Koalisi
Sistem Pangan Lestari
Bagian dari Food and Land Use Coalition (FOLU)

Systems Thinking for a
Sustainable Food System Booklet Series

Understanding the Food System and the Systems Thinking Framework

1

Foreword

Food is a basic human need. Without food, human life will be disrupted, even cease to exist. It is not surprising then that food has become an integral part of human history. The way in which humans secure food has evolved over time. Such evolution does not happen on its own.

The evolution of the way humans secure food has been influenced by and, in turn, influenced other sectors that may not seem to be relevant at all. For instance, political and economic policies can shape the way in which people secure their food and vice versa. It is therefore essential to apply systems thinking to assess food issues comprehensively and find effective solutions. The failure to do so will only lead to further problems, which will impact other sectors.

Koalisi Sistem Pangan Lestari (KSPL), part of Food and Land Use Coalition (FOLU) has produced this booklet to invite readers to apply systems thinking not only in looking at food issues, but also in finding solutions. This booklet is a part of the Systems Thinking for a Sustainable Food System Booklet Series, which consists of five volumes:

Volume 1: Understanding the Food System and the Systems Thinking Framework

Volume 2: Healthy Diet

Volume 3: Agroecology

Volume 4: Reducing Food Loss and Waste

Volume 5: Environmental Sustainability within the Food System Framework

This booklet, Volume 1, is divided into four sections. The first section provides an overview of the situation and issues surrounding food in Indonesia. It offers readers a brief understanding of the food issues that the country is facing.

Moving forward, the second section of this booklet introduces the concept of systems and the importance of systems thinking. Readers will be introduced to the term "system" and the mindset behind it

The third section outlines the food system framework, where readers will identify the various interconnected elements of a food system.

The fourth and final section of this booklet focuses on outlining the crucial steps that can be taken towards achieving a sustainable food system. It offers readers a range of measures that can be taken to achieve a sustainable food system.

This booklet draws on training materials on systems thinking for a sustainable food system and other relevant literature. KSPL would like to express our gratitude to all those who have assisted in the publication of this booklet.

We understand that this booklet may not be perfect and there is always room for improvement. We welcome any feedback or constructive criticism that can help us enhance the quality of this booklet in the future.

Ultimately, we hope for this booklet to be a valuable resource for readers who are interested in learning about the application of systems thinking in building a sustainable food system.

Jakarta, January 2023

I. Food Situation and Problems in Indonesia

Food is a fundamental issue for humanity as the availability of quality and adequate food is essential for our survival. Article 25 of the Universal Declaration of Human Rights even recognizes the right to adequate food as a basic human right.[1]

However, every country has its unique set of challenges related to food security, including Indonesia. According to the Global Food Security Index 2022, Indonesia ranks 63rd out of 113 countries[2] in terms of food security. In general, Indonesia's food affordability scores a respectable 81.5 points.

However, other indicators such as supply availability, quality and safety and food sustainability and adaptation still require improvement.

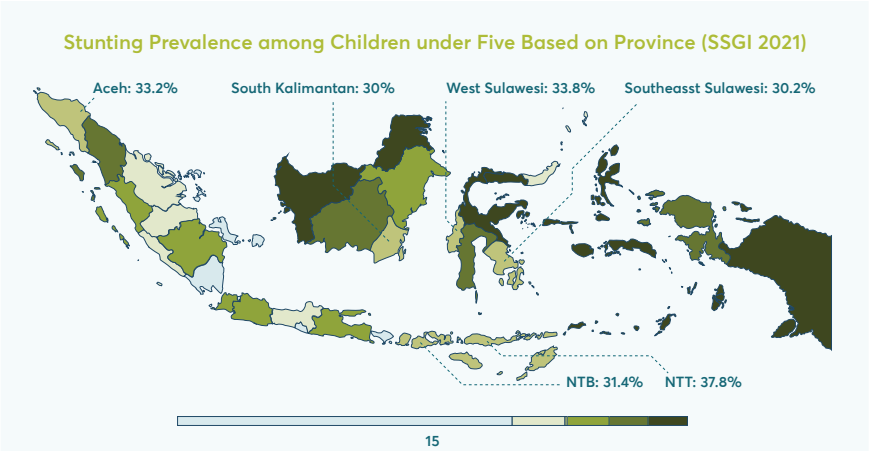
Indonesia scores 50.9 points for supply availability, 56.2 points for food quality and safety and 46.3 points[3] for food sustainability and adaptation.

