery services, roadside restaurants, markets, hawkers, pushcart vendors, etc., (Health Guides, 2022; National Health Service, 2020; Segen's Medical Dictionary, 2011). |
| 1.3 | Consumption of high-sugar beverages | **Individual Level (by age and income)**<br>- Number of servings (250 ml) of sugary beverages per week |
| | | **National Level**<br>- Sales of sugary beverages per year<br>*Note:* "Sugary beverages" refers to drinks that contain more than 6 grams of sugar per 100 ml[1] -- which may be carbonated or drinks made from fruits, plants, vegetables, including tea and coffee. |
| 1.4 | Consumer awareness of healthy food consumption in terms of type, portion, and quantity for different age and income groups. | **Individual, Local and National Level**<br>- Percentage of the population who are aware of adequate intake of carbohydrates such as rice, flour, cassava/taro, classified by age, household income, and region |
| | | - Percentage of the population who are aware of eating enough fruits and vegetables classified by age, household income, and region |
| | | - Percentage of the population who are aware of eating enough protein foods such as eggs, meat, fish, nuts, classified by age household income and sector/region |
| **Health outcomes and nutrient adequacy** | | |
| 1.5 | Population with overweight and obesity[2] | **Local Level** |

[1] (Phonsuk, P., Vongmongkol, V., Pongutta, S., Suphanchaimat, R., Rojroongwasinkul, N., Swinburn, BA., 2021)

[2] **Assessment of children under 18 years of weight versus height. It can be used to assess both wasting and overweight conditions. Children whose weight relative to height was less than -2 times the standard deviation away from the median of the reference population were considered to be moderately or severely wasted. For children whose weight relative to height was less than -3 times the standard deviation from the median of the reference population. Considered to have severe emaciation. Wastingness is generally caused by a lack of food or illness. The prevalence of wasting may change seasonally due to abundance or lack of food, or the prevalence of disease. Children who were**

| Order | Indicator | Assessment Method |
|---|---|---|
| | | - The ratio of the population with a waist circumference of ≥90 cm in men and ≥80 cm in women, by sex, age, occupation, and income.<br>- Percentage of population with onset of overweight and obesity by sex, age, occupation, and income<br>- Number of people with onset of overweight and obesity by sex, age, occupation, and income |
| | | **National Level**<br>- The ratio of the population with a waist circumference of ≥90 cm in men and ≥80 cm in women, by sex, age, occupation, and income<br>- Percentage of population with onset of overweight and obesity by sex, age, occupation, and income<br>- Number of people with onset of overweight and obesity by sex, age, occupation, and income |
| 1.6 | Population with type 2 diabetes | **Local Level**<br>- The proportion of the population with type 2 diabetes of the total population in the area by age group and individual income |
| | | **National Level**<br>- The proportion of the population with type 2 diabetes of the total population by sex, age, occupation, and income |
| 1.7 | Children with malnutrition | **Local Level**<br>- Percentage of children with urinary iodine <100 μg/L by age group (under 1 year, 2-5 years, 6-9 years, 10-14 years)<br>- Number of children with urinary iodine <100 μg/L by age group (under 1 year, 2-5 years, 6-9 years, 10-14 years) |
| | | **National Level**<br>- Percentage of children with urinary iodine <100 μg/L by age group (under 1 year, 2-5 years, 6-9 years, 10-14 years)<br>- Number of children with urinary iodine <100 μg/L by age group (under 1 year, 2-5 years, 6-9 years, 10-14 years) |

**overweight for height and had a standard deviation greater than +2 were considered moderately or severely overweight (National Statistical Office, 2020c). Waist circumference is the value obtained with standard tape measure. The waist is measured at the at the midline position of the waistline between the lower edge of the lower rib and the upper edge of the iliac crest, and is parallel to the ground. Abdominal obesity was defined as waist circumference ≥90 cm in men and ≥80 cm in women (Wichai Ekpalakorn (Editor), 2014). Body mass index (BMI) = body weight (kg) / height ( m)$^2$ = ..... Kg/m$^2$ . Overweight or obesity refers to a BMI of 23 kg/m$^2$ or more. BMI is considered underweight if the BMI <18.5; physically fit = BMI of 18.5 - 22.9; overweight or obese (Degree 1) = BMI 23.0 - 24.9; overweight of obese Degree 2 = BMI 25.0 - 29.9; dangerous obesity or obesity Degree 3 = BMI of 30.0 or higher (Department of Disease Control, 2020).**

