



## Identifying Drivers of Inequalities that Induce Food Insecurity and Nutrition with a Food System Approach: Case Study of Ghana

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### 1. Introduction

Enough food is produced worldwide to feed up to 10 billion people when there are only about 7.5 billion. This fact shows how inequality and inequity in food systems persist, as all do not people have the right to have adequate food that not only meets the minimum requirements for survival but also nutritionally adequate for health and well-being. Agriculture in West Africa is becoming more industrialized and food products more processed, shifting the food systems from traditional to more modernized, this phenomenon is often called the “quiet revolution”. Modern food systems are characterized by intensive agriculture and food production that increasingly supplies urban and peri-urban supermarkets. Ghana presents characteristics of transitioning food system as it shows trends of high urbanization rates, increasing population rates, and in middle-income class due to economic growth. These trends are leading to more demand for processed foods, and changes in the retail sector which push food producers and actors in the supply chain to “modernize” their production system. In this case, value chains have vertical coordination, large-scale processing, and higher capital, leaving in some cases, the small-scale food producers at disadvantage.

Many challenges persist as food systems are facing a “triple challenge”, which are to ensure food and nutrition security for a growing population, provide livelihoods for people working in food supply chains, and build environmental sustainability while adapting to and helping to mitigate climate change. The triple challenge sometimes creates opportunities for synergies as integrating excluded people in vulnerable food conditions in transportation, processing, and distribution—the expanding “hidden middle” of the food supply chain— can promote inclusion of the rural poor (SWAC/OECD, 2021), but often trade-offs are difficult to foresee. To understand and resolve such trade-offs, it is required to recognize that food systems are dynamic and rapidly changing, and a way to do so is by conceptualization that current food systems as complex, heterogeneous over space and time and replated with linear and non-linear feedbacks (Béné et al., 2019). This research aims to present the drivers of inequalities that induce food insecurity and nutrition in Ghana food systems with a system thinking approach that shows casual dynamics and relationships, by identifying indicators systematically for each section of the system, and analyzing the linkages and interconnections to assess inequalities defined as actors in the food system in vulnerable conditions, using the sustainable food system framework from the High-Level Panel on Food Security and Nutrition (HLPE). This research is part of the European HealthyFoodAfrica project cities funded by Union Horizon2020 programme which aims at more sustainable, equitable and resilient food systems in 10 African cities.

### 2. Materials and Methods

The sustainable food systems framework from HLPE allows to analyze the food system interactions and determine food security and nutrition as outcomes, and therefore to identify the link to inequalities and equity. Using Ghana as a case study, the food system was assessed using indicators with available information from secondary data and literature, which allowed to identify trends of food systems, the main characteristic of supply chains, food environments, consumer behaviors, and diets, and later on the analysis of the interlinkages from the different component of the systems, and to identified the drivers in inequality as outcomes using food security and nutrition concept.

The definition for each indicator was obtained from secondary data obtained through open data sources such as FAOSTAT, the World Bank, Eurostat, UNICEF Division of Data Research, and Policy, Economist Intelligence Unit, National Statistics, Child Growth Database, and the (NCD) Non-communicable disease database. The selection of indicators was done using the sustainable food system framework from HLPE (2020), the Food System Dashboard from Johns Hopkins University (2020), and literature from (Allen et al., 2019; Fanzo et al., 2020; HLPE, 2020; Kennedy et al., 2020; van Berkum et al., 2018). For the case of Ghana, most of the indicators were compared with the Western African region or with time evolution to perform the analysis. For the case study, 7 crops were considered; cassava, maize, millet, plantains, sorghum, rice, and yams, as these are the main staple foods in Ghanaian diets in order to compare trade and production indicators, and understand the import dependency in the supply chain.

The selection of indicators for a food systems assessment are oriented toward the goal of better-quality diets, reflect the situation at a national scale, rather than sub-national, have a standard method used for data collection and a standardized formula for

construction to enable cross-country comparisons (Kennedy et al., 2020), and the data used to construct the metric/indicator had to be routinely collected updated publicly-accessible database.

### 3. Results and discussion

Drivers of food systems influence activities related to food, actors, and outcomes. The sustainable food system framework recognizes biophysical and environmental, technology, innovation and infrastructure, political and institutional, socio-cultural and demographic components as drivers of the system, together drivers lead to trends that define the way food is produced, traded, and consumed. For the analysis of the drivers 20 indicators and 27 variables were selected using the criteria found in the literature that affects inequality conditions in the food system. Following the food system framework, 15 indicators with 33 variables were selected to analyze the supply chain that is integrated by food production, storage and trade, packing and processing, and retail and marketing, making special emphasis on the processes and interaction of the actors. For the consumer behavior component, 2 indicators with one variable each were selected to understand the knowledge, attitudes, motives, and practices of the consumers in the food system. For the diet component, 4 indicators were selected to analyze adequacy, diversity, moderation, and safety, with 7 variables in total.

In this framework, food environments directly interact with supply chains, consumer behaviors, and diets. Individual consumers' awareness and decisions are focused on where and what foods to acquire, prepare and eat; they shape diets in terms of quantity, quality, diversity, safety, and adequacy of food (Downs et al., 2020). As a result of individual awareness and decisions, nutritional and health outcomes take place. Those outcomes creates feedback into food systems by influencing people's ability to work and to exercise agency within the system. Ultimately, these outcomes are shaped by the drivers that influence food systems as trends, as well as policies that respond to it.

As an example, migration to cities is argued to be one of the leading factors of food systems transformation in West Africa. Ghana has one of the highest growing urban migrations rates in this region, and as it is over-urbanizing without planning poverty rates increase. Migration to cities also changes the food supply dynamic as food needs to be transported to cities as a consequence of the growth of demand for perishable foods, at the same time food losses increase as a consequence of deficient agricultural infrastructure and roads connecting rural to urban areas. This has an effect at some level on food environments and behaviors as diets changes when people moved to cities, increasing the demand for processed foods. This dynamic is reflected by the high overweight rates in cities, and underweight, and vitamin and mineral deficiencies in rural areas, leading to food security and nutrition problems which creates a feedback loop on inequalities in the food system.

### 4. Conclusion

Using the sustainable food system framework, and the indicators and variables selected, it is possible to present the drivers of inequalities that induce food insecurity and nutrition in Ghanaian food systems. Casual dynamics and relationships are shown as trends, which allowed to identify the inequalities along with the system. As food systems transform rapidly in Africa's the main drivers such as urbanization, population growth, economic growth, and ecological and environmental, present new challenges for vulnerable agricultural producers and consumers. Natural resources scarcity, migration to cities, poor agricultural infrastructure, food losses, gender inequality, dependence on commodity markets, market imbalances, and nutrition, are recognized as problems derived from these trends that lead to more inequality, as often creates loops that make vulnerable actors from the food system to escape from poverty and exert the right to food. The framework built by the HLPE shows great consensus for analysis among the scientific community, but often in literature the indicators used differ from one research to another, and also accessible data are not harmonized across countries as it is mainly built for national scale analysis. Regional or local level cross-comparison of food systems often are difficult to make with this framework. Using the sustainable food system framework with a more dynamic approach like system dynamics could facilitate the assessment of the sequencing of the dynamics and the specificity, as the negatives or positive feedbacks and effects can have more specificity.

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