

FOOD SECURITY MANAGEMENT AND ASSESSMENT

Mohammad A. Alshuniaber*

Food Sciences and Nutrition Department, King Saud University, Riyadh, Saudi Arabia (KSA).

***Corresponding Author:-**

Email: malshuniaber@ksu.edu.sa ORCID # (0000-0001-6358-0653) Tel: +966-556115567

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Abstract:-

Food security is a multidisciplinary and multidimensional subject, rendering food security governance a complex issue. However, it is important for food security researchers, policy-makers, and other interested parties to realize the international food security framework. Understanding the dimensions of the food security framework facilitates planning and improves the national food security system. As achieving national food security requires collaboration and coordination among several domestic organizations, an efficient food security framework should be in place that highlights the roles of each contributing organization. Furthermore, governments should apply measures to ensure the suitability and adequacy of their state of food security. National food security should be regularly assessed using sound, accurate, and up-to-date food security indicators and internationally recognized food security assessment models to support the decision-making process. This review paper highlights the international food security framework to provide insight for national governments regarding the governance of food security. However, based on an extensive review of the international food security framework, this paper suggests five major dimensions thereof. These dimensions should be considered for any national food security system, as they are crucial to achieving national food security by improving food availability and affordability.

These dimensions are a sustainable agriculture and food system, food trade, nutrition, food security knowledge and databases, and fighting poverty.

Keywords: - Agriculture, Climate change, Food insecurity, Malnutrition, Poverty, Sustainability.

INTRODUCTION

Food security is the central interest of the Food and Agriculture Organization (FAO), and the Committee on World Food Security (CFS) of the FAO plays the key role in global food security. The CFS, established in 1974 as an intergovernmental body, serves as a forum that aims to review and follow up on food security policies.

The Committee reports annually to the Economic and Social Council (ECOSOC) of the United Nations (CFS 2017a). The CFS was reformed in 2009 as the most inclusive international and intergovernmental platform for all stakeholders to facilitate and coordinate food security and global nutrition activities. The vision of the reformed CFS is to “strive for a world free from hunger where countries implement the voluntary guidelines for the progressive realization of the right to adequate food in the context of national food security” (CFS 2017b).

The CFS includes members from FAO, IFAD, WFP, and representatives from FAO’s and other UN member states. It conducts meetings with its Advisory Group and other stakeholders on food security and nutrition issues. CFS holds an annual plenary session to debate food security recommendations to provide food security policies and advice for members and stakeholders (CFS 2013). The High Level Panel of Experts (HLPE) is the Steering Committee of the CFS. HLPE’s reports are independent from those of the CFS, and its recommendations to the CFS are used as a basis for policy discussions. HLPE was created in 2009 to enable the formation of informed, high quality, effective, and coherent food security and nutrition policies from the local to international levels. It selects and manages Project Teams that provide scientific and knowledge-based analyses and advice by utilizing available data, research, and technical studies. Its tasks are focused on analyzing and assessing the current state of food security and nutrition, and on identifying emerging issues and trends in food security and nutrition to help members prioritize future actions and focus on key focal areas (CFS-HLPE 2015, HLPE 2018).

1. INTERNATIONAL FOOD SECURITY FRAMEWORK

FAO is the major international organization responsible for global food security. It leads international efforts to evaluate and improve global food security, and collaborates with UN member countries to evaluate and improve their agriculture and food system. The five major goals of FAO are to 1) eliminate hunger, food insecurity, and malnutrition; 2) reduce poverty; 3) enable efficient and inclusive food and agriculture systems; 4) create more productive and sustainable agriculture, forestry, and fisheries; and 5) improve resilience of livelihoods to crises and threats (FAO 2018a). With the major responsibility of international food security mandated to FAO, other international organizations also contribute to the global food security system. [Figure 1 around here.]

1.1 Sustainable agriculture and food systems

Sustainability is incorporated into the UN agenda, and the 17 Sustainable Development Goals (SDGs) should be within member states’ scope of actions. Sustainability in agriculture and food systems is central to FAO’s goals. The major role of FAO is to create efficient, inclusive, productive, and sustainable agriculture, forestry, and fisheries. The United Nations Environment Program (UNEP) is the leading global environmental authority that promotes sustainable development of the environment. Its task is to enable people and authorities to improve their quality of life by utilizing the environment without compromising that of the future generation. A major task for the UNEP is to study the causes and effect of climate change, which affects agriculture and food systems. It also plays a key role in ensuring a sustainable environment, which could affect quality of life and the agriculture system (UNEP 2018). The Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization (WMO) and UNEP. It aims to assess scientific, technical, and socio-economic information relevant to understanding climate change. The IPCC also estimates the potential impact of climate change and assesses the best available mitigation options (IPCC 2013).