| Order | Indicator | Assessment Method |
|---|---|---|
| | | *Note*: Not getting enough iodine (urinary iodine level <100 μg/L) (Wichai Ekpalakorn. (Editor), 2014) |
| 1.8 | Children who are stunted or severely thin [3] | **Local Level and National Level**<br>- Number and percentage of stunted children by age group **<br>- Number and percentage of children stunted or severely skinny (stunting and wasting), by age range |
| 1.9 | Breastfeeding | **Local Level**<br>- Percentage of infants under 6 months of age who are exclusively breastfed by income group<br>- Percentage of children aged 12-15 months (1 year) and 20-23 months (2 years) who were breastfed on the day before the interview by income group<br>*Note*: MICS survey of some provinces. |
| | | **National Level**<br>- Percentage of infants under 6 months of age who are exclusively breastfed by income group<br>- Percentage of children aged 12-15 months (1 year) and 20-23 months (2 years) who were breastfed on the day before the interview |
| **Nutritional value and variety of food in the market** | | |
| 1.10 | Food products with clear nutrition labels | **Local Level and National Level**<br>- Number of food products with specified source<br>- Number of food products with specified ingredients<br>- Number of food products with specified energy and nutrients |
| 1.11 | Food diversity rating at market level (Market-level food diversity score) | **Local Level and National Level** |

[3] **Height-age It is a linear measure of a child's growth. Children whose height relative to age was less than -2 times the standard deviation from the median of the reference population are classified as being short for their age or having moderate or severe stunting. For children whose height relative to age was less than -3 times the standard deviation from the median of the reference population are considered to have severe short stature. Stunting or chronic malnutrition reflects a prolonged lack of adequate nutrition early in life and/or frequent or chronic illness. A median of the reference population of less than -3 times the standard deviation is considered severely underweight compared to height. That indicator can be used to assess both wasting and overweight conditions. Children whose weight relative to height was less than -2 times the standard deviation from the median of the reference population were considered to be moderately or severely wasted. For children whose weight relative to height was less than -3 times the standard deviation from the median of the reference population. Were considered to have severe emaciation. Wasting is generally caused by a lack of food or illness. The prevalence of wasting may change seasonally due to abundance or lack of food, or the prevalence of disease. Children who were overweight for height and had a standard deviation greater than +2 were considered moderately or severely overweight (National Statistical Office, 2020c).**

| Order | Indicator | Assessment Method |
|---|---|---|
| | | - Having 9-16 main food groups [4] found in the locality (Household Dietary Diversity Score-HDDS) (classified by fresh market and supermarket) **<br>*Note:* Based on the number of different foods or food groups available in the local market at any given time |
| **Policy Dimension** | | |
| 1.12 | Promotion of food production that contains ingredients for healthy food consumption | **Local Level**<br>- Number of projects (government, private sector, civil society) promoting healthy food consumption |
| | | **National Level**<br>- The number of measures or regulations to control the production and ingredients in food and beverages that are harmful to health, such as tax policies on sugary drinks |

## 2) Ecosystem Stability (ES): 9 indicators; 32 sub-indicators

| Order | Indicator | Assessment Method |
|---|---|---|
| **Natural Resources and the Environment** | | |
| 2.1 | State of natural resources: Quality, properties and contamination of the water, land, forests, biodiversity, air) | **Local Level and National Level**<br>- Percentage of natural forest area (excluding planted forests, rubber plantations, economic forest plantations) per area of the country** |
| | | - Size of community forest area (rai per year) |
| | | - Quality of surface water and coastal water (According to the Pollution Control Department) |
| | | - Sufficiency of water for agriculture (measured as rainfall per year) ** For example, New Theory Agriculture requires approximately 1,000 cubic meters of water per 1 rai of cultivation[5] |
| | | - Soil properties that are suitable for planting each type of crop. |
| | | - Amount of greenhouse gases classified by the agricultural, industry, and transportation sectors** |
| | | - Air quality (air pollution, PM2.5 level, etc.) |

[4] Classified by season: 1. Rice or grains; 2. Vitamin-rich vegetables such as pumpkin, carrots, sweet potatoes; 3. Other tubers such as potatoes, cassava; 4. Green leafy vegetables (Vitamin A); 5. Other vegetables; 6. Vitamin-rich fruits such as mango, papaya; 7. Other fruits, including wild fruits; 8. Meat (fresh meat) such as pork, chicken, beef, duck meat; 9. Organ meat such as liver, heart, blood; 10. Eggs such as chicken eggs, duck eggs; 11. Fish and seafood such as fresh fish, dried fish; 12. Nuts, dried beans and seeds; 13. Milk and dairy products; 14. Desserts; 15. Oils and fats; 16. Spices, seasonings, beverages (Pingali, P.& Ricketts , K., 2014; Kennedy, G., Ballard, T. & Dop, M, 2014).

