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## **Food Systems for Healthier Diets in Ethiopia**

**Toward a Research Agenda**

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## ABSTRACT

While dietary energy supply has improved, diets in Ethiopia remain low in diversity and provide insufficient amounts of protein, vitamin A, and zinc. Poor dietary quality contributes to the multiple burden of malnutrition in the country, with 38% stunting among children under five years and 24% anemia and 8% overweight among adult women.

Recent Ethiopian government policies and programs call for sustainable food systems approaches aimed at achieving better nutrition for all. Such food systems approaches imply actions that include but also go beyond agriculture to consider the many processes and actors involved in food production, processing, storage, transportation, trade, transformation, retailing, and consumption.

In this paper, we identify research streams to support the operationalizing of such food systems approaches in Ethiopia. To this end, we engaged with stakeholders, reviewed the literature, and applied a food systems framework to research priorities in the Ethiopian context. We develop an initial food systems profile of Ethiopia and identify 25 priority research questions, categorized into three main areas. A first area focuses on diagnosis and foresight research, for example, to further characterize dietary gaps and transitions in the context of the variety of Ethiopian settings, and to understand and anticipate which food system dynamics contribute positively or negatively to those trends. A second area includes implementation research and focuses on building a base of evidence on the dietary impact of combined demand-, market-, and supply-side interventions/innovations that focus on nonstaples; potential trade-offs in terms of economic, social, and environmental outcomes; and interactions between food system actors. A third area focuses on institutional and policy processes and explores enabling factors and private or public anchors that can take food systems approaches for healthier diets to a regional or national scale.

The paper contextualizes the case of Ethiopia within global food systems thinking and thereby aims to stimulate in- and cross-country learning.

**Keywords: Ethiopia, food systems, dietary diversity, nutrition**

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- National Nutrition and Food Industries Conference, held at Hawassa University in Hawassa, Ethiopia, on February 23, 2016
- Agriculture, Nutrition, and Health (ANH) Academy Week 2016, hosted by ANH Academy in Addis Ababa, Ethiopia, June 20–24, 2016

Finally, we thank all workshop, meeting, and conference attendees for participating in the process. There are far too many to name individually, but without the help and input of each, the report would not have been possible.

## 1. INTRODUCTION

Adequate diet quality is essential throughout the life cycle, for sufficient growth, for mental and physical development, and for minimizing the risks of noncommunicable diseases (NCDs) (Lim et al., 2012).

The health and economic implications of poor-quality diets in low-, middle-, and high-income countries are increasingly acknowledged by governments, businesses, and civil society (High Level Panel of Experts on Food Security and Nutrition [HLPE], 2017; Development Initiatives, 2017; Second International Conference on Nutrition [ICN2], 2014; International Food Policy Research Institute [IFPRI], 2014; World Health Organization [WHO] & Food and Agriculture Organization of the United Nations [FAO], 2003). While a substantial share of the population in Africa and South Asia remains chronically undernourished and suffers from widespread micronutrient deficiencies, a rapidly growing share suffers from overweight and diet-related NCDs (Lim et al., 2012; Development Initiatives, 2017). These challenges are linked, as global, national, and subnational food systems do not supply appropriate nutritious and safe foods for healthy lives (Global Panel on Agriculture and Food Systems for Nutrition [GLOPAN], 2016; HLPE, 2017). In many countries, a shortage of supply and low levels of consumption of healthy dietary components such as fresh vegetables, fruits, legumes, and nuts, is observed, while an excess of unhealthy components, such as sugar-sweetened beverages, saturated and trans fats, sodium, and ultraprocessed meats, is increasing (Imamura et al., 2015).

With 38% of children under five years stunted, Ethiopia still has one of the highest levels of chronic undernutrition in the world, despite the significant progress demonstrated by the reduction in stunting from 58% in 2000 to 38% in 2016 (Central Statistical Agency, Ethiopia [CSA], & ICF, 2016). Levels of wasting or acute malnutrition are around 10% and have remained largely unchanged over the past decade. While 22% of women are still underweight, overweight is increasing and becoming a public health issue, with 8% of women currently overweight (CSA & ICF, 2016). It is further estimated that the number of adults with diabetes in Ethiopia will double between 2011 and 2030, from 1.4 million to 2.7 million (GLOPAN, 2016).