Minimizing food loss and waste is an important factor in the sustainable food system. The FAO international initiative SAVE FOOD—in partnership with international organizations, civil society, and the private sector—aims to enable food systems worldwide reduce food loss and waste. The SAVE FOOD Initiative aims to achieve the following four goals: 1) increase awareness of the impact of and solutions for food loss and waste; 2) collaborate and coordinate global initiatives on food and waste reduction; 3) develop food loss and waste policies, strategies, and programs; and 4) support food loss and waste investments and programs implemented by the private and public sector (FAO 2017b). Furthermore, FAO is one of the seven Steering Committee expert institutions for the Food Loss and Waste (FLW) Protocol. This multi-stakeholder partnership was launched in 2013 and aims to develop global food loss and waste standards (namely, FLW Standards) and ensure their adaptation to motivate reducing food loss and waste (FLW-Protocol 2018).

UNEP also significantly contributes to food system sustainability, especially regarding food loss and waste. UNEP are involved in the “Think. Eat. Save” campaign of the SAVE FOOD Initiative in partnership with FAO and others including the UN Secretary-General’s Zero Hunger Challenge (UNEP and FAO 2014, UNEP 2013). UNEP is part of a coalition dedicated to accelerating progress toward achieving SDG 12.3 by 2030, namely to halve food loss and waste from farm to fork (UNEP 2016).

1.2 Nutrition

The 1996 World Food Summit reaffirmed the right of everyone to have access to adequate, safe, and nutritious food. FAO supports the progressive realization of the right to adequate food in the context of national food security (FAO 2005b). However, food insecurity is one major cause of malnutrition, as it could subject food insecure families to a less nutritious diet. In 2017, while the level of malnutrition decreased, it remained high and food insecurity increased (FAO et al. 2018). The UN 2030 Agenda for Sustainable Development includes nutrition in its scope. The UN Decade of Action on Nutrition

2016–2025 aims to “end hunger, achieve food security and improved nutrition and promote sustainable agriculture” by 2030 (FAO et al. 2017).

The World Health Organization (WHO) runs the Work Program for the United Nations Decade of Action (DoA) on Nutrition. The UN’s DoA on nutrition (2016–2025) is “a commitment by United Nations Member States to undertake 10 years of sustained and coherent implementation of policies, programs and increased investments to eliminate malnutrition in all its forms, everywhere, leaving no one behind” (UN 2018). Moreover, the WHO became a strategic partner for FAO in its efforts regarding food security. Since 2017, WHO contributes to publishing FAO’s flagship report “The State of Food Security and Nutrition” (WHO 2018).

Fittingly, the United Nations International Children’s Emergency Fund (UNICEF) runs nutrition programs to reduce malnutrition among children by supporting breastfeeding, providing complementary food for infants older than six months, and providing micronutrient supplementation for women and children to address nutrient deficiencies (UNICEF 2018b). UNICEF’s Toolkit for Action aims to highlight the recommended nutrition actions to ensure preparedness for, response to, and recovery from emergencies. It identifies key practical actions to support the capacity to prepare for and/or respond to nutrition issues in emergencies. This Toolkit for Action fulfills UNICEF’s Core Commitments for Children in Humanitarian Action (UNICEF 2017).

1.3 Food trade

The role of the World Trade Organization (WTO) in food trade, and hence food security, is crucial. The major international agreements that regulate international food trade include the General Agreements on Tariffs and Trade (GATT), agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), and agreement on Technical Barriers to Trade (TBT). In addition to these are the Agreement on Agriculture (AOA) and Agreement on the Application of Sanitary and Phytosanitary Measures (SPS) (WTO 2017, FAO 2005a). These international agreements aim to promote international fair trade by removing possible trade barriers through defining and accrediting relevant standards for the government and private sector to serve as the basic texts to resolve trade disputes.

On the other hand, the WTO’s accredited food standards are a regulatory tool that facilitates food trade by ensuring sufficient, safe, and nutritious food for the growing population. Standards aim to address transparency in product characteristics, processing methods, packaging, labeling, and analytical procedure to assess conformity.

The WTO accredited standards are voluntary, and become compulsory only when required by national legislation. Despite that WTO member states are encouraged to adopt these standards, they can apply their own stricter standards when scientifically justified by a risk assessment. These standards, along with other published guidelines, aim to enable governments to publish their own national standards in a harmonized way without creating unnecessary trade boundaries (FAO and WTO 2017).

The WTO has accredited organizations to elaborate food-related standards to facilitate international trade in agricultural and food products. The main source of international food safety and quality standards is the Joint FAO/WHO Codex Alimentarius Commission. Moreover, standards published by the International Organization for Standardization (ISO) are referenced by the WTO’s agreements (FAO and WTO 2017). Other WTO-accredited organizations for standards include the World Organization for Animal Health (OIE), which ensures and promotes animal disease control and prevention. The WTO also references the standards published by the FAO’s International Plant Protection Convention (IPPC), which aims to coordinate effective actions to control plant pests and diseases (FAO 2005a).

The Joint FAO/WHO Codex Alimentarius Commission established in 1963 aims to protect consumers’ health while ensuring fair food practices and trade. This intergovernmental body is responsible for preparing and publishing international food standards and guidelines to promote food safety and quality. With more than 220 food standards and more than 120 guidelines and codes of practice, Codex targets the highest attainable levels of consumer protection. Its standards help governments develop scientifically based domestic regulations and fulfill the objectives of international trade. The guidelines and code of practices targeting the industrial sector enable them to comply with national and international standards (Codex 2016). Codex food standards are referenced in the WTO’s SPS agreement, implying the role of Codex in resolving trade disputes. Note that WTO members can apply food safety and quality measures in a stricter way than those set by Codex standards. In this case, the new measures should be scientifically justified (Codex 2018). Although Codex is not mandated to facilitate food trade, its widely accepted standards and guidelines facilitate food trade, because countries align their domestic standards with those of Codex. Codex’s publications are intended to guide and promote the establishment of harmonized food definitions and requirements (FAO and WHO 2016).