[5] (Chaipattana Foundation, 2010)

| Order | Indicator | Assessment Method |
|---|---|---|
| | | - Biodiversity (e.g., increase or decrease in flora and fauna) |
| 2.2 | Degradation of agricultural land | **Local Level and National Level**<br>- The size of agricultural areas with surface water quality at very deteriorated levels. [6] (According to the Pollution Control Department) |
| | | - Coastal water levels are deteriorated or very deteriorated. |
| | | - The size of agricultural areas with soil quality problems for cultivation, such as soil contaminated with toxins |
| 2.3 | Environmentally-friendly food packaging to reduce the use of unnecessary packaging or use of recyclable packaging materials, packaging that is biodegradable or able to decompose organically (compostable) | **Local Level and National Level**<br>- An increase in the number of non-packaged food products in the market or supermarket per year, such as thick-skinned vegetables/fruits that do not need packaging |
| | | - An increase in the number of food products that use packaging materials that are recyclable, biodegradable, or compostable per year<br>- Classify food products at the industrial level (Mass) and products from community enterprise groups |
| | | - An increase in the number of food entrepreneurs (restaurants/modern trade entrepreneurs) that reduce/eliminate packaging per year |
| | | - An increase in the number of food operators (restaurants/operators ordering food delivery/modern trade operators) using recyclable/biodegradable packaging per year |
| 2.4 | Climate change | **Local Level and National Level**<br>- The change in rainfall per month and per year that affects the crop yield (mm) |
| | | - Changes in temperature (average, min, max) per month and per year which affect plant growth (Celsius) |
| 2.5 | Greenhouse gas reduction mechanisms (mitigation) | **Local Level and National Level**<br>- Reduction of agricultural burning to prepare land for cultivation |
| | | - An increase in the use of clean energy in the agricultural sector such as solar energy, wind energy, etc. |
| | | - Decrease in the use of fossil fuels in agriculture** |

[6] Assessment of quality of surface water uses the General Water Quality Index (WQI) with scores ranging from 0 to 100 points: 91–100 = very good water quality, 71-90 = good; 61-70 = fair; 31-60 = deteriorated; 0-30 = very deteriorated. The score is obtained by combining the scores of eight water quality index parameters: pH, Dissolved Oxygen (DO), Total Solids (TS), Fecal Coliform Bacteria (FCB), Nitrate (NO3), total phosphorus (TP), suspended solids (SS), and organic impurities (Biological Oxygen Demand (BOD.) The values were added together as a total score (Pollution Control Department, (no date).

| Order | Indicator | Assessment Method |
|---|---|---|
| | | - Increase of rail transport routes |
| 2.6 | Organic agricultural land[7]/ ecological agriculture [8]/safe agriculture[9]/agro-forestry[10]New Theory Agriculture[11]/integrated agriculture[12] | **Local Level and National Level**<br>- The size of the organic farming area / community ecological agriculture / safe agriculture / agroforestry / new theory agriculture / integrated agriculture (square kilometers) ** |
| | | - Percentage of organic farming/ecological agriculture/safe agriculture/agroforestry/new theory agriculture/integrated agriculture per total area in the community |
| | | - Proportion of organic farming / ecological agriculture / safe agriculture / agroforestry / new theory agriculture / integrated agriculture of all agricultural area in the community<br>*Note*: All community agriculture (including urban and non-municipal areas) for different production systems (e.g. organic farming, agro-ecology, general, etc.) |
| **Area and diversity of resources** | | |
| 2.7 | Regulations and policies to promote environmentally friendly agriculture | **Local Level and National Level**<br>- Having regulations and policies that support biodiversity, soil, water, ecosystems, and sustainable farmland per year |

7 'Organic farming' refers to an agricultural system that focuses on environmental, social and economic sustainability by emphasizing soil improvement, respect for the natural potential of plants, animals and agro-ecology. Organic farming reduces the use of external production factors and avoids the use of chemicals. The strategy is to apply nature to increase productivity and improve disease resistance (Office of the National Economic and Social Development Council, 2011).

8 'Ecological agriculture' means farming in conjunction with natural ecosystems. The aim is to achieve a balance between economy, society, and the environment. promote food production, food security, and nutrition while restoring ecosystems and biodiversity (SDG Move, 2021).

9 'Safe agriculture' means good agricultural practices (GAP) according to the standards set by the National Bureau of Agricultural Commodity and Food Standards. The production process must be safe for farmers and consumers, and free from chemical contamination and does not pollute the environment (Department of Land Development, 2016).

10 'Agroforestry' refers to an agricultural system that operates in forest areas, such as planting crops in natural forest areas, take animals to graze in the forest, collecting forest products for sustainable use, and the creation of an agricultural system that mimics the natural forest ecosystem which is a dense perennial system, covered with trees and has high humidity (Office of the National Economic and Social Development Council, 2011).

11 'New Theory Agriculture' refers to guidelines or principles for land and water management for agriculture in a small area to maximize the benefits (Chaipattana Foundation, 2010).

