FOOD SYSTEMS DASHBOARD

About Food Systems

gain Global Alliance for Improved Nutrition

JOHNS HOPKINS UNIVERSITY

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About Food Systems

This report uses the Food Systems Dashboard's conceptual framework to define and describe food systems. It summarizes the components, drivers, and outcomes of food systems. The report also describes the food system typologies used in the Dashboard.

About the Food Systems Dashboard

Founders

The Food Systems Dashboard was created by the Global Alliance for Improved Nutrition and the Johns Hopkins University.

Partners

Supporting Partners include the University of Michigan and Michigan State University.

Developer

The Dashboard site was developed by iTech Mission.

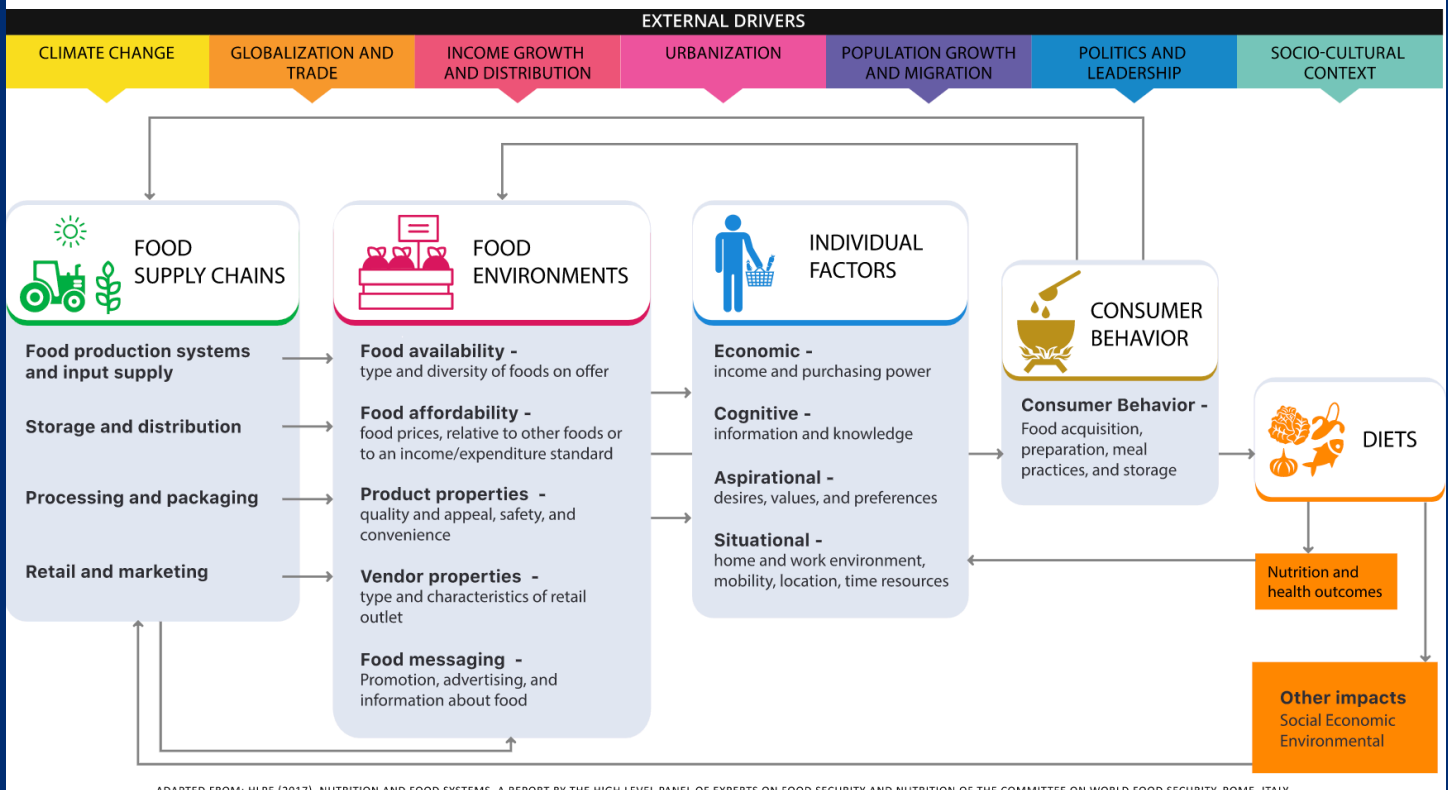
Food Systems Definition & Framework

The food system is all of the people and activities that play a part in growing, transporting, supplying, and, ultimately, eating food. These processes also involve elements that often go unseen, such as food preferences and resource investments.