1.4 Fighting poverty and resilience to crises

FAO operates the World Food Program (WFP), a leading humanitarian organization that aims to deliver food assistance in emergencies and help local communities improve their nutrition and resilience. The WFP provides cash and food to affected people to empower them to feed themselves. However, according to the WFP, food assistance “involves a more complex understanding of people’s long-term nutritional needs and of the diverse approaches required to meet them” (WFP 2018). Moreover, UNICEF aims to save children’s lives, defend their rights, and support their education, especially those most vulnerable and excluded. It works to overcome difficulties and threats facing children owing to violence, poverty, disease, and discrimination. UNICEF’s programmatic response and emergency preparedness program provide several funding options to protect and help children in their humanitarian action (UNICEF 2018a).

FAO also operates the International Fund for Agricultural Development (IFAD), which aims to achieve inclusive and sustainable rural transformation. It targets rural poverty by supporting and enabling people in rural areas to access finance, the market, knowledge, and technology. It also promotes gender equality, builds the capacity of local communities, and

strengthens resilience to climate change. IFAD invests in rural people's food security and nutrition by increasing their income, improving their resilience, and expanding their business (IFAD 2018).

The International Monetary Fund (IMF) aims to foster global monetary cooperation, promote sustainable economic growth, secure financial stability, facilitate international trade, and reduce poverty. It is committed to the UN's 17 SDGs by supporting its member states in their implementation thereof (IMF 2018). Moreover, the World Bank Group (WBG) is a unique global partnership of five institutions working for sustainable solutions that reduce poverty and build shared prosperity in developing countries. Its mission is to end extreme poverty, increase shared prosperity, and promote sustainable development, and it is considered the largest source of funding and knowledge for developing countries. It provides financing, policy advice, and technical assistance for governments, while providing financing, political risk insurance, and settlement of disputes for the private sector. The WBG has funded thousands of development projects through traditional loans, interest-free credit, and grants to help create sustainable economic growth and build resilience to shocks and threats (WBG 2018a, WBG 2018b).

1.5 Food security knowledge and databases

FAO publishes many reports intended to raise awareness regarding food and agriculture including the flagship reports for "The State of World." This flagship publications series includes "The State of World Fisheries and Aquaculture," "The State of the World's Forests," "The State of Food and Agriculture," "The State of Agricultural Commodity Markets," and "The State of Food Security and Nutrition in the World" (FAO 2018d, FAO 2018c). The latter was entitled "The State of Food Insecurity in the World" between 1999 and 2015. In 2017, the name of the report was changed to "The State of Food Security and Nutrition in the World" and jointly published by FAO, IFAD, and WFP in collaboration with WHO, UNICEF, and the World Bank. This flagship annual report highlights issues pertaining to global hunger and malnutrition. The new report integrates monitoring progress toward the targets related to SDG2 and other related aims (CFS 2017b). Moreover, another important publication series is the "Policy Recommendations" published by FAO-CFS. National food security decisionmakers should seriously consider these recommendations. FAO-CFS published 14 policy recommendation reports since 2010 to provide vital guidelines for food and agriculture systems (CFS 2018). Most policy recommendations are based on HLPE's reports, which are considered an important source of information on food security and nutrition (CFS-HLPE 2018).

[Table 1 around here.]

Furthermore, Article (1) of FAO's constitution mandates FAO to "collect, analyze, interpret, and disseminate information related to nutrition, food and agriculture." Therefore, FAO provides massive international data relevant to agriculture and food systems. FAO's databases and monitoring systems can be classified into two groups based on their objectives. The first group includes FAO's Global Water Information System (AQUASTAT) and their Food and Agriculture Data (FAOSTAT). This group aims to provide free access portals of standardized data regarding agriculture, water, and food (FAO 2017a, FAO 2016). Moreover, WBG also provides an open data portal considered an important source for world development indicators, many of which are related to agriculture and food security (WBG 2018a, WBG 2018b). The second group of databases considers the national laws, regulations, and policies on agriculture, food, and natural resources. This group includes the FAOLEX Database and Food and Agriculture Policy Decision Analysis (FAPDA), which aims to provide a comprehensive database to promote evidence-based agriculture and food legislation, and to disseminate information on policies and framework decisions (FAO 2018e, FAO 2018f).