12 'Integrated agriculture' refers to an agricultural system that includes growing crops and raising animals. In this system, there are many animals in the same area, whereby each type of production activity must be able to effectively benefit one another. It is an appropriate use of resources available in the farm for maximum benefit. There is a balance of the environment and increased abundance of natural resources (Office of the Permanent Secretary, Ministry of Agriculture and Cooperatives, 2016).

| Order | Indicator | Assessment Method |
|---|---|---|
| | | - Having community codes of conduct that support biodiversity, soil, water, ecosystems and sustainable farming practices per year |
| | | - Having regulations and policies to regulate the annual use of chemicals and hormones in agriculture, livestock and fisheries |
| | | - Having regulations and policies to control the use of fishing gear that kills immature fish per year |
| | | - Having a project to promote and educate and monitor the evaluation of regulations and policies to promote environmentally-friendly agriculture per year |
| 2.8 | Having policies and plans that encourage actionable initiatives to promote environment-friendly food systems. | **Local Level and National Level**<br>- Having annual policies, action plans, incentives and practical initiatives to promote environment-friendly food systems |
| 2.9 | Having policies, regulations for the preservation of agricultural land in both rural and urban areas | **Local Level and National Level**<br>- Having policies, regulations and support for the conservation of agricultural land<br>Use of relevant open space in both rural and urban areas that can be used to produce practical results per year |

### 3) Food Affordability and Availability (FA): 10 indicators, 33 sub-indicators

| Order | Indicator | Assessment Method |
|---|---|---|
| **Access/Food Production** | | |
| 3.1 | The presence of agricultural land in the city | **Local Level**<br>- Percentage of food-producing agricultural areas in the city per total urban area |
| | | - Percentage of food-producing agricultural land in low-income communities per total low-income community area |
| | | - Percentage of households using food-producing agricultural land in low-income communities per total household in low-income communities |
| | | - The number of communities allocating common areas for urban food production |
| 3.2 | Population and urban households involved in urban/community food production | **Local Level**<br>- Percentage of households in the area/community that grow vegetables or fruits for their own consumption to the total number of households in the area |

| Order | Indicator | Assessment Method |
|---|---|---|
| | | - Percentage of households in the area/community that grow vegetables or fruit for sale to the total number of households in the area |
| | | - Percentage of the population that involve in the process of growing vegetables or fruits for their own consumption per total population in the area/in the community |
| | | - Percentage of the population that involve in the process of growing vegetables or fruits for sale per total population in the area/in the community |
| 3.3 | The presence of urban agricultural producers that sell or share their produce directly with consumers (e.g., community-supported agriculture (CSA), box schemes) and households using the service | **Local Level**<br>- The number of agricultural producers or CSAs which sell or share the agricultural produce produced in the area |
| | | - The number of agricultural producers or CSAs that provide delivery services for produce in the area. |
| | | - Percentage of households purchasing agricultural produce from CSAs or local growers per total household |
| | | - Number of green markets in the area<br>*Remarks*: Community Support Agriculture – CSA means community-supported organic agriculture. Consumers who are members pay for food from is agricultural products in advance. That way, they are guaranteed to receive seasonal vegetables and fruits that are delivered according to the agreed time |
| 3.4 | Land access and agricultural land allocation for urban/community food production | **Local Level**<br>- Having agricultural land for food production in urban areas/communities for people in the community to benefit |
| | | - The number of communities allocating agricultural land for their own food production |
| | | - Proportion of households benefiting from agricultural land for food production in urban/community areas |
| **Access to/Sales of Food** | | |
| 3.5 | Access to the fresh fruit and vegetables | **Local Level**<br>- Number of shops, points of sale, or fruit orchard areas in the community** |
| | | - Number of shops, sales points or vegetable gardens located in the community**<br>'Selling point' means fresh market, flea market, peddler, supermarket, convenience store, etc.<br>'Source of garden produce' means the area where one can go to collect or buy fresh vegetables and fruits |

| Order | Indicator | Assessment Method |
|---|---|---|
| 3.6 | Access to nutritious food | **Local Level**<br>- Percentage of households located in a radius of 1 km[13] from the point of sale of healthy food in the community per total households in the area |
| | | - Percentage of households whose distance from home via a road is closer than 1 km from a health food stand or outlet in the community per total households in the area |
| | | - Percentage of households purchasing home delivered food from health food outlets in the community per total households in the area<br>*Note*: 'Food point' or 'food source' means all food shops or sources, including outlets that sell fresh food, food products, and/or cooked food.<br>'Radius' represents the distribution.<br>'The distance from the house via a road' represents the distance or duration of travel<br>'Healthy food' means food that is beneficial to the body, helps reduce the risk of various diseases, helps to maintain a healthy body, and will result in good mental health. Healthy food is high in dietary fiber but low in fat, cholesterol, sugar and salt (sodium), according to food-based dietary guidelines. The World Health Organization recommends a healthy diet for adults, including fruits, vegetables, nuts and whole grains, with daily amounts specified as at least 400 grams of fruit and vegetable with less than 10% sugar (or about 50 grams), and less than 30% fat, and less than 5 grams of salt. These amounts should help balance the energy needs and expenditure of the body on a daily basis (GinDuD, 2021; National Health Service, n.d.; Salubrity, N.P.; WHO, 2020; Division of Alternative Medicine, 2008). |
| **Food Affordability** | | |
| 3.7 | Food affordability index | **Local Level and National Level**<br>- The average ratio of food expenditure to daily income among unskilled or low-skilled workers (i.e., groups at risk of food price fluctuations that can lead to food insecurity and poor nutrition)** |
| | | - Proportion of the population below the food poverty line **<br>*Note*: 'Food poverty line' means having income or expenditure below the level necessary to purchase or provide sufficient nutritious food. This excludes non-food expenditures. The FAO recommends an adequate energy level for adults of 2,100 kcal per day. |
| 3.8 | Volatility of food prices | **Local Level and National Level** |