In several key government strategies, the Ethiopian government has expressed a commitment to transform food systems to combat malnutrition. The National Nutrition Program (Government of Ethiopia 2013) supported by nine national ministries, mobilizes multiple sectors and stakeholders to improve nutritional status. The latest version (2016) addresses both undernutrition, micronutrient deficiencies, and the emerging diet-related NCDs, with healthier diets at center stage. The nutrition-sensitive agriculture strategy builds on the second Agricultural Growth Program (AGP-II) and emphasizes the opportunities for improving nutrition through several pathways—via improved production, value chains, and marketing of nutritious foods; increased household income; and women’s empowerment (Ministry of Agriculture [MoA], 2016). The Seqota Declaration represents a strong commitment to end malnutrition in Ethiopia and includes sustainable food systems as one of its eight pillars<sup>1</sup> (Government of Ethiopia, 2015). The Seqota implementation plan (Government of Ethiopia, 2016) calls for an approach that is systemic, creative, and participative. It includes unique learning hubs, through which integrated research and innovation can guide adaptive management and context-specific scaling.

At the same time, the private sector and food processing industry are steadily developing in Ethiopia, enabled by the overall Growth Transformation Plan. This development opens up significant new opportunities to complement government efforts on nutrition and food systems and is triggering new regulation processes, with an emphasis on in-depth consumer nutrition knowledge, food quality, and safety checks.

To support Ethiopia’s commitment to address malnutrition holistically, there is a strong call for capacity building and research to help implement, learn, and adapt a systems approach to the local contexts (HLPE, 2017). “Systems thinking” seeks to take into account the interactions between different parts of a system and understand how they are effecting change together rather than simply trying to

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<sup>1</sup> The eight pillars are zero stunting in children under two years; universal access to adequate food year-round; social protection; sustainable food systems; transformation of smallholder productivity and income; zero loss of food; education; and water, sanitation, and hygiene.



understand specific components in isolation (Oxfam, 2014) Systems approaches can play an important role in developing truly sustainable and transformative change.

In this paper, we identify and discuss the types of research that can support operationalizing food systems approaches to improve diets in Ethiopia. To this end, we build on global food systems reports (GLOPAN, 2016; HLPE, 2017) and learn from major research-agenda-setting examples (e.g., Pretty et al., 2010; Lachat et al., 2014). We applied the following methodology. First, we performed a rapid review of literature to structure a consultative workshop with key stakeholders. Second, we held a consultative workshop to review the nature of the food systems landscape in Ethiopia and identify knowledge gaps, and to guide further analysis of the literature and existing data sources. Third, given global food systems frameworks, we performed further literature and secondary data analysis, formulated research questions (Table 1), and developed an initial food systems profile (see Figure 1 and appendix). Fourth, we organized panel discussions with various stakeholders at the Agriculture, Nutrition, and Health Academy week in Addis Ababa and at the National Nutrition Congress in Hawassa to obtain further input and feedback on a food systems research agenda in Ethiopia. Finally, we circulated our findings to the key national stakeholders involved, for validation and feedback. A key part of the process was to ensure that the development of the food systems analysis and questions was grounded at every step by national strategies and plans and aligned with national food system actors and actions.

We hope this paper will add value to the literature by contextualizing food systems research in Ethiopia, as a case study in applying global food systems thinking to a concrete setting, and by stimulating in- and cross-country learning.