Moreover, FAO provides portals for monitoring agricultural commodities and food prices as well as price volatility. The Agricultural Market Information System (AMIS) platform aims to enhance food market policy response for food security and transparency. It assesses the global food supplies of four major food commodities to coordinate policy action in times of market uncertainty and price volatility (FAO 2015). In addition, the Food Price Monitoring and Analysis (FPMA) website targets the domestic prices of the basic food commodities of developing countries. It aims to capture high food prices at the country level that might affect food security (FAO 2018h). However, FAO continuously monitors and analyzes food supply and demand to conduct market analyses and provide an early warning of food crises at the country or regional level. FAO's monitoring of food crises is conducted through its Global Information and Early Warning System (GIEWS), which aims to issue analytical reports related to food security (FAO 2018i). Finally, FAO's Early Warning Early Action (EWEA) System translates warnings into anticipatory actions to reduce the impact of foreseen crises. Early action is critical in food security crises and can be anticipated through consolidating available forecasting information (FAO 2018b).

2. ASSESSMENT OF THE STATE OF FOOD SECURITY

2.1 FAO's models

The World Food Summit (WFS) mandated FAO to monitor progress toward the objectives set by WFS and goals of the Millennium Declaration (MD). In addition, FAO's Committee on World Food Security (CFS) recommended measuring hunger and capturing various aspects of food insecurity. However, FAO's statistics division has rigorously and continuously worked to compile food security indicators, resulting in the publication of the Food Security Index (FSI). The FAO-FSI is considered one major source of food security indicators and is published annually for all member states when data is available. It is a collection of food security indicators published by FAO and other international organizations to serve as a single database for information classified according to the four dimensions of food security (FAO 2018g). The FAO-FSI indicators were selected based on data sufficiency and expert judgment to enable the evaluation and comparison of the state of food security across regions/countries and over time. In 2017, the FAO-FSI encompassed a

revised selection of indicators to fulfill the SDGs monitoring requirements and data availability, and to match official SDG indicators. Furthermore, in 2017, the annual FAO report “State of Food Security and Nutrition” considered nutrition security in collaboration with WHO and UNICEF for the first time. This collaboration led to incorporating a new indicator that measures the severity of food insecurity based on the Food Insecurity Experience Scale (FIES) (FAO 2017c).

Regarding food insecurity, FAO’s Integrated Food Security Phase Classification (IPC) is a tool by which to classify the severity and magnitude of food insecurity in a country or region. The IPC enables a comparison of food insecurity across countries and over time to help decision makers understand the current food security situation and evaluate mitigation options (IPC 2017b). The IPC is “a set of analytical tools and processes to analyze and classify the severity of acute and chronic food insecurity situations according to scientific international standards.” The IPC classifies acute food insecurity into five phases: 1) minimal, 2) stressed, 3) crisis, 4) emergency, and 5) famine. Moreover, it categorizes chronic food insecurity on four levels: 1) minimal, 2) mild, 3) moderate, and 4) severe chronic food insecurity. The IPC employed a wide range of indicators for its food insecurity classification, including food consumption levels, livelihood changes, nutritional status, mortality rate, food availability, access, utilization and stability, and vulnerability (IPC 2017a).

2.2 Models of the Economist Intelligence Unit (EIU)

The EIU publishes the Global Food Security Index (GFSI) sponsored by Du Pont®. The GFSI aims to evaluate advancements in food security and compare food security indexes among the countries studied. It considers 113 countries from 6 regions, namely Asia and the Pacific, Central and South America, Europe, the Middle East and North Africa, North America, and Sub-Saharan Africa (EIU 2015). The GFSI aims to provide insights beyond food security and provide an objective framework for evaluating, ranking, and comparing food security issues across the 113 countries to facilitate decision-making in this regard (EIU 2014, EIU 2017c). The GFSI overall index considers three core food security indicator categories covering food availability (six indicators), food affordability (eight indicators), and food quality and safety (five indicators). These categories can be weighted in two pre-set weighing schemes, namely a “default” scheme (set by a peer panel), which weighs the availability, affordability, and quality and safety effects on the overall Food Security Index as 44%, 40%, and 16% respectively. The other is the “neutral” scheme, in which the three categories are equally weighted (33.3% for each).

Users can test other scenarios by weighting categories and indicators they consider suitable (EIU 2015, EIU 2017c). Most indicators are measured quantitatively out of 100. Those that score above 75 are considered food security strengths, and those less than 25 as food security weaknesses (EIU 2017a). The 2017 EIU-GFSI added a new index related to the “Natural Resources and Resilience Index” (NRRI). This index aims to assess countries’ exposure to the impacts of climate change, susceptibility to natural resource risks, and adaptation to these risks. The new index is not calculated in the GFSI; however, it can be corrected based on the NRRI scores. The NRRI comprises seven categories of indicators: exposure, water, land, oceans, sensitivity, adaptive capacity, and demographic stress (EIU 2017b).

Another relevant model published by the EIU and Barilla Center for Food and Nutrition is the “Food Sustainability Index” (FSI). The FSI assesses the sustainability of the national food system across three pillars, namely sustainable agriculture (3 categories, 19 indicators), nutritional challenges (3 categories, 11 indicators), and food loss and waste (2 categories, 6 indicators) (EIU and BCFN 2018). Each indicator is scaled from 0 to 100, where 100 indicates that it is fully sustainable. The overall score is calculated from a weighted average of the categories. The FSI aims to highlight issues of concern and best practices to support decision making related to food sustainability. It is a quantitative and qualitative benchmarking model that facilitates comparison between countries and pillars (EIU and BCFN 2017).