[13] (ver Ploeg, M., Breneman, V., Farrigan, T.,2009)

| Order | Indicator | Assessment Method |
|---|---|---|
| | | - Standard deviation from the mean of food prices for the reference period can be calculated both monthly and yearly based on food prices and consumers in the country. This is done by recording monthly food price changes and calculating the monthly standard deviation for the previous 12 months.**<br>*Note*: 'Food classification' covers meat, vegetables, fruits, rice, and cooking oil |
| **Crisis situation** | | |
| 3.9 | Need for food in an emergency | **Local Level**<br>- The type of population that needs emergency food assistance |
| | | - The number of people who need emergency food assistance classified by population type, such as specific population groups in the community, such as low-income communities, the disabled, the elderly living alone, etc. |
| | | - Percentage of population requiring emergency food assistance |
| | | - Percentage of people who registered to receive relief measures from the government<br>- *Note:* Food emergencies occur in the event of disasters such as disease outbreaks, floods, drought, violent storms, etc. |
| | | **National Level**<br>- The type of population that needs emergency food assistance. |
| | | - The number of people who need emergency food assistance classified by population type, such as specific population groups in the community, such as low-income communities, the disabled, the elderly living alone, etc. |
| | | - Percentage of population requiring emergency food assistance |
| | | - Percentage of people who registered to receive relief measures from the government |
| 3.10 | Availability and access to emergency food supplies for those in crisis | **Local Level and National Level**<br>- Percentage of crisis victims receiving food assistance |
| | | - The number of communities that have food management approaches to respond to crises |

### 4) Sociocultural Wellbeing (SW): 9 indicators; 24 sub-indicators

| Order | Indicator | Assessment Method |
|---|---|---|
| **Awareness Raising and Knowledge Cultivation** | | |
| 4.1 | | **Local Level and National Level** |

| Order | Indicator | Assessment Method |
|---|---|---|
| | Agriculture/food education via public media, media publishing and consumer awareness | - Number of public communications on safe agriculture, organic agriculture, and food safety (TV, radio, online media, brochures, posters, etc.) per year |
| | | - The number of communications advertising agricultural chemicals [14] and fast food and processed food (TV, radio, online media, leaflets, posters, etc.) per year |
| | | - Assessment of consumer's awareness level on food safety |
| | | - Assessment of farmer's awareness level on the use of agricultural chemicals |
| 4.2 | Promoting greater agricultural awareness/knowledge | **Local Level and National Level**<br>- Number of agricultural courses in higher education institutions and colleges (per year) |
| | | - Number of schools with courses or extracurricular activities related to agriculture (per year) |
| | | - Number of agricultural training events outside the educational curriculum (with farmers, local sages, fishermen, government officials, representatives from civil society organizations working in agriculture, foundations, YouTube channels that produce agricultural content, etc., as key speakers) (per year) |
| | | - Number of schools that offer courses or extracurricular activities related to food, nutritional value, safe food consumption behavior (per year) |
| | | - Number of graduates from agricultural programs in higher education institutions and colleges (per year) |
| **Labor and equality** | | |
| 4.3 | Labor equality in the food system (workers in the entire supply chain from upstream, midstream, and downstream such as farmers, middlemen, storage and transportation workers, food processing workers, restaurant workers, food delivery workers, etc.) | **Local Level and National Level**<br>- Proportion of workers in the food system receiving a living wage compared to the total number of workers** |
| | | - The average wage ratio of males to females** |
| | | - The ratio of wages to food expenses classified by socioeconomic groups<br>*Note*: In Thailand, the concept of a living wage is not yet widely applied; there is only the concept of minimum |

[14] 'Agricultural chemicals' means pesticides, as divided into the following five groups: CARBAMATE, ORGANOPHOSPHATE, ORGANOCHLORINE, PYRETHROID, and PHENOXY HERBICIDE, each of which has different characteristics in killing insects, killing weeds, preventing and eliminating plant diseases, etc. (Thai-Pan, 2012).