Although some people may find food security statistics challenging to understand, various food-related issues affect our daily lives. These issues range from malnutrition-related diseases such as stunting and obesity, food-related non-communicable diseases such as diabetes mellitus to climate crisis-induced problems.

How are these problems interrelated to the food system?

Source: Global Food Security Index 2022

Issue	Relation to Food System
 **Stunting**	According to the results of the Indonesian Nutritional Status Study (SSGI) by the Ministry of Health, the prevalence of stunting among children under five in Indonesia reached 24.4 percent in 2021. This means that almost **1 out of 4** children experience stunting, which is considered a moderate level according to the World Health Organization (WHO) standards. In some provinces, the prevalence of stunting among children under five years old even exceeds 30 percent according to the graph on the next page, which shows some provinces in a darker shade than the rest. The provinces with the highest prevalence of stunting are East Nusa Tenggara (NTT) at 37.8 percent, West Sulawesi at 33.8 percent, Aceh at 33.2 percent, West Nusa Tenggara (NTB) at 31.4 percent, Southeast Sulawesi at 30.2 percent and South Kalimantan at 30 percent[4]. One of the causes of stunting is logistics. High logistics costs lead to an increase in the cost of basic needs, which will ultimately increase poverty and malnutrition rates as seen in the eastern part of Indonesia[5]. Additionally, stunting is also influenced by consumer behavior based on social, cultural and economic backgrounds[6].
 **Obesity**	According to the Basic Health Research (Riskesdas) in 2018, the prevalence of obesity among Indonesian adults has almost doubled. For men, the prevalence of obesity increased from 19.1 percent in 2013 to 26.6 percent in 2018. For women, the rate increased from 32.9 percent in 2013 to 44.4 percent in 2018[7]. Consumer behavior when it comes to food choice is a significant factor in the development of obesity. Such consumer behavior is influenced by food information and promotion as well as food quality[8].
 **Diabetes Melitus**	Diabetes is considered the mother of various diseases as it can trigger various complications and other health problems for patients[9]. According to data from the Indonesian Health Insurance (BPJS Kesehatan), the cost of diabetes mellitus care has been on the rise in recent years. The cost of primary and referral care for diabetes mellitus in 2017 was at IDR84 trillion. This number increased to IDR94 trillion in 2018 and IDR108 trillion in 2019[10]. The high prevalence of type 2 diabetes mellitus in Indonesia can be attributed to the population's high consumption of white rice and sugar as their primary source of carbohydrates[11]. Increasing food diversity is one of the ways to prevent diabetes, but it is a complex issue that involves multiple factors such as food production, access to food, consumer behavior and government policies on food.
 **Climate Crisis**	The way agricultural products are produced and distributed greatly affects the increase of greenhouse gas emissions (GHG), which are the cause of the climate crisis. For example, the shorter the food supply chain, the smaller the greenhouse gas emissions it generates[12].



Source: Prevalensi Balita Stunting di 6 Provinsi Ini Masih Tinggi[13]

A. Stunting and Obesity

The term stunting frequently appears in mass media and is often debated among local leaders, even the president. But what does "stunting" actually mean?

Stunting is a condition where a child's body and brain growth have been compromised due to chronic malnutrition during the first 1,000 days of life, from a fetus until the age of 23 months. As a result, the child may experience stunted growth compared to their peers and a delay in cognitive development. The causes of stunting are low access to nutritious food, low intake of vitamins and minerals as well as lack of food diversity and animal[14].

Despite a decrease, the prevalence of stunting in Indonesia is still relatively high. According to the Indonesian Nutrition Status Study (SSGI) by the Ministry of Health, the prevalence of stunting in children under five was at 24.4 percent in 2021, meaning that almost one-quarter of Indonesian children under five experience stunting. Despite a slight decrease from 26.9 percent[15] in the previous year, this number still calls for concern.