**Table 1. Twenty-five priority research questions to support food systems approaches for healthier diets in Ethiopia**

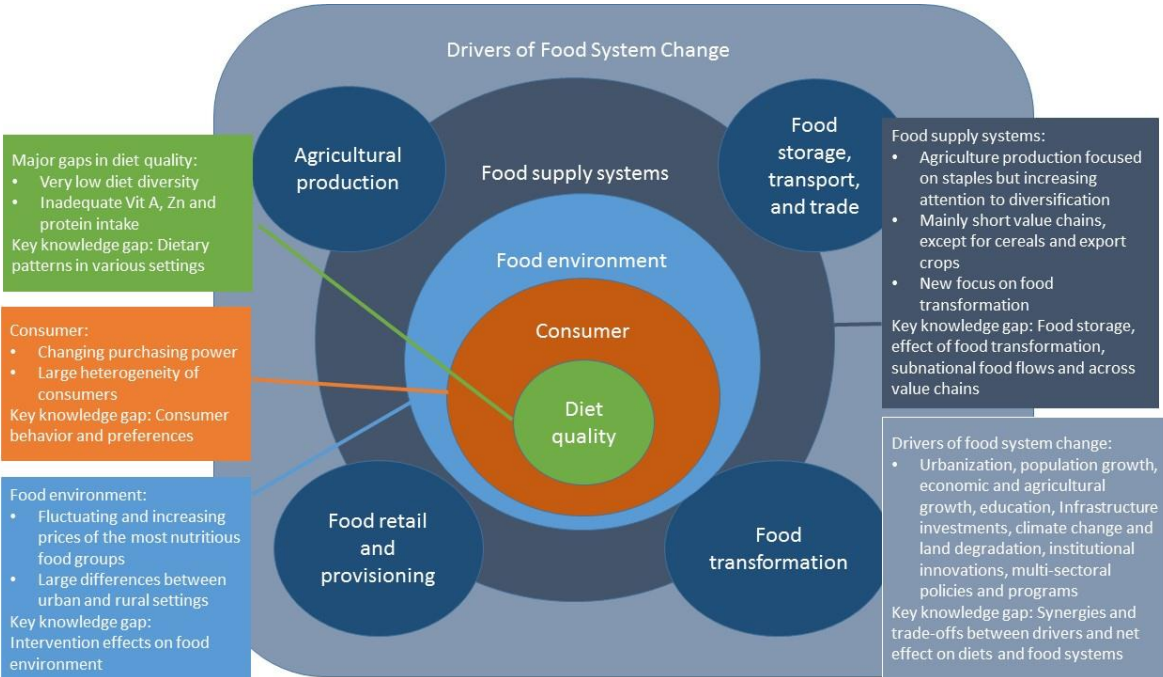
	<b>Research question</b>	<b>Category</b>
<b>1</b>	How do dietary patterns, quality, and safety—and trends therein—differ in Ethiopia between settings and population groups and within households? What are the dietary recommendations based on local dietary patterns and different settings?	Diagnosis & foresight
<b>2</b>	Why, when, where, and how do people consume or not consume certain foods or engage or not engage in certain dietary practices?	Diagnosis & foresight

	For example, how do fasting practices influence the diet quality of children, youth, and adults?	
<b>3</b>	Given current trends, how are diets expected to change over the next 10–20 years, and what are the potential implications for human health?	Diagnosis & foresight
<b>4</b>	How can rural market integration be improved to enhance diet diversity?	Innovations
<b>5</b>	To what extent, beyond market integration, are additional incentives (on both the supply side and the demand side) needed to ensure market and diet diversification across different population groups?	Innovations
<b>6</b>	How do price fluctuations (or efforts to control them) impact the dietary habits of different population groups?	Diagnosis & foresight
<b>7</b>	To what extent is social and behavior change communication effective in improving the diets of youth and adults? Which channels (e.g., product marketing versus education sessions) are most efficient?	Innovations
<b>8</b>	To what extent does the new phase of the Productive Safety Net Program (PSNP) impact the diet quality of children and adults, on average and under conditions of a price or other shock?	Innovations
<b>9</b>	What effect would local food-based dietary guidelines, labeling, and better food quality / safety assurance, and the communication of these measures, have on people’s diet?	Innovations
<b>10</b>	What is the relative importance of the various pathways through which agriculture contributes to nutrition in the Ethiopian food systems context? Which agriculture-nutrition pathways should be invested in most/first for scaling in Ethiopia when considering how the food systems function?	Anchoring & scaling
<b>11</b>	What is the net effect of agricultural interventions on the diet? Does this change when market integration strengthens?	Innovations
<b>12</b>	How can Ethiopia diversify and increase production of—and at the same time support local demand and markets for—food groups other than cereals, particularly vegetables, fruit, pulses, and animal-sourced products, alongside further cereal intensification?	Innovations
<b>13</b>	What can be produced more efficiently during the dry season, and how can functioning markets for those products off-season be ensured?	Innovations
<b>14</b>	What are the capacity and quality of current storage facilities, and how are they connected to farmers and the markets?	Diagnosis & foresight
<b>15</b>	What are the key entry points into the food system that can strengthen value chains for a diversity of food products simultaneously?	Innovations
<b>16</b>	How do current infrastructure investments influence food transport, environment, and diets? What types of new infrastructure would potentially generate a (stronger) positive effect on diets?	Anchoring & scaling
<b>17</b>	What is the extent of food loss and waste for different food groups in Ethiopia, and how can this be reduced?	Diagnosis & foresight