| Order | Indicator | Assessment Method |
|---|---|---|
| | | wage, and that does not reflect the well-being of the workers |
| 4.4 | Effects of chemical use on farmers | **Local Level and National Level**<br>- The number of farmers who are sick or die from diseases caused by pesticides |
| | | - Number of farmers and consumers have levels of pesticide residues in their blood (from preliminary screening with reactive paper test kit) |
| **Policy Dimension** | | |
| 4.5 | Having labor policies and social protection regulations | **Local Level and National Level**<br>- Number of labor policies and social protection regulations (in government and the food business) ** |
| | | - The number of policies related to the establishment of community enterprises that will support the integration of food production |
| 4.6 | The presence of agencies or stakeholders in food policy formulation which come from diverse population groups in areas such as gender, age, education level, occupation, income, and representatives of various civil society groups | **Local Level**<br>- Number of agencies or stakeholders in food policy from diverse demographics such as gender, age, education level, occupation, income, and representatives from civil society groups that reflect broad representation of local groups |
| | | **National Level**<br>- Number of agencies or stakeholders in food policy from diverse demographic groups such as gender, age, education level, occupation, income, and representatives from different civil society groups reflect different groups in society** |
| 4.7 | Budget allocated to government agencies for the management of mechanisms, structures and programs related to food | **Local Level**<br>- Proportion of the budget allocated to/by the Local Administrative Organization for the management of mechanisms, structures and programs related to food per year, such as the operation of a 'health promotion' school, organizing agricultural training from local sages to apply to their own farms, etc. |
| | | **National Level**<br>- Proportion of budget allocated to government agencies for the management of mechanisms, structures and food-related plans per year, such as the development of the processed food industry |

| Order | Indicator | Assessment Method |
|---|---|---|
| 4.8 | Having a policy that is integrated between national agencies and linked to local food policy | **Local Level and National Level**<br>- The number of policies that are integrated between national agencies and linked to local food policies; consideration of participation of local administrative organizations (LAO) |
| | | - The number of policies arising from the integration between agencies at each level of the food chain: upstream, midstream, and downstream. |
| 4.9 | State support to help reduce inequality of specific groups (e.g., the lower-income, those with disabilities, those living in remote areas, disaster victims), such as the establishment of a market investment in fresh food retailing, home and kitchen improvements, household fuel contributions, school food projects, food support for disaster victims, etc. | **Local Level**<br>- Support from local governing bodies (e.g., market establishment, investment in fresh food, retailing from home, kitchen improvements, household fuel contributions, school food projects, food support for disaster victims, etc.) |
| | | **National Level**<br>- Government support (e.g., market establishment, investment in fresh food, retailing from home, kitchen improvements, household fuel contributions, school food projects, food support for disaster victims, etc. |

### 5) Resilience (RE): 10 indicators, 24 sub-indicators

| Order | Indicator | Assessment Method |
|---|---|---|
| **Supply chain** | | |
| 5.1 | Size of agricultural area/community forest area/agroforest area that produces crops for food in urban areas or communities | **Local Level**<br>- The size of the agricultural land that produces crops for food (sq. km.) per total community area (sq. km.) |
| | | - Proportion of households receiving food from agricultural areas in the community to total households in the community |
| | | - Proportion of households receiving food from community forest areas /wetland/agroforest area per total households in the community |
| | | **National Level**<br>- Proportion of agricultural land that produces crops for food (sq. km.) per total area of the country (sq. km.) ** |
| 5.2 | Turnover in the number of activity in the local food system. | **Local Level**<br>- The number of activities/businesses at the upstream level (manufacturing process) that are still open or operating in the past 1 year, such as growing crops or raising animals for food (number of enterprises) |

| Order | Indicator | Assessment Method |
|---|---|---|
| | | - The number of activities/businesses at the midstream level (processing and distribution of products) that are still open or operating in the past 1 year, such as markets / supermarkets / convenience stores / grocery stores / food trucks / selling online / various restaurants, etc. |
| 5.3 | Losses from weather effects or disasters on infrastructure and businesses in the food system in 1 year | **Local Level and National Level**<br>- The size of the area affected by natural disaster or disaster from the structure and management (floods / droughts / storms / wash-out, erosion of topsoil / rupture of dams and reservoirs / failure to open sluice gates) (sq. km.) |
| | | - The number of agricultural households affected by adverse weather or disasters in the area/country |
| | | - Value of economic losses due to weather or disasters to infrastructure and businesses in the food system (baht) |
| **Infrastructure** | | |
| 5.4 | Adjusting land for food production after the impact of a disaster | **Local Level and National Level**<br>- Areas that have been rescued/maintained to resume food production after being threatened or lost due to economic impacts or disasters (square kilometers) |
| 5.5 | Location and distribution of food businesses in the area | **Local Level**<br>- Type of food business in the area (locations per sq. km.)<br>*Note*: Business at the upstream level (businesses in the production process), such as growing crops or raising animals for food (locations); Midstream business (businesses in processing, distribution, buying and selling) such as markets/supermarkets/convenience stores/grocery stores / food processing plant |
| 5.6 | Local food storage and distribution infrastructure (e.g., wholesale markets, warehouses, temperature controlled rooms, agricultural products processing plant) | **Local Level**<br>- Presence of a food warehouse, wholesale market, or storage site for produce (locations per sq. km.) |
| | | - Storage capacity for produce or goods of local warehouses (tons) |
| | | **National Level**<br>- Number of food warehouses, wholesale markets or produce storage sites in each region** |
| | | - Storage capacity for produce or goods of the infrastructure in each region (tons). |