Food systems influence diets by determining what kinds of foods are produced. They also influence what foods people want to eat and are able to access.

As shown in the image below, the different parts of the food system include food supply chains, food environments, individual factors, and consumer behavior, as well as external drivers (factors that push or pull at the system). These different parts shape food systems and can lead to both positive and negative outcomes.

This section explains each of these parts, as well as the drivers of food systems.



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Components of Food Systems

Food Supply Chains

The food supply chain includes all the steps needed to produce and move foods from field to fork. These steps consist of agricultural production, storage and distribution, processing and packaging, and retail and marketing, among others. Farmers, processors, wholesalers, transporters, and retailers are some of the people involved in food supply chains (1).

The steps in the food supply chain are all connected. Changes to one step affect other steps along the chain. Supply chain activities – like processing – affect a food product's nutritional quality and affordability.

Food supply chains operate at different scales and levels, depending on the food system. In rural and isolated communities, food supply chains may be short — farmers and food producers either eat the food directly or sell it to their neighbors in the local market. In large urban settings, food supply chains may be longer and more complex — food is typically produced farther away and more people are involved in its production, processing, packaging, and retail (2,3). However, food supply chains are undergoing rapid transformations, especially in low and middle-income countries, often leading to more interaction between these urban and rural settings and actors (4).

Food Environments

The food environment is where consumers interact with the food system for the purpose of acquiring and eating food. The food environment includes physical places, like stores or markets where people buy food. It also includes social, economic, and cultural factors. Food availability and affordability; safety, quality, and convenience; and advertising are all part of the food environment (2,3,5). These characteristics of the food environment affect diets by influencing the way people access foods.

Individual Factors

Individual factors include a person's economic status, thought process, dreams and aspirations, and overall life situation. These factors all affect what foods a person buys and eats. For example, a person's income might determine what foods are affordable. For some people, nutrition knowledge or environmental awareness affects what they purchase and eat. Work or home environments can affect how much time people have to shop for and prepare food. These individual factors influence how people interact with their food environment and, ultimately, what they choose to buy and eat.

Consumer Behavior

Consumer behavior includes people's decisions about what kinds of foods they choose to eat, as well as how people prepare, store, eat, and share food with others in their households. The food environment and individual factors also affect consumer behavior. There is a large body of nuanced research on consumer behavior, but key indicators of consumer behavior, based on data sourced across countries and globally agreed upon, are lacking.

External Drivers of Food Systems

External drivers affect food systems and their diet, nutrition, and health outcomes.

Climate Change

Climate change is a significant, long-term shift in global weather patterns and sea levels. The effects of unmitigated climate change will likely cause increased food insecurity. At the production level of the food system, climate change can lead to declines in fish populations and crop yields (6). Staple crops grown in high carbon dioxide conditions will likely have reduced nutrient content (e.g. protein, iron, and zinc) which affects the quality of people's diets (3,6–8).

At the storage and distribution stage of the food system, climate change leads to more crop losses due to increased disease susceptibility and extreme weather events (8). Food prices may increase because of agricultural losses and declining crop yields. Staple crops grown in high carbon dioxide conditions will likely have reduced nutrient content, which affects the quality of people's diets (3,6,7).

Globalization and Trade

Globalization makes people and countries more interconnected and interdependent. It shapes local economies and affects human health and nutrition in both positive and negative ways. Trade may create new employment opportunities, but it can also increase competition for local producers, which may reduce prices for domestic products and threaten the livelihoods of smallholders (9,10).

Trade can allow people to access foods that may not be easily grown where they live or are less available during a particular season. This increases the diversity of the food supply and access to seasonal foods year-round. It also makes foods less expensive through efficiency and competition (11). The lowered cost of imported food and animal feed can increase access to animal source foods and lead to higher protein intake, which is important for areas with high rates of undernutrition (10).

Globalization and trade can also have adverse effects on diets and nutrition. Unhealthy foods have become increasingly accessible and inexpensive around the world, partly due to trade policies and widespread advertising (9,10,12). People's diets have changed from more traditional ones high in minimally processed foods to those high in animal source foods and highly-processed foods with a lot of salt, unhealthy fats, and added sugars. People are also less physically active as a result of

globalization (13). All of these changes have contributed to the increasing burdens of overweight/obesity and non-communicable diseases.