18	How is the food-processing sector changing, and how does this impact people’s diets?	Diagnosis & foresight
19	How can the potential negative effects on diets of a quickly developing food-processing sector be avoided, and how can nutritional value be effectively enhanced?	Innovations
20	Which food outlets can most effectively be encouraged to increase access to a diversity of nutritious foods and avoid excesses, unhealthy components, and increasing food waste?	Anchoring & scaling
21	How is food waste managed in various Ethiopian contexts? How can food waste be managed to benefit diet quality?	Diagnosis & foresight
22	What is the net dietary impact of supply- and demand-side interventions/projects?	Innovations
23	What are the pathways through which the various drivers change the food system structure and its social and environmental outcomes?	Diagnosis & foresight
24	What are the existing or needed institutional and social innovations that can be used to bring to scale selected successful food system innovations?	Anchoring & scaling
25	What are the potential trade-offs or synergies (environmental, social, economic) of specific food system innovations that aim for healthier diets?	Diagnosis & foresight

Source: Compiled by authors.

**Figure 1. Schematic overview of trends in diet quality and related food system components in Ethiopia**



Note: This schematic food systems framework was adapted from the 2016 GLOPAN report and applied to the Ethiopian context, illustrated with examples of key issues, trends, and knowledge gaps for each food system component.

## 2. DIET QUALITY AS AN ENTRY POINT

We focus on diet quality as an entry point and a primary outcome of food systems. For diet quality, we consider four main dimensions: diversity, nutrient adequacy, excesses, and safety (Trijsburg et al., submitted; HLPE, 2017). Food systems have many important outcomes—social, environmental, and economic—that affect and are affected by diets (Melesse et al., 2017). We will consider how these other outcomes interact with changing diets.

To this end, it is crucial to first capture gaps and trends in diet quality in Ethiopia. Several existing studies serve this purpose. The Ethiopian Public Health Institute (EPHI, 2013) led a nationwide food consumption study in 2011, using a detailed quantitative 24-hour recall, and a national micronutrient survey in 2015 (EPHI, 2016), for both adult women and children under five years. Ethiopia was also included in a few global studies that investigated dietary patterns using national consumption and supply data (Imamura et al., 2015; Oxfam, 2014; GLOPAN, 2016). Taken together, these studies reveal at least six important insights on gaps in dietary quality in Ethiopia.

**First, diet diversity is in general extremely low**, with an average of 1.67 (95% confidence interval [CI] 1.64–1.69) out of 10 food groups for adult women, and an average of 1.23 (95% CI 1.18–1.28) out of seven food groups for children under five (EPHI, 2013; Ministry of Health [MoH], UNICEF, & European Union [EU], 2016). While some regions have slightly higher dietary diversity than others, the limited diversity and overdependence on starchy staples is a nationwide problem, cutting across rural and urban populations. Ethiopia therefore scores the lowest of 125 countries on the food quality dimension of the Oxfam “Good Enough to Eat” index, which measures diet diversification and access to clean water (Oxfam, 2014).

**Second, consumption of fruits and vegetables is particularly low.** Only 34% of women reported having consumed any vegetable or fruit the previous day; 14% consumed dark leafy vegetables, 10% other vitamin A–rich vegetables or fruits, 18% other vegetables, and 1.3% other fruits (EPHI, 2013).

Ethiopia scored lowest among 187 countries for fruit consumption among women and men, and second lowest (above Vanuatu) for vegetable consumption (Imamura et al., 2015).