| Order | Indicator | Assessment Method |
|---|---|---|
| 5.7 | Having a service or support project to help develop food in the area that has been continuously implemented in 1 year | **Local Level**<br>- Providing services or supporting projects to help develop local food in the area, such as OTOP, various learning centers |
| | | - Number of marketing promotion projects of agricultural products and local food |
| | | **National Level**<br>- Number of services or support projects to increase food value |
| | | - The number of economy stores, such as the Blue Flag Shop |
| | | - Number of marketing promotion projects for agricultural and food products<br>*Note*: Services or projects such as product development, transportation system, marketing promotion, quality assurance process, market linkage services between producers and sellers, information on product purchase prices, promoting processing and associated equipment, promoting community market managers, developing a new generation of farmers to operate online, local market promotion is linked to other dimensions such as tourism, promoting and developing plans to raise quality production, etc. |
| 5.8 | Having a food reserve system | **Local Level and National Level**<br>- Number of food reserve systems that have been operating continuously for at least 1 year |
| | | Proportion of communities with food reserve systems<br>*Note*: 'Food reserve system' refers to an agency responsible for collecting food from community members to accumulate, exchange, circulate, and share among members such as cooperatives, farmers groups, community food reserve systems |
| 5.9 | Agencies or projects that distribute food to needy people in times of crisis such as floods, epidemics, earthquakes, etc. | **Local Level and National Level**<br>- The number of agencies/projects that carry out food distribution to those in need in times of crisis, such as the Pan-Im Project, Pan-Im Kitchen Project, Scholars of Sustenance Food Preservation Programs, government agencies and programs |
| 5.10 | Having policies or plans or guidelines for supporting and preventing disaster risk reduction for food production, storage, transportation, and distribution of food | **Local Level and National Level**<br>- Having a plan, guidelines and suggestions for improving the plan to suit the context of the area or country**<br>*Note*: Emergency plans to mitigate damage, and adaptation/recovery measures from climate change and disasters such as the following:<br>- Having a food reserve plan before a crisis |

| Order | Indicator | Assessment Method |
|---|---|---|
| | | - Having a plan for storing and distributing food during and after a crisis<br>- Having an emergency warning system<br>- Having plans to help agricultural areas and food businesses that are damaged or affected by disasters<br>- Having temporary suspension of bank loan repayments<br>- There is a public relations plan to communicate in the area to deal with the crisis in a timely manner<br>- Having an immunity/prevention plan from the impact of disasters |

## 6 Food Safety (FS): 7 indicators, 26 sub-indicators

| Order | Indicator | Assessment Method |
|---|---|---|
| **Situation** | | |
| 6.1 | Production and food safety standards for crop production, livestock and fisheries | **Local Level and National Level**<br>- Percentage of crop and livestock production systems that meet production and food safety standards |
| | | - Percentage of organic farming entrepreneurs who pass the standard of Participatory Guarantee System (PGS) |
| | | - Percentage of farms that meet the standards set by the Ministry of Agriculture and Cooperatives such as GAP**<br>*Note*: The 7 GAP standard principles are farm components, farm management, personnel, animal health, animal welfare, environment, data recording |
| | | - Percentage of livestock/fishery farms with appropriate antibiotic use |
| | | - Amount of use of highly dangerous pesticides |
| | | - Amount of imported chemicals for agriculture** |
| | | - Proportion of pesticide residues in food that exceeds the Maximum Residue Limits (MRL) ** |
| **Regulations/procedures** | | |
| 6.2 | Having a food safety law and implementing it with efficiency, effectiveness, and efficacy | **Local Level and National Level**<br>- Having a law on food safety of vegetables<br>Having a law on meat food safety, such as hygiene, trade/slaughter of diseased animals |

| Order | Indicator | Assessment Method |
|---|---|---|
| | | - Evaluation of the effectiveness of the law (*Ex post* evaluation) that the law is efficient and effective, and how well it solves problems (efficacy) |
| 6.3 | having regulations to control the use of chemicals and antibiotic with efficiency, effectiveness, and efficacy | **Local Level and National Level**<br>- Having regulations to control the use of chemicals and appropriate use of antibiotics |
| | | - *Ex post* evaluation on the efficiency, effectiveness, and efficiency of the law |
| | | - There is a mechanism to monitor and report the correct use of chemicals in agriculture or production processes at the area level |
| | | - Having local provisions, community rules, sub-district statutes on the production, storage, processing, and sale of safe food, for example, not using formalin in fishing communities |
| **Inspections** | | |
| 6.4 | Food safety inspections | **Local Level and National Level**<br>- Percentage of food products at risk of contamination that has been verified for safety in the local classified as pesticide residues in plants and antibiotic contamination in meat |
| | | - Percentage of food products certified with food safety standards such as the FDA mark, Food Safety Management System (ISO22000), HACCP) ** |
| | | - The proportion of the budget allocated for annual food safety audits to the total budget, and frequency of food safety audits (per year) |
| 6.5 | Food items are labelled with provenance on how the food is grown, processed, and sold | **Local Level and National Level**<br>- The number of products requested for labelling indicating their origin on how they are grown, processed and sold (e.g., GAP, GMP, organic standards and other community standards) |
| 6.6 | Dietary exposure assessment indicators<br><br>*Note:* This is a food safety measure by calculating food consumption together with chemical concentration data in food. | **Individual Level**<br>- 24-hour Dietary Recall ** |