Income Growth and Distribution

As a country's average income grows, nutritious foods – like animal source foods (e.g. meat, dairy) and fruits – become more accessible. Income growth can also lead to greater demand for animal source foods, which can stress food systems by putting more demands on land and water resources, and increasing greenhouse gas emissions (11). Rising incomes can also lead people to buy more unhealthy foods, such as sodas and highly-processed, packaged foods (14,15).

People may not have equal access to healthy foods because of increased income inequality. In high-income countries, healthier foods – like fresh fruits and vegetables – are typically more expensive than highly-processed, packaged foods. These less expensive foods tend to be higher in saturated fat and sodium (11,16). In low- and middle-income countries, highly-processed foods and animal source foods are linked to wealth, which may make these foods socially desirable (11,17).

Urbanization

In 2050, most of the world's population (68%) is expected to live in urban areas (18). The biggest increases in urban populations will take place in Africa and Asia (18).

Urbanization shapes a country's food system – it creates longer food chains and limits agricultural land. However, urban areas are also typically centers of food technology innovation. This is because there is an increased need for processing, packaging, and refrigeration, and more food losses (11).

Urbanization changes the food environment by increasing the number of supermarkets in an area. Additional supermarkets can increase access to both healthy and unhealthy foods (19). Urbanization provides easier access to all foods, including more processed foods. In low-and lower middle-income countries, street vendors, not supermarkets, provide easier access to food.

For people with low incomes, urbanization can lead to food deserts and swamps. In these areas, access to healthy, fresh food is limited, but unhealthy fast foods and highly-processed, packaged foods are plentiful.

Urbanization is also linked to increased incomes, demand for convenience foods, and eating outside of the home (11). Increased attention is being placed on the way that linkages between cities and rural areas can be leveraged to revitalize rural economies and increase access to healthy diets for both urban and rural populations (20).

Population Growth and Migration

From 2017 to 2050, the world's population is expected to increase by more than two billion people. Countries in Africa and Asia will experience the most rapid population growth (18).

Increases in population will put more stress on the current food system. Due to global trade and migration, population growth in one country can affect the food system in other regions as well. Additionally, countries may not be prepared for the influx of migrants fleeing conflict or severe weather events. Food systems may not be able to supply everyone with a healthy diet (2,11).

Politics and Leadership

A region's policies on agriculture, nutrition, and trade affect food systems. Economic policies on agricultural subsidies and trade can influence the availability and affordability of certain foods, which in turn can affect dietary intake (20).

Governments can implement dietary guidelines to shape policies and promote healthy diets. For example, tax policies can be used to discourage eating unhealthy foods like soda and highly-processed, packaged foods. Political will and investment are needed to make sure that there are sufficient resources to create a sustainable food system (11).

Socio-cultural Context

Social and cultural traditions shape diets by influencing what foods are desirable, when and how meals are prepared, and what traditions are practiced. In some cultures, food may reflect a person's social status in society or the household. Foods associated with a higher wealth status may be more desirable.

In most cultures, food is a central part of holidays and traditions. Strong cultural ties to traditional foods and meal practices could work to prevent the shift to diets high in highly-processed foods and reliance on fast food. In many cultures, certain foods are avoided for reasons such as life stage (adult vs. childhood foods) or gender. In particular, culture has a strong influence on what people eat while pregnant or lactating (11).

Outcomes of Food Systems

Diet Outcomes

Diets are influenced by all aspects of the food system, and they affect nutrition and health. The World Health Organization states that a healthy diet starts early in life and includes a diversity of foods — starchy staples, legumes, fruits, vegetables, and foods from animals, like meat and dairy. It balances the intake and expenditure of energy, and limits salt, fat, added sugar, highly-processed foods, and sugar sweetened beverages (21).

Throughout the world, people still do not have access to adequate calories or a diversity of healthy, nutrient-rich foods. This lack of access results in hunger and micronutrient deficiencies. Rising incomes have increased the availability and accessibility of nutrient-rich foods like fruits, vegetables, and seafood. However, globalization and rising incomes have also contributed to people eating more unhealthy foods, like highly-processed foods and sugar sweetened beverages (2,22). Researchers, policy makers, and consumers are also increasingly focused on the

environmental sustainability of diets (23). Diets and food systems have major impacts on the use and degradation of land and water resources, as well as on greenhouse gas emissions.