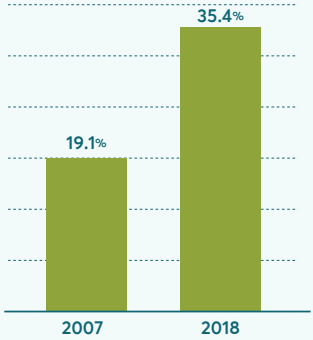
Diverse solutions are required for stunting prevention programs, including healthy diet, food diversity and more. Without comprehensive solutions, stunting prevention programs will be difficult or even impossible to achieve. Based on the Global Food Security Index data in 2019, Indonesia has problems in agricultural infrastructure, including food distribution. Weakness in food distribution can cause food shortages in many areas, especially in food-insecure areas[16].

Consumer behavior, which shows preference for buying non-diverse snacks in the market, is also one of the causes. In Klaten Regency, for example, this habit is a daily routine for children and is the cause for increased stunting rate[17].

In addition to stunting, obesity is another food-related issue faced by Indonesians. According to the WHO, obesity is the accumulation of excessive fat due to an imbalance of energy intake with energy expenditure over a long period[18]. The cause of obesity is unhealthy diet, such as consumption of fast food or sugary drinks in the long term. Obesity can also be caused by excessive food consumption without regular exercise[19].

Globally, obesity has more than doubled since 1980[20]. Meanwhile, WHO data from 2016 shows that around 650 million adults are obese. In 2020, around 39 million of children under five years old are obese[21,22].

What is the rate of obesity in Indonesia? The numbers are quite concerning. According to the Basic Health Research (Riskesdas) in 2018, the prevalence of obesity among Indonesian adults has almost doubled from 19.1 percent in 2007 to 35.4 percent in 2018.



B. Diabetes Melitus

Food issues are closely related to public health problems, including diabetes mellitus.

What is diabetes mellitus? Diabetes mellitus (DM) is defined as a chronic disease or metabolic disorder characterized by high blood sugar and inefficient carbohydrate, lipid and protein metabolism as a result of insulin resistance[23]. Insulin resistance can be caused by disorders or deficiencies in insulin production by the beta cells of the pancreas's Langerhans gland or by cells' unresponsiveness to insulin[24].

Diabetes is a dangerous disease. Even the General Chairman of the Indonesian Pediatrician Association (IDAI), dr. Piprim Basarah Yanuarso, SpA(K), once said that diabetes is the mother of all non-communicable diseases, especially when it emerges at an early age[25]. Unfortunately, there is quite a large number of diabetes patients in Indonesia.

Data from the International Diabetes Federation (IDF) shows that the number of diabetes patients in Indonesia has increased rapidly in the last 10 years. The number of diabetes patients in 2021 reached 19.47 million people, more than double the 7.29 million diabetes patients in 2011[26].

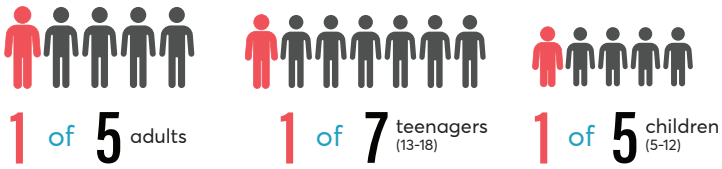
In January 2023, the Indonesian Pediatrician Association (IDAI) also released data showing that the number of children with diabetes has increased up to 70 times from 2010[27].

The increasing number of diabetes patients is directly proportional to the number of deaths caused by it. In 2021, Indonesia recorded 236,711 diabetes-caused deaths in Indonesia. This number increased by 58 percent from 149.872[28] in 2011. Without proper action, the IDF estimates that the number of diabetes patients in Indonesia could increase up to 47 percent or reach 28.57 million people by 2045[29].

There are two types of diabetes, type 1 and type 2. In type 1 diabetes, the body cannot produce insulin hormones, whereas in type 2 diabetes, body cells become less sensitive to insulin despite normal[30] insulin production and levels. The majority of diabetes patients worldwide has type 2 diabetes, which makes up around 90-95 percent of DM patients worldwide, while type 1 diabetes patients are only around 5-10 percent[31].

The main contributing factor to type 2 diabetes is obesity and lacking physical activity[32].

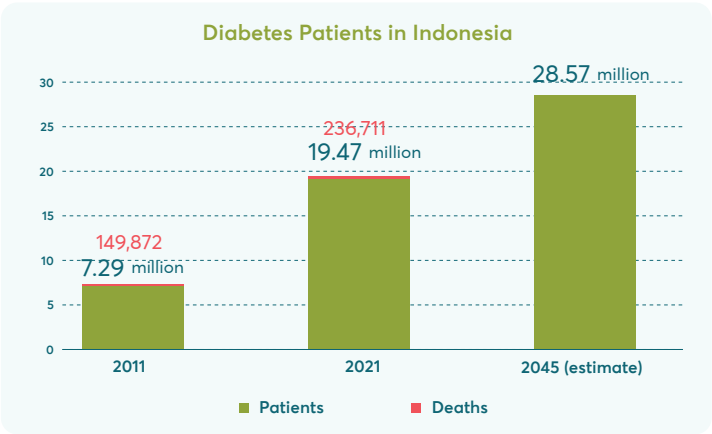
Basic Health Research in 2018 estimates that in Indonesia:



are **obese**.

Source: Basic Health Research in 2018

This trend is worsened by the COVID-19 pandemic. Mobility restrictions made it difficult for children and teenagers to access healthy food or to remain physically active. A survey in 2020 conducted on low-income households in urban areas of Jakarta found that children consume less nutritious food such as fruits and vegetables, beef and fish and nuts during the pandemic than in 2018[33]. In other words, **food issues are one of the main contributors to type 2 diabetes.**



Sumber: Katadata

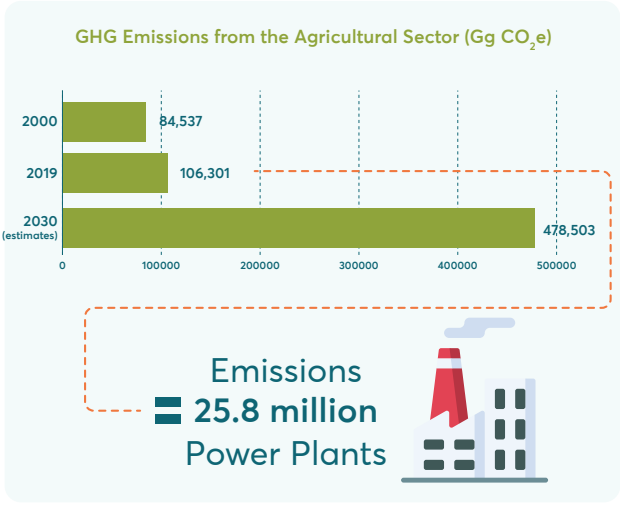
C. Climate Crisis

Lately, we have been witnessing more disasters due to extreme weather. At present, extreme weather events are happening more frequently and on a larger scale. In October 2022, extreme weather caused floods and landslides in Bogor, affecting 35 households or 140 people in five districts, displacing one household or three people and causing four people missing[34]. Similar incidents have also occurred in Bali, Jakarta, Malang and other regions. This is what a climate crisis looks like.

The climate crisis has caused disruptions around the world. With a warming rate of only 1.1 degrees Celsius, droughts, extreme heat and major floods have threatened food security and the livelihoods of millions of people[35]. Various climate-related disasters have occurred in Indonesia. According to the National Disaster Management Agency (BNPB), 98 disaster events in Indonesia over the last 10 years were hydro-meteorological disasters resulting from climate change[36].

It is mentioned above that the climate crisis will affect food security. This means that the food sector will be disrupted by various climate-related disasters. However, the food sector not only is affected by the climate crisis, but also contributes to the increase of GHG emissions that cause the climate crisis. Almost a quarter of all greenhouse gas emissions that cause global warming come from food production and related land conversion[37].

In Indonesia, GHG emissions from the agricultural sector continue to increase. GHG emissions from the agricultural sector in 2019 reached 106,301 Gg CO_2e or equivalent to emissions produced by 25.8 million power plants in a year. This figure is much higher than GHG emissions from the same sector in 2000, which only reached 84.537 Gg CO_2e[38]. Without any significant transformation, GHG emissions from the agricultural sector could reach 478.503,66 Gg CO_2e[39] by 2030.



Source: INDONESIA, Third Biennial Update Report

The Food Issues Iceberg

Stunting, obesity, diabetes and other health problems are easily identifiable health issues. However, looking more closely would reveal that these surface issues are related to food issues. The climate crisis not only damages food security, but is also contributed by the food sector.

On the other hand, the problem in the food sector are driven by different factor:

Population growth increases food demands.

Agricultural land expansion through land conversion creates other problems, such as social problems and ecological imbalance.

Ecological imbalance will in turn hit the food sector, which will give rise to other health and socio-economic problems.

In short, we have to look beyond the surface when it comes to food issues. We must look deeper and broader at the same time. By doing so, we can formulate more appropriate food solutions. Failing to do so would allow us to solve only the surface problems without addressing the root cause. In other words, **we must look at food as a part of a system** instead of a stand-alone issue.

II. Understanding System and the Importance of Systems Thinking

In the previous section, we learned that to address food issues, it is important to consider them within the context of a system. So, what exactly do we mean by "system"?

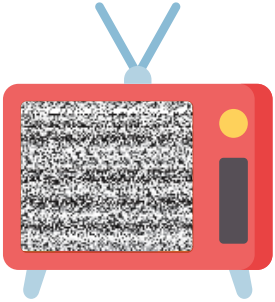
To answer this, let's look at this television:

If we take apart a television, we will find different components inside, such as cables, processors, monitors and more. Each of these components serves a different function, but **all of them work together towards the shared goal** of projecting images and sounds to the viewers. For them to work together towards this goal, these components with their various functions are interconnected. If one of the components is disrupted, the television will not work. In fact, if any one of the components experiences an issue, the television may not be able to achieve its intended purpose of projecting images and sounds.

The above example tells us that a system is a collection of interrelated elements that form a structure that produces a combination of behaviors from various elements and their functions, which work towards a common goal[40].

Now that we know what a system is, the next question is, **why do we have to think within the context of systems when looking at a problem?**

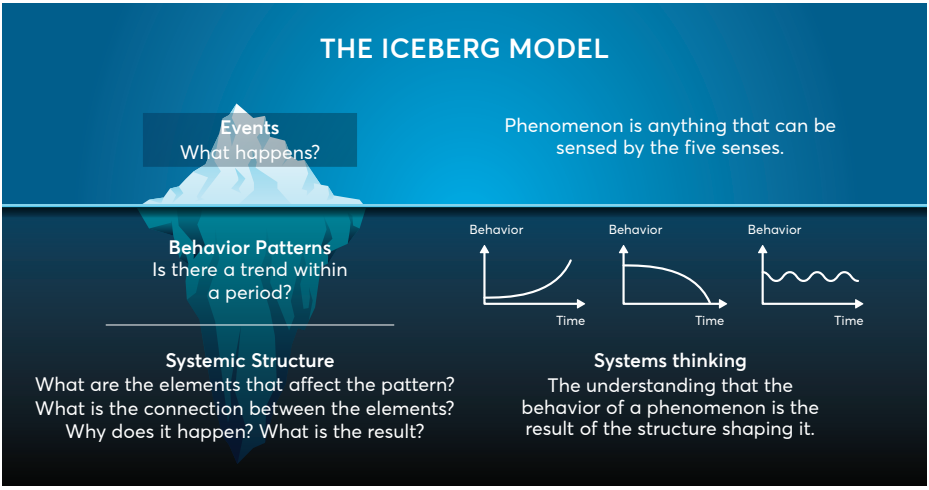
To answer this, let's revisit that television.



If we approach the issue of a television not projecting images and sounds optimally from the perspective of systems, we do not simply address what is visible on the surface. Rather, we seek to investigate the underlying cause of the suboptimal images and sounds.

If we determine that the cause is a faulty electronic component within the television, we do not immediately replace it with another component without first understanding how the television system operates and the role that particular component plays within the system.

Systems thinking is necessary so we can take a more comprehensive view of world's problems. By doing so, we can make better-informed decisions and take actions that address the root causes of the problems to produce effective systemic change (Hidayatno, 2016)[41]. To better understand systems thinking, let's take a look at the following illustration.



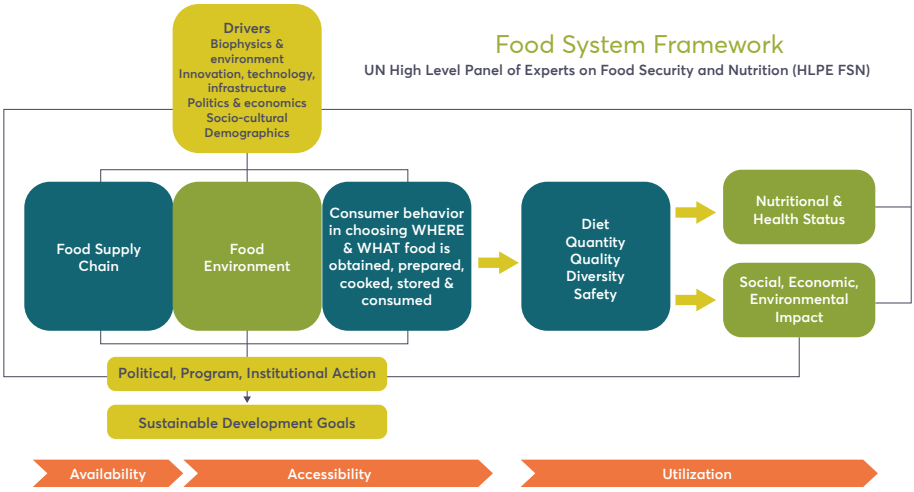
In other words, systems thinking is about understanding that the way a phenomenon behaves is influenced by the relationships among the elements within it and their impact on the patterns (structure) that form it[42]. Systems thinking will allow us to view a problem more holistically for more effective solutions to address that problem.

III. The Food System Framework

As explained in the previous section, a system consists of various interconnected elements that work towards a common goal. In other words, every system has a broad framework that describes the interconnections and operational processes within it. So, what is the broad framework in the context of the food system?

The broad framework of the food system consists of the following interconnected elements:[43]

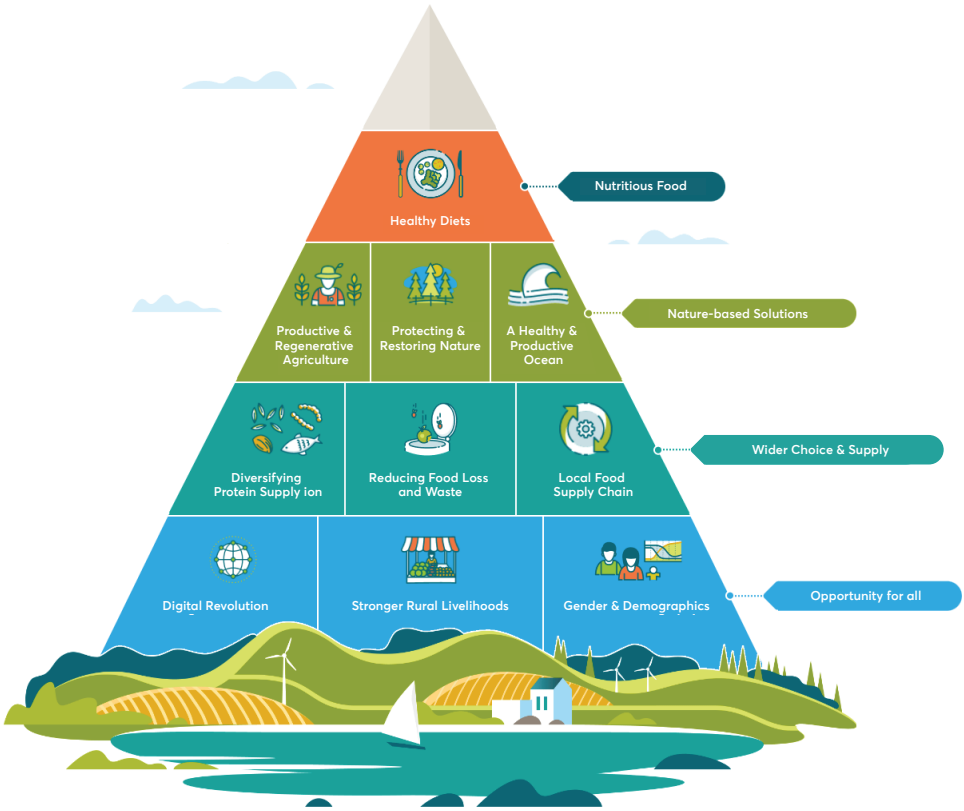
1. **Drivers:** Biophysics and environment, technological innovation and infrastructure, politics and economics, socio-cultural factors and demographics.
2. **Driven Objects:** Food availability (production, storage and distribution systems, processing, retail), food access (availability and access to food, economic access to food, information and promotion of food, food quality and safety) and food utilization (consumer behavior towards food).
3. **State Action or Programs:** Sustainable Development Goals or SDGs.



These three elements are interconnected and mutually influential. In addition, the roles of each actor within the food system are also interrelated. If one element or role is not functioning effectively, it will cause the entire system to not function effectively.

IV. Key Steps towards a Sustainable Food System

Now that we understand food issues within the framework of food system, what are the necessary steps to achieve a sustainable food system?



Source: https://www.foodandlandusecoalition.org/interactive-pyramid/

The "Growing Better"[44] Report released by the FOLU Coalition in 2019 mentions 10 critical transitions required to transform our current food system:

1. Healthy Diets

Healthy diets, such as reducing sugar intake to below 50 grams per day, consuming no more than 43 grams of red meat per day and a total energy intake of 2,200-2,300 kilocalories per day, should be based on the variety of food available locally. In addition, our diets must also consider human health and environmental sustainability. Diets need to cover a variety of food sources, including fruits, vegetables and grains, a variety of protein sources and reduced sugar, salt and processed foods. With such a healthy diet, we as consumers will enjoy a variety of nutritious and sustainably healthy foods.

2. Developing a Productive and Regenerative Agriculture

Productive and regenerative farming practices combine traditional techniques, such as crop rotation, controlled grazing and cover crops, with new bio-based agricultural technologies, fertilizers and pesticides. These practices are supported by sustainable land management and integrated water resource management.

3. Realizing Protected and Restored Natural Ecosystems

Nature must be protected and restored. This requires halting deforestation and other conversions of natural ecosystems as well as investing in large-scale restoration efforts. According to WRI and The Nature Conservancy, 42 percent of the total emissions reduction achievable through reforestation depends on reducing grasslands, which includes reforestation in all forested ecoregions. Forest products obtained from restored forests, such as nuts, fruits and meat, help to enhance food security, while trees absorb carbon dioxide[45].

4. A Healthy and Productive Ocean

Sustainable fishing and aquaculture can increase seafood protein supply, reduce the demand for land and support healthier and more diverse diets.

5. Diversifying Protein Supply

Developing diverse protein sources will complement the global transition to healthy diets. Human protein supply is divided into the four main categories of aquatic, plant-based, insect-based and lab-based scientific engineering. The latter three sources alone can cover up to 10 percent of the global protein market by 2030 and are expected to grow rapidly.

6. Reducing Food Loss and Waste

Around one-third of the food produced is lost or wasted. Producing this wasted food requires a land the size of China. According to FAO, if we can prevent food loss and waste, we can save one-third of the food consumed and produced by the world's population[46]. Scientists also believe that if we stop wasting food, we can prevent 11 percent of the greenhouse gas emissions produced by the food system[47].

7. Building Local Food Supply Chains

According to FAO, around 70 percent of the world's population will live in cities by 2050. As a result, food demands will also increase. Locally sourcing 80 percent of the food demands of city dwellers in 2050 will strengthen and enhance efficient and sustainable local food economies.

8. Utilizing Digital Revolution

Food systems and land use are digitized through gene editing techniques, precision agriculture as well as digital logistics and marketing tools. This allows producers and consumers to make better, more informed choices and enables more efficient and effective coordination within the supply chain.

9. Achieving Stronger Rural Livelihoods

There is this vision where rural areas are transformed into places of hope and opportunity where growing communities can adapt to new challenges, protect and regenerate natural capital and invest in a better future. This will help ensure the transition to food equality.

10. Promoting Gender Equality in Food Systems

Women have great potential to shape food systems and land use through their central role in agriculture and decision-making on nutrition, health and family planning. Ensuring women have equal access to resources such as land, labor, water, credit and other services must be a critical part of food policies, including accelerating demographic transitions to replacement-level fertility in all countries.

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