| Order | Indicator | Assessment Method |
|---|---|---|
| 6.7 | Food establishments that have been inspected and passed health and food safety standards[15] | **Local Level and National Level**<br>- The number of restaurants that pass the criteria in the "Clean Food Good Taste" project and the "Clean Food Good Taste Plus" project |
| | | - Number of restaurants participating in the "Healthy Menu" project |
| | | - The number of markets that pass the standard criteria in the "Fresh Market -- Worth Buying" project |
| | | - Percentage of restaurants that pass the criteria in the Clean Food Good Taste project and the Clean Food Good Taste Plus project |
| | | - Percentage of markets that pass the standard criteria in the Fresh Market -- Worth Buying Project |
| | | - Number of food establishments (e.g., food producers, food collection sites) that have registered food or have food vending licenses |
| | | - Percentage of food establishments (e.g., food producers, food storage facilities) that have food registration or license to sell food |

## 7. Waste and Loss Reduction (WL): 5 indicators, 13 sub-indicators

| Order | Indicator | Assessment Method |
|---|---|---|
| **Situation** | | |
| 7.1 | The amount of food loss from the production process, harvest, transport to the consumer. [16] *Food loss is the decrease in the amount or weight of edible food in the production process after harvest and processing of the food chain. This most often* | **Local Level and National Level**<br>- The amount of food loss in the local/country stage from production, harvest, transport to the consumer (e.g., due to inadequate storage, lack of labor, pruning, etc.), grading or quality of produce, weather, plant disease, insect disease, transportation, etc.) ** |

[15] The 1979 Thai Food Act mandates the need to control food standards in establishments which not only sell food but also to the production and processing of food, by supervising both pre-market and post-market processes. Entrepreneurs must adhere to the standards for food imported for processing and marketing (Food and Drug Administration, 2011).

[16] SDG 12.3.1 Global Food Loss and Waste Sub-Indicator 12.3.1.a - Food Loss Index The Food Loss Index (FLI) focuses on food losses that occur from production up to (and not including) the retail level. It measures the changes in percentage losses for a basket of 10 main commodities by country in comparison with a base period. The FLI will contribute to measure progress towards SDG Target 12.3 (FAO, 2018)

| Order | Indicator | Assessment Method |
|---|---|---|
| | *occurs in developing countries (FAO, 2022).* | |
| 7.2 | Amount and proportion of total food waste from food businesses per year (divided by type of business according to the food chain)<br><br>Food waste refers to edible food that is discarded at both the retail and consumer levels; this mostly occurring in developed countries (FAO, 2022.) | **Local Level and National Level**<br>- Amount of food waste discarded from supermarkets, fresh markets, and convenience stores (kilograms per month) ** |
| | | - The value of food waste discarded from supermarkets, wet markets and convenience stores (baht per month) |
| | | - Amount of food waste from food producers (kilograms per month) |
| | | - Amount of food waste from restaurants and organizations (hotels, schools, hospitals) (kilograms per month) |
| | | - Amount of household food waste (kilograms per month) |
| **Reducing food waste or making use of food waste** | | |
| 7.3 | Food waste management | **Local Level and National Level**<br>- Number of landfills where waste is properly separated according to standard |
| | | - Amount of food waste in local/country level sent for disposal per year (tons) ** |
| | | - Percentage of local governments that separate food waste or encourage households to separate food waste |
| 7.4 | Making practical use of food waste | **Local Level**<br>- Percentage of local food waste recycled for animal feed, compost, and energy recovery, etc. per year (by LAO/enterprise/household) |
| | | **National Level**<br>- Percentage of domestic food waste recycled for animal feed, compost, and energy, etc. per year** |
| **Policy Dimension** | | |
| 7.5 | The presence of appropriate policies or strategies in practice of i) prevention of food loss and food waste, ii) reduction of food loss and food waste, and iii) recycling | **Local Level and National Level**<br>- Having a policy or strategy at the local /country level which is practical and appropriate: i) prevention of food loss and waste, ii) reduction of food loss and food waste, and iii) recycling<br>- Having a policy to promote safe food donations to reduce food waste and help those in need. |

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