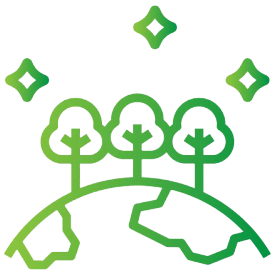
Nutrition and Health Outcomes

Healthy diets are essential for nutrition and health. Poor diets are one of the main risk factors for deaths globally (24). Unhealthy diets are a leading risk factor for disease and can lead to undernutrition, which is associated with poor cognitive development and increased susceptibility to infections. Diets that lack essential nutrients may lead to micronutrient deficiencies. Children, women, and other nutritionally-vulnerable populations are especially susceptible to poor health outcomes from these deficiencies.

Diets that exceed recommended energy intake – especially diets that consist of unhealthy eating patterns – can lead to overweight, obesity, and non-communicable diseases, like diabetes and cardiovascular diseases. Diets high in sodium and low in whole grains, fruit, nuts, vegetables, and omega3-fatty acids contribute to an increased risk of death (24).

Food safety, antimicrobial resistance, and pesticide usage also affect the health of consumers and people who work within the food system (1).

Environmental Impacts



Food systems affect the local and global environment. Global food production uses approximately 50% of habitable land (Tilman & Clark, 2014) and accounts for 19-29% of total greenhouse gas emissions, which exacerbates climate change (6).

Different types of food production have varying environmental impacts. Producing ruminant meat (e.g. beef, lamb) and dairy can be especially environmentally damaging in many contexts and depending on the method of production. Production can require large areas of land and water, and produce large amounts of greenhouse gas emissions.

Intensive agriculture requires more fertilizer and pesticide use. In addition, the practice of mono-cropping – growing the same crop over an extended area – and cash crop production can lead to biodiversity loss. This can result in soil degradation and a food system that is less resilient to droughts or other extreme weather events (11,25).

Economic Impacts

Globally, the food system is one of the main sectors of employment. Agriculture is a major contributor to the economies of low- and middle-income countries. Changes in food systems and shifts in dietary patterns can have large economic effects on farmers, retail owners, and consumers (11).

For example, increases in imported food products may lead to more competition for smallholder farmers and reduce the production of domestic staples. However, support for export industries may contribute to an increase in the production of cash crops by local producers. Trade can also lead to more investment in the food industry and technology sector, which creates new jobs (9,10).

Social Impacts

Food systems play an important role in societal well-being – they help to make sure that all members of society are able to be as healthy as possible.

To achieve this goal, food systems can help ensure that all members of society have equitable access to a healthy diet. They can also guarantee that food system workers have well-paying jobs and safe working conditions. Equitable food systems help promote community health, gender equality, labor rights, and animal rights (11,26).

Types of Food Systems

General Note:

The categories of food systems developed for this dashboard highlight common patterns in food supply chains and food environments that exist across countries. By comparing these different food systems types, users can understand the complexity of food systems and begin to identify priority areas of action within their own food systems.

These categories of food systems are based on four indicators that reflect key dimensions of food supply chains, food environments, and food systems drivers. These indicators include:

- Agricultural value added per worker
- Share of dietary energy derived from cereals, roots, and tubers (staples)
- Number of supermarkets per 100,000 population
- Percent of total population living in urban areas

The types of food systems were determined for 146 countries. Countries received a rank-based score for each of the four indicators. Based on the sum of these four scores, countries were then separated into quintiles. Each quintile represents one of five food systems types. Summary statistics are presented in Table 1 and descriptions of these food systems follow below.

Countries have been categorized into five types of food systems. It should be noted however that countries within one food system may still be very different from each other. There are also many types of food systems that can exist within a single country, as different regions of a country and different foods include a mix of traditional and modern characteristics.

Rural and Traditional

In rural and traditional food systems, farming is mainly done by smallholders, and agricultural yields are typically low. Among most farmers, production is typically focused on staple crops (some of which they keep to eat) and a limited number of cash crops. Food imports represent a small percentage of domestic consumption.

Supply chains are short due to smaller urban populations, resulting in many local, fragmented markets. The lack of refrigeration and storage facilities results in large food losses for some crops, which may make producers less likely to diversify into perishable foods. It can also contribute to the fragmentation of markets. The quantity and diversity of foods available varies seasonally, often with a pronounced lean season. Seasonal price swings tend to be large. Many countries with rural and traditional food systems are experiencing rapid growth in rural non-farm employment opportunities (e.g. sales of agricultural inputs, basic food processing, small-scale trading, and storage).

Food is mainly sold in informal market outlets, including independently-owned small shops, street vendors, and central/district markets. Supermarkets are rare outside of capital cities, though they are beginning to grow in number along with fast food chains. Compared to other types, a greater proportion of countries in this food system type have adopted mandatory or voluntary fortification guidelines for staple foods in order to combat micronutrient deficiencies.

Informal and Expanding

In informal and expanding food systems, agricultural productivity is higher on average than in rural and traditional food systems. The use of inputs (e.g. seeds and fertilizer) is greater. Medium- and some large-scale farms are beginning to emerge. Modern food supply chains are common for grains and other dry foods, with large-scale processors (along with many small) and centralized distribution centers. Modern chains are also emerging for fresh foods, though traditional supply chains continue to dominate for these foods due to weak cold chains and inadequate market infrastructure.

Processed and packaged foods are available in both urban and rural areas. Food processing may include a combination of locally-sourced and imported ingredients. Demand for convenience foods increases as the formal labor force grows and includes more women. Urbanization and income growth also play a role. Supermarkets and fast food are rapidly expanding and, compared to rural and traditional food systems, are more accessible to middle-class consumers. However, most consumers continue to obtain most of their food from informal market outlets, especially for animal source foods, fruits and vegetables. Few food quality standards are in place and advertising is not regulated. As in rural and traditional food systems, however, many countries have fortification guidelines for staple foods.

Emerging and Diversifying

In emerging and diversifying food systems, an increased number of medium- and large-scale commercial farms co-exist alongside large numbers of small-scale farms. These small-scale farms

are more linked to markets than in more traditional food system types. Modern supply chains for fresh foods, including fruits, vegetables, and animal source foods, are developing more rapidly. Urban areas source both dry and fresh foods through longer supply chains and rely on food imports more than traditional and informal food systems. Processed and packaged foods are more available in rural areas, and there is less seasonal fluctuation in the availability and pricing of perishable foods.

Supermarkets are common even in smaller cities and towns, and their market share is growing rapidly. Processed foods, including ultra-processed foods, are common in urban areas and also found in many rural areas. Most fresh food continues to be acquired through informal markets, but the share of supermarkets is rising and significant. Food safety and quality standards exist, but are enforced mainly within formal markets due to limited government monitoring capacity. A greater proportion of countries in this food system type have adopted food-based dietary guidelines.

Modernizing and Formalizing

In modernizing and formalizing food systems, agricultural productivity is generally higher than in emerging, informal, and traditional systems. Larger farms rely more on mechanization and input-intensive practices. Food supply chain infrastructure is more developed, which results in fewer food losses on the farm and beyond the farm gate. On the other hand, food waste is rising rapidly, and spoilage at the end of the supply chain remains a challenge. Food and beverage manufacturing represent a smaller percentage of overall manufacturing because countries in this type have more manufacturing in non-food sectors. Dietary energy is derived from diverse food sources. Better national distribution chains enhance the role of food imports in enabling more year-round availability of diverse foods.

Multiple supermarket chains exist within cities and larger-sized towns, but their growth is slower than in late transitional systems. These supermarkets and other modern retail outlets hold a large share of processed and dry goods sales, have captured a larger market share of fresh foods, and low-income consumers are much more likely to shop in them. Government regulation and monitoring of food safety and quality standards are more common. Most recently, aggressive food labeling is emerging for ultra-processed foods.

Industrialized and Consolidated

In industrialized and consolidated food systems, farming is a small proportion of the economy. There are a small number of large-scale, input-intensive farms that serve specialized domestic and international markets (e.g., horticulture, animal feed, processed food ingredients, biofuels). Market consolidation is common — large-sized food retailers procure directly from processors and urban wholesalers procure directly from farmers, which reduces the number of intermediaries along the supply chain. Supply chains are long, with national and international sourcing of nearly all types of foods.

Supermarket density is high in urban and metropolitan areas. In general, only small towns lack a supermarket and most medium-sized towns have multiple outlets. The formal food sector has captured nearly all of the food eaten domestically, including fresh foods. There is growth in luxury food retail, as well as “fast-casual” restaurants, which market higher-quality fast food. Pockets of food insecurity persist, along with economic disparities. A greater proportion of countries in this type of food system have adopted policies that ban the use of industrial trans fats and encourage the reformulation of processed foods to reduce salt intake.

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