**Third, intake of quality protein is limited.** Despite traditional use of a large variety of legumes, consumption of beans and peas was reported by only 18% of women, and only 0.17% reported consuming seeds and nuts (EPHI, 2013). Only 1.2% of women consumed eggs, 1.5% flesh foods, and 17% dairy. On average, 10% of dietary energy comes from protein, and given the predominantly plant-based diet, the protein quality may be also low.

**Fourth, in terms of micronutrients, there is widespread insufficient intake of vitamin A (81.9%) and zinc (50.4%) among adult women** (EPHI, 2013). Despite sufficient dietary iron intake (mainly in the form of iron-rich staples such as teff, barley, and maize), anemia levels are high, at 56% in children and 24% among adult women (CSA & ICF, 2016). This could potentially be explained by high levels of infections and diseases, combined with vitamin A and zinc deficiencies, and relatively low bioavailability of iron in grains.

**Fifth, unhealthy dietary components often linked to ultra-processed foods are still limited in Ethiopian diets;** for example, consumption of saturated fats, sugary beverages, processed meats, cholesterol, and sodium is much below the world's average (Imamura et al., 2015). However, since 1990, unhealthy components have started to transform diets, particularly in urban areas (Imamura et al., 2015). The problem is particularly related to oil consumption. Many of the varieties of oil (e.g., butter as a base for many dishes, and increasing amounts of imported palm oil) that are consumed in Ethiopia are high in saturated fats (Atinafu and Bedemo, 2011).

**Sixth, foodborne pathogens such as *Salmonella* spp. and *Escherichia coli* are common causes of illness and death and a public health problem.** The latest Demographic and Health Survey reported that 12% of children under five in Ethiopia experienced diarrhea, but to what extent this burden of disease is attributed to foodborne pathogens is unknown (CSA & ICF, 2016). Concerns about aflatoxin contamination, particularly in milk, maize, and certain legumes, is also increasing. However, only a

limited number of studies on food safety are available, and none are national, large-scale studies, nor is there a comprehensive surveillance system (Abayneh, Nolkes, & Asrade, 2014).

Despite commonalities in the dietary quality gaps observed at the national level, dietary cultures and tastes differ strongly between and within regions and populations and across seasons. Ethiopia is a highly diverse country in terms of agroecology, geography, rural-urban gradients, population, and food cultures. For example, cereals are the main staple in the north, enset or false banana (*Ensete ventricosum*) is the main staple in part of the south, and animal-sourced foods are common among pastoralists. Intrahousehold and gender differences are also pronounced in Ethiopia. Belachew et al. (2011) showed that the health and food security status of adolescent girls decreased more than that of boys when facing food insecurity.

Dietary patterns and gaps have, however, not yet been studied according to this heterogeneity. Better characterization of the heterogeneity in diets is therefore an outstanding research topic in order to design adequate food-based dietary guidelines, which do not exist yet for Ethiopia (**Research Question 1**). This research would include monitoring over time to understand change across seasons, over time, and across population groups. The relevance and feasibility of this approach is illustrated by a recent study (Osendarp, Brouwer, & Samuel, 2015) that applied Optifood, a linear modeling tool to optimize diets based on existing dietary patterns, to different Ethiopian settings in Amhara; Oromia; Tigray; and Southern Nations, Nationalities, and Peoples' Region (SNNPR). The study focused on children between 6 and 23 months, and the results of the analyses show that current dietary adequacy in terms of calcium and several micronutrients (zinc, iron, thiamin, niacin, folate) is poor in all four regions, but in particular in Amhara and SNNPR. The modeling of diets indicates that dietary diversity can be significantly improved using available foods, for example, potatoes, eggs, dairy milk, and local vegetables and legumes in Amhara, and emmer wheat porridge, eggs, buttermilk, and green leafy vegetables in SNNPR.

Starting from these insights on dietary quality and recognizing related knowledge gaps, below we explore whether the elements and dynamics of food systems are contributing to the dietary gaps and trends, and if so, which elements and dynamics are doing so.