2.3 Other models

The International Food Policy Research Institute (IFPRI) aims to sustainably reduce poverty, hunger, and malnutrition in developing countries by providing research-based food-related policies and solutions. IFPRI also aims to evaluate the causes of geopolitical shocks and their impact on food security, among others (IFPRI

2018). IFPRI publishes the Global Hunger Index (GHI) annually, a tool to measure and track hunger worldwide. The GHI aims to raise awareness, draw attention, and direct resources to areas threatened by hunger. It is based on four indicators, namely undernourishment, child wasting, child stunting, and child mortality. These indicators can capture the nutrition situation as well as acute and chronic under-nutrition while minimizing the effect of random measurement error. The GHI usually targets low and medium-income countries where hunger is considered relevant. However, even in high-income countries, under-nutrition may be a serious concern for a specific segment of the population (IFPRI 2017a, IFPRI 2017b). The Economic Research Service of the United States Department of Agriculture (USDA-ERS) developed a demand-oriented International Food Security Assessment (IFSA) model. The IFSA model relies on economic data including average per capita food consumption, domestic food price, world prices, price and income elasticity, tariff data, exchange rate, and Consumer Price Indexes (CPIs). It evaluates food insecurity by measuring the gaps between food demand (i.e., food consumption) and the nutritional target of 2,100 calories per day per capita. Food demand is expressed as the “grain equivalent” of four food groups including major grain, other grains, roots and tubers, and all other food. Food items are classified into these groups based on caloric content. It evaluates food security by estimating the share of population unable to attain the nutritional target. In this model, a country is considered “food secure” when the average consumption for the poorest 10% of the population is above the 2,100-calorie threshold (USDA-ERS 2016). The model measures the depth of food insecurity by projecting three food security indicators—number of food-insecure people, share of food-insecure population, and food gap—as the grain equivalent. Furthermore, information on consumer responsiveness to changes in incomes and prices is also included (USDA-ERS 2018).

3. CONCLUSION

Governing food security is intricate and involves several organizations. However, an efficient food security framework should be in place to ensure the effectiveness of the national food security system. It is crucial to adopt a national food security system that considers the structure of the global food security system to facilitate regional and international coordination and collaboration. It is important for national legal and regulatory frameworks to address the national food security system. A national food security system should comprise food security law and regulations as well as a food security framework that addresses the five major dimensions of a food security framework and highlights the role of each contributing organization in achieving the desired state of food security.

[Figure 2 around here.]

Furthermore, the national food security system should apply measures to assess the food security framework to ensure its suitability and adequacy in achieving national food security. An assessment of the state of food security will facilitate continuous improvement of the national food security framework to cope with changing food demand, availability, and affordability. It is recommended that sound, accurate, and up-to-date food security indicators and internationally recognized food security assessment models be used. Adopting the international food security assessment models would improve comparability and benchmarking against other food security systems, which will support the food security decision-making process.

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REFERENCES

- [1]. CFS-HLPE. (2015). *The High Level Panel of Experts on Food Security and Nutrition (HLPE): Key elements*. Committee on World Food Security Secretariat, FAO; Rome. <http://www.fao.org/cfs/cfs-hlpe/about-thehlpe/en/>. Accessed on 19 September 2018.
- [2]. CFS-HLPE. (2018). *HLPE reports* [web page]. High Level Panel of Experts on Food Security and Nutrition, CFS, FAO, UN. <http://www.fao.org/cfs/cfs-hlpe/reports/en/>. Accessed on 2 November 2018.
- [3]. CFS. (2013). *The Committee on World Food Security (CFS)*. Committee on World Food Security Secretariat, FAO; Rome. <http://www.fao.org/cfs/home/about/en/>. Accessed on 19 September 2018.
- [4]. CFS. (2017a). *Committee on World Food Security* [web page]. Committee on World Food Security Secretariat, FAO. <http://www.fao.org/cfs/home/en/>. Accessed on 19 September 2018.
- [5]. CFS. (2017b). *Global strategic framework for food security and nutrition*. Committee on World Food Security Secretariat, FAO; Rome. <http://www.fao.org/3/a-mt648e.pdf>. Accessed on 19 September 2018.
- [6]. CFS. (2018). *CFS's major products and policy recommendations* [web page]. Committee on World Food Security Secretariat, FAO. <http://www.fao.org/cfs/home/products/en/>. Accessed on 19 September 2018.
- [7]. Codex. (2016). *About Codex* [web page]. Codex Alimentarius. <http://www.fao.org/fao-whocodexalimentarius/about-codex/en/>. Accessed 11 December 2017.
- [8]. Codex. (2018). *Codex Alimentarius Commission Procedural Manual*. Codex Alimentarius Commission; Rome. <http://www.fao.org/fao-who-codexalimentarius/publications/en/>. Accessed on 5 December 2018.
- [9]. EIU. (2014). *Food loss and its intersection with food security*. The Economist Intelligence Unit; New York. <http://going-global.economist.com/en/2014/08/14/gfsi/>. Accessed on 15 October 2018.
- [10]. EIU. (2015). *Global Food Security Index 2015: An annual measure of the state of global food security*. The Economist Intelligence Unit; New York. https://www.eiu.com/public/topical_report.aspx?campaignid=FoodSecurity2015. Accessed on 15 October 2018.
- [11]. EIU. (2017a). *Global Food Security Index [Microsoft Excel Dataset]*. The Economist Intelligence Unit; New York. <http://foodsecurityindex.eiu.com/>. Accessed on 15 October 2018.
- [12]. EIU. (2017b). *Global Food Security Index: Measuring food security and the impact of resource risks*. The Economist Intelligence Unit; New York. <https://foodsecurityindex.eiu.com/Resources>. Accessed on 15 October 2018.
- [13]. EIU. (2017c). *User guide for the Global Food Security Index*. The Economist Intelligence Unit; New York.
- [14]. EIU, & BCFN. (2017). *Food Sustainability Index 2017: Global Executive Summary*. The Economist Intelligence Unit & Barilla Center for Food and Nutrition; Parma. <http://foodsustainability.eiu.com/wpcontent/uploads/sites/34/2016/09/FoodSustainabilityIndex2017GlobalExecutiveSummary.pdf>. Accessed on 15 October 2018.
- [15]. EIU, & BCFN. (2018). *Food Sustainability Index* [web page]. The Economist Intelligence Unit & Barilla Center for Food and Nutrition. <http://foodsustainability.eiu.com/>. Accessed on 15 October 2018.
- [16]. FAO. (2005a). *Perspectives and guidelines on food legislation, with a new model food law*. FAO; Rome. <http://www.fao.org/3/a-a0274e.pdf>. Accessed on 10 June 2018.
- [17]. FAO. (2005b). *The right to food: Voluntary guidelines*. Food and Agriculture Organization, UN; Rome. <http://www.fao.org/3/a-y7937e.pdf>. Accessed on 9 June 2018.
- [18]. FAO. (2015). *AMIS: About AMIS* [web page]. Food and Agriculture Organization, UN. <http://www.amisoutlook.org/amis-about/en/>. Accessed on 9 June 2018.
- [19]. FAO. (2016). *AQUASTS: About AQUASTAT* [web page]. Food and Agriculture Organization, UN. http://www.fao.org/nr/water/aquastat/About_us/index.stm. Accessed on 9 June 2018.
- [20]. FAO. (2017a). *FAOSTAT: Food and agriculture data* [web page]. Food and Agriculture Organization, UN. <http://www.fao.org/faostat/en/#home>. Accessed on 10 June 2018.

- [21]. FAO. (2017b). *Food loss and food waste* [web page]. Food and Agriculture Organization. <http://www.fao.org/food-loss-and-food-waste/en/>. Accessed on 10 June 2018.
- [22]. FAO. (2017c). *Food Security Index [Microsoft Excel Dataset]*. Food and Agriculture Organization; Rome. <http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/#.WT3lBmh97Dc>. Accessed on 27 October 2018.
- [23]. FAO. (2018a). *About FAO: What we do* [web page]. Food and Agriculture Organization, UN. <http://www.fao.org/about/what-we-do/en/>. Accessed on 27 October 2018.
- [24]. FAO. (2018b). *EWEA: Early warning early action* [web page]. Food and Agriculture Organization, UN. <http://www.fao.org/emergencies/fao-in-action/ewea/en/>. Accessed on 19 September 2018.
- [25]. FAO. (2018c). *FAO flagship publications: The state of the world* [web page]. Food and Agriculture Organization, UN. <http://www.fao.org/publications/flagships/en/>. Accessed on 10 June 2018.
- [26]. FAO. (2018d). *FAO Publications Catalogue 2018*. Food and Agriculture Organization, UN; Rome. <http://www.fao.org/3/I9004EN/i9004en.pdf>. Accessed on 27 October 2018.
- [27]. FAO. (2018e). *FAOLEX Database* [web page]. Food and Agriculture Organization, UN. <http://www.fao.org/faolex/en/>. Accessed on 10 June 2018.
- [28]. FAO. (2018f). *FAPDA: Food and agriculture policy decision analysis tool* [web page]. Food and Agriculture Organization, UN. <http://www.fao.org/in-action/fapda/fapda-home/en/>. Accessed on 13 November 2018.
- [29]. FAO. (2018g). *Food security statistics* [web page]. Food and Agriculture Organization, UN. <http://www.fao.org/economic/ess/ess-fs/en/>. Accessed on 27 October 2018.
- [30]. FAO. (2018h). *FPMA: Food price monitoring and analysis* [web page]. Food and Agriculture Organization, UN. <http://www.fao.org/giews/food-prices/home/en/>. Accessed on 13 November 2018.
- [31]. FAO. (2018i). *GIEWS: Global information and early warning system* [web page]. Food and Agriculture Organization, UN. <http://www.fao.org/giews/background/en/>. Accessed on 13 November 2018.
- [32]. FAO, IFAD, WFP, WHO, & UNICEF. (2017). *The state of food security and nutrition in the world: Building resilience for peace and food security*. Food and Agriculture Organization; Rome. <http://www.fao.org/stateof-food-security-nutrition/en/>. Accessed on 15 September 2018.
- [33]. FAO, IFAD, WFP, WHO, & UNICEF. (2018). *The state of food security and nutrition in the world: Building climate resilience for food security and nutrition*. Food and Agriculture Organization, UN; Rome. <http://www.fao.org/3/I9553EN/i9553en.pdf>. Accessed on 15 November 2018.
- [34]. FAO, & WHO. (2016). *Understanding Codex*. Food and Agriculture Organization & World Health Organization, UN; Rome. <http://www.fao.org/3/a-i5667e.pdf>. Accessed on 15 November 2018.
- [35]. FAO, & WTO. (2017). *Trade and food standards*. FAO & WTO; Rome. https://www.wto.org/english/res_e/publications_e/tradefoodfao17_e.htm. Accessed on 15 November 2018.
- [36]. FLW-Protocol. (2018). *One-third of all food produced in the world is lost or wasted between farm and fork*.
- [37]. Food Loss and Waste Protocol. <http://flwprotocol.org/>. Accessed on 15 November 2018.
- [38]. HLPE. (2018). *About the High Level Panel of Experts (HLPE) on Food Security and Nutrition* [web page].
- [39]. HLPE, CFS, FAO. <http://www.fao.org/cfs/cfs-hlpe/about-the-hlpe/en/>. Accessed on 19 September 2018.
- [40]. IFAD. (2018). *IFAD: About us* [web page]. International Fund for Agricultural Development, FAO. <https://www.ifad.org/web/guest/about>. Accessed on 8 August 2018.
- [41]. IFPRI. (2017a). *Global Hunger Index: Scores 2017* [web page]. International Food Policy Research Institute. <http://ghi.ifpri.org/>. Accessed on 8 August 2018.
- [42]. IFPRI. (2017b). *Global Hunger Index: The Inequalities of Hunger*. International Food Policy Research Institute; Washington, DC. <http://www.globalhungerindex.org/download/2017-download.html>. Accessed on 8 August 2018.
- [43]. IFPRI. (2018). *About IFPRI* [web page]. International Food Policy Research Institute. <http://www.ifpri.org/about>. Accessed on 8 August 2018.
- [44]. IMF. (2018). *About the IMF* [web page]. International Monetary Fund; IMF. <http://www.imf.org/en/About>. Accessed on 6 July 2018.
- [45]. IPC. (2017a). *Evidence and standards for better food security*. Integrated Food Security Phase Classification, FAO; Rome. <http://www.ipcinfo.org/ipcinfo-about/what-is-the-added-value-of-ipc/en/>. Accessed on 6 July 2018.
- [46]. IPC. (2017b). *Evidence and standards for better food security decisions* [web page]. The Integrated Food Security Phase Classification. <http://www.ipcinfo.org/>. Accessed on 6 July 2018.
- [47]. IPCC. (2013). *IPCC Factsheet: What is the IPCC?* IPCC Secretariat; World Meteorological Organization; Geneva. http://www.ipcc.ch/news_and_events/docs/factsheets/FS_what_ipcc.pdf. Accessed on 19 September 2018.
- [48]. UN. (2018). *United Nations decade of action on nutrition* [web page]. United Nations. <https://www.un.org/nutrition/home>. Accessed on 9 January 2019.
- [49]. UNEP. (2013). *Think, eat, save: UNEP, FAO and partners launch global campaign to change culture of food waste* [web page]. United Nations Environment Programme. <https://www.unenvironment.org/news-andstories/press-release/think-eat-save-unep-fao-and-partners-launch-global-campaign-change>. Accessed on 13 March 2018.
- [50]. UNEP. (2016). *New 'Champions 12.3' coalition inspires action to halve global food waste* [web page]. United Nations Environment Programme. <https://www.unenvironment.org/news-and-stories/press-release/newchampions-123-coalition-inspires-action-halve-global-food-waste>. Accessed on 13 March 2018.
- [51]. UNEP. (2018). *About UN Environment* [web page]. United Nations Environment Program. <https://www.unenvironment.org/about-un-environment>. Accessed on 19 September 2018.
- [52]. UNEP, & FAO. (2014). *Think, eat, save: Reduce your food print* [web page]. Think.Eat.Save Campaign. <http://thinkeatsave.org/>. Accessed on 13 March 2018.

- [53]. UNICEF. (2017). *Committed to nutrition: A toolkit for action*. United Nations International Children's Emergency Fund; UNICEF; https://www.unicef.org/nutrition/files/NIE_Toolkit_Book_Final.pdf. Accessed on 13 March 2018.
- [54]. UNICEF. (2018a). *About UNICEF* [web page]. United Nations International Children's Emergency Fund; UNICEF. <https://www.unicef.org/about-unicef>. Accessed on 9 January 2019.
- [55]. UNICEF. (2018b). *Nutrition* [web page]. United Nations International Children's Emergency Fund; UNICEF. <https://www.unicef.org/nutrition/>. Accessed on 9 January 2019.
- [56]. USDA-ERS. (2016). *International Food Security Assessment, 2016–2026*. Economic Research Service, United States Department of Agriculture; Washington, D.C.
- [57]. https://www.ers.usda.gov/webdocs/publications/37270/59794_gfa27.pdf?v=0. Accessed on 9 January 2019.
- [58]. USDA-ERS. (2018). *International Food Security Assessment, 2018–2028*. Economic Research Service, United States Department of Agriculture; Washington D.C. <https://www.ers.usda.gov/webdocs/publications/89391/gfa-29.pdf?v=0>. Accessed on 10 January 2019.
- [59]. WBG. (2018a). *What we do* [web page]. World Bank Group, UN. <https://www.worldbank.org/en/what-we-do>. Accessed on 20 September 2018.
- [60]. WBG. (2018b). *Who we are* [web page]. World Bank Group, UN. <https://www.worldbank.org/en/who-we-are>. Accessed on 20 September 2018.
- [61]. WFP. (2018). *WFP: Overview* [web page]. World Food Programme, FAO. <http://www1.wfp.org/overview>. Accessed on 20 September 2018.
- [62]. WHO. (2018). *Nutrition* [web page]. World Health Organization; WHO. <http://www.who.int/nutrition/en/>. Accessed on 20 September 2018.
- [63]. WTO. (2017). *WTO legal texts* [web page]. World Trade Organization. https://www.wto.org/english/docs_e/legal_e/legal_e.htm#wtoagreement. Accessed on 22 September 2018.

Table 1. List of policy recommendations by FAO's CFS

S	Policy Recommendation Topic	Publish Date
1	Land Tenure & International Investment in Agriculture	2011
2	Price Volatility and Food Security	2011
3	How to Increase Food Security and Smallholder Sensitive Investments in Agriculture	2011
4	Gender, Food Security, and Nutrition	2011
5	Food Security and Climate Change	2012
6	Social Protection for Food Security & Nutrition	2012
7	Biofuels and Food Security	2013
8	Investing in Smallholder Agriculture for Food Security and Nutrition	2013
9	Sustainable Fisheries and Aquaculture for Food Security and Nutrition	2014
10	Food Losses and Waste in the Context of Sustainable Food Systems	2014
11	Water for Food Security and Nutrition	2015
12	Connecting Smallholders to Markets	2015
13	Sustainable Agri. Development for Food Security and Nutrition: What Roles for Livestock?	2016
14	Sustainable Forestry for Food Security and Nutrition	2017

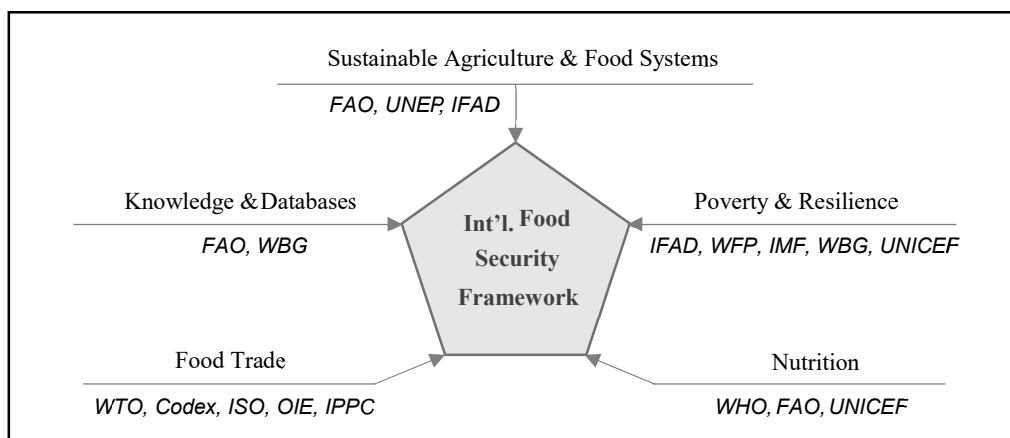


Figure 1. Dimensions of the international food security framework

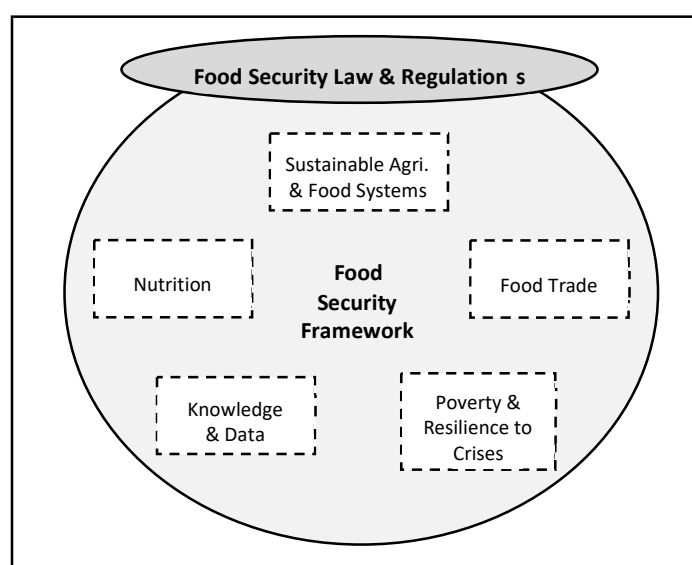


Figure 2. Food security system structure