### 3. DIETS AND THE ROLE OF FOOD SYSTEMS IN ETHIOPIA

We apply the schematic food systems framework from the Global Panel on Agriculture and Food Systems for Nutrition report (GLOPAN, 2016) (Figure 1) to the Ethiopian context. We chose this framework for the purpose of this exercise because it places diets at the center, structures multiple food system components around that, and highlights the purpose of systems thinking, that is, to acknowledge that problems and solutions are interconnected. Moreover, we consider the simple layout practical for application to a concrete setting and for engaging multiple sectors with different food system entry points and perspectives, while keeping a central focus on diets. Drawing on more comprehensive food systems frameworks, such as the HLPE framework (2017), we note three limitations of the GLOPAN framework, which are important for the Ethiopian as well as the broader context and are considered explicitly in our approach. First, other social, economic, and environmental outcomes of the food systems (such as employment, income, equity, water quality, biodiversity habitat, and soil health), are not directly reflected in the framework. Second, the framework does not illustrate the dynamic nature of the food systems, where causal connections and feedback loops between different components and actors drive or catalyze change. Third, there is no specific mention of food waste management, which is an increasingly important component in changing food systems.

In the section below, we start from the consumer and work outward toward the food environment, food supply systems, and drivers to identify causes of dietary gaps, how they are connected, and where important research questions relevant to the application of a food systems approach arise. The figures in the appendix support the text and the characterization of Ethiopia's food systems profile.

#### **Consumer behavior and purchasing power**

Consumer behavior research—aimed at understanding why, when, where, and how people consume certain foods or diets—is critical in nutrition and agriculture intervention programs as well as in private-sector investments in the food sector (Soethoudt, van de Riet, Sertse, & Groot, 2013). In general, in

Ethiopia, culture, religion, and local production are believed to be dominant determinants of consumer choice, according to participants in the 2016–2017 consultation process. But systematic research to really understand consumer choice—in terms of preferences, taste, convenience factors, and other drivers—is largely absent in the Ethiopian context, and targeted research is needed in this area (**Research Question 2**).

Some older studies have investigated the effects of religious fasting on dietary quality in Ethiopia. Knutsson (1970) found that diets during periods of fasting were significantly inferior in terms of dietary energy and nutrients, except thiamin, niacin, and iron, than diets during nonfasting periods, but we have found no recent studies that confirm these findings. While children under five years of age normally do not participate in fasting, it also remains unclear if and how altering the household diet during the fasting period affects the diets of young children.

Various forms of taboos, misconceptions, and cultural beliefs about certain foods or food practices exist worldwide (Quiroz & van Andel, 2015), but the extent to which such food taboos and misconceptions exist and how they affect dietary quality in Ethiopia remains largely unknown. A study by Zerfu, Umeta, and Baye (2016) points to this knowledge gap and investigates dietary habits, food taboos, and perceptions among pregnant women in a rural site in central Ethiopia. The researchers identified a number of taboos and misconceptions related to the intake of certain food items that were perceived to adversely affect pregnancy, for example, green leafy vegetables, yogurt, cheese, sugarcane, and green pepper. However, the frequency and extent of adherence to the taboos varied by maternal age, family composition, literacy level, and geographic setting. Older mothers, those from rural villages, and those with no formal education were more likely to practice the taboos than younger and more educated ones. A study in southern Ethiopia indicated that pregnant women's diets were no different from those of nonpregnant women (Asayehu, Lachat, Henauw, & Gebreyesus, 2016). Although all pregnant women considered it important to increase food intake during pregnancy, only a quarter of women reported doing so, resulting in inadequate intake of zinc, protein, calcium, folate, niacin, and overall dietary energy during pregnancy (Asayehu et al., 2016).



Awareness of food safety (e.g., potential contamination of local milk with aflatoxin [Szonyi, Gizachew, Tegegne, Hanson, & Grace, 2015]) is increasing, particularly among the urban and educated population, but it is unclear how those emerging concerns are impacting dietary habits (e.g., potentially less milk consumption).

Using a time series of household expenditure and consumption data, Worku Hassen, Dereje, Minten, and Hirvonen (2017) highlight overall trends and show that consumer purchasing power is changing in Ethiopia. Food consumption differs significantly by income level, but all income levels show similar changes over time.

First, the share of food in overall expenditures is declining, from 62.8% in 2000 to 47.9% in 2011. Such a decrease in the share of food in overall expenditures, and thus an increase in nonfood expenditures, is typical of transforming and improving economies and implies significant improvements in welfare in the country.

Second, quantities of food consumed per capita are increasing. Consumption increased on average from 293 kilograms in 2000 to 361 kilograms in 2011. Consistent with this trend, expenditures on food in real terms grew by 19% between 2000 and 2011, meaning that incomes have been increasing while the share of income spent on food has declined (Worku Hassan et al., 2017).

Third, the relative importance of cereals is declining in terms of share of food expenditures, from 47.5% of total food expenditures in 2000 to 35.8% in 2011, and growth in the noncereal food share was recorded in a number of categories, for example, animal products (from 7.7% to 10%) and fruits and vegetables (from 3.7% to 6.4%). The roots and tubers and enset/kocho categories show the opposite pattern, with a decrease in share of food expenditure, as these are considered relatively inferior and cheap foods. The share of pulses remains more or less the same, at about 10% in both 2000 and 2011. When it comes to amount of food (kilograms) and shares in food energy (kilocalories), the picture is more mixed. An increase in consumption of animal-food products (from 12 kilograms per capita per year to 17 kilograms per capita per year) and fruits and vegetables (from 26 kilograms per capita per year to 36 kilograms per capita per year) is observed, but the share of kilocalories from these food groups actually

declined slightly, while kilocalories from oils and fats increased significantly. So although there is a trend toward consumption of more expensive foods (such as animal-based products), their share in terms of energy remains limited.

Fourth, cereals, particularly maize, remain the principal component of dietary energy intake, with 61.8% of all energy coming from cereals in 2011 (compared to 65.1% in 2000). A consistent increase in per capita consumption is seen over the years, reflecting the improving food security situation in the country. Average energy consumption was at 2,742 kilocalories per day per adult equivalent in 2000, and 3,001 kilocalories in 2011.

Fifth, there are large differences in purchasing power and in the composition of food baskets between rural and urban households, indicating the impact of increasing urbanization on the food economy. While the share of the urban population in Ethiopia is still relatively small, at approximately 20% in 2015 (Ozlu et al., 2015), cities are growing rapidly—in 1990, only about 10% of the population lived in urban areas. In particular, Addis Ababa (which has a population of approximately 3 million) has been expanding rapidly. Average per capita expenditures are significantly higher in urban areas, and the share of nonfood expenditures is also higher in urban areas (62%) than in rural areas (48%). Urban populations consume significantly more teff, wheat, animal-based products, fruits and vegetables, and oils and fats than rural populations. Rural populations, in contrast, consume more maize, sorghum, enset, and other root crops.

Sixth, purchased foods are becoming more important in the Ethiopian diet. Households' consumption of foods they produce themselves accounts for 42% of total food expenditures in rural areas. This reflects the high level of subsistence agriculture in the rural Ethiopian economy. However, this number is lower than what is usually assumed (see, for example, Worku Hassen et al., 2017), and for the growing number of urban households, less than 5% of food expenditures represent their own production.

Taken together, these trends provide important insights into consumer purchasing power and related transitions in Ethiopia, and, if assumed to be continuing, can provide a basis for further predictions

on consumer purchasing power and dietary change for various scenarios in the future ([Research Question 3](#)).

### **Food environment**

Food environments are defined as the collective physical, economic, policy, and sociocultural surroundings, opportunities, and conditions that influence people's food and beverage choices and consumption (Swinburn et al., 2014). Food environments encompass the availability, affordability, acceptability, and desirability of food for an individual or a group (Herforth & Ahmed, 2015) and include aspects such as food prices, composition, safety, labeling, promotion, provision in schools and other settings, and food trade policies (Swinburn et al., 2014).

An increasing number of studies are shedding light on the changing food environments in Ethiopia.

Access to markets and distance from markets are shown to be key determinants of diet diversity and levels or quantities of consumption. Children and households across Ethiopia that are located closer to main markets consume more diverse diets than those located farther away from markets (Hirvonen & Hoddinott, 2017; Stifel & Minten, 2017; Sibhatu, Krishna, & Qaim, 2015). It has been observed that nutrition knowledge benefits children's dietary diversity only when a household has market access (Hirvonen, Hoddinott, Minten, & Stifel, 2017). Similarly, a strong link has been found between remoteness from markets and lower consumption levels (Stifel & Minten, 2017).

The Demographic and Health Survey data for Ethiopia reveal significant differences in children's dietary diversity between rural and urban food environments, with significantly higher diversity in urban areas. Interestingly, this large rural-urban gap in dietary diversity is largely explained by differences in household wealth, parental education, and access to health services between rural and urban areas (Hirvonen, 2016).

Compared to many other countries, rural market integration in Ethiopia is still weak, with an average distance of 10.9 kilometers to a weekly market for the average rural household (Hirvonen &

Hoddinott, 2017). But the functioning of markets is actually improving (Minten, Tamru, Engida, & Kuma, in press). At least for cereals, markets are increasingly integrated, and margins between wholesale markets are declining significantly (Minten et al., in press). Market functioning is expected to improve further with rapid urbanization and the growth of secondary cities.

The role of secondary cities and ways to strengthen rural markets in order to increase rural access to food diversity have not been explored as extensively, but these considerations are particularly important in highly intensified rural areas where local production diversity is low or decreasing and efforts are needed to avoid food deserts, as observed in other countries (**Research Question 4**).

Further, observers have debated whether market integration in itself is sufficient for diversification of local markets and ensuring access to a diversity of nutritious products across different population groups, and/or to what extent additional incentives (e.g., active demand creation, health services, education) are needed in the Ethiopian context to diversify local markets and diets (**Research Question 5**) (Sibhatu et al., 2015).

Market prices for food products fluctuate considerably in Ethiopia (Soethoudt et al., 2013). Grain prices fluctuate more than prices in the international grain markets, and since the 2008 world food crisis, Ethiopia's grain prices have become more volatile.

Increases in cereal prices in Ethiopia have raised concerns about adverse effects for poor net consumers. Moreover, the domestic prices of some cereals (especially maize) have fluctuated widely, with wholesale prices at harvest times dropping dramatically in some years, to the detriment of producers (Dorosh, Minten, & Stiffel, 2014). Although fluctuations in nominal prices are large, fluctuations in real prices are smaller than in many other countries because cereal price fluctuations have been driven primarily by changes in monetary policy, and the macroeconomic stability in the country helps stabilize real food prices (Dorosh et al., 2014).

Household diets in Ethiopia remain subject to significant seasonal stress and price fluctuations, with lower caloric intake and lower diet diversity in lean seasons (Hirvonen, Taffesse, & Worku, 2016).

Even in households that are better nourished and located closer to local food markets, children's body weight and diet changes considerably across seasons (Abay & Hirvonen, 2017).

Further, on more than 200 days each year, the Orthodox Christian population in Ethiopia (about 50% of the total) participates in fasting and does not consume animal products, such as meat or dairy. Although not all adhere strictly to fasting norms, the demand for animal-based products may drop by 25%–30% during fasting season (Soethoudt et al., 2013).

Unsteady food prices can hamper consumers' ability to buy enough food and can also change the composition of the food basket (Bouis et al., 2011) (**Research Question 6**). The impact of the high inflation in 2009 on the population of Addis Ababa (UNICEF & WFP, 2009) indicates that there are limited alternative options available for those affected, emphasizing the vulnerability of the population. The impact of food price volatility also tends to differ according to gender, with female-headed households more likely to experience a reduction in asset holdings, household income, or consumption due to high food prices (Kumar & Quisumbing, 2013; Beyero, Hodge, & Lewis, 2016). This volatility increases the pressure on women's time. In addition, adolescent girls tend to be more chronically food insecure than boys in both rural and urban areas, as boys are often favored when allocating household resources.

To better understand the affordability of nutritious foods in Ethiopia, Bachewe, Hirvonen, Minten, and Yimer (2017) analyzed the consumer price patterns of different food groups, which are often used together to proxy for dietary quality. Using a large-scale price dataset collected monthly in 116 urban retail markets across the country, the researchers found that the real prices of all nutritionally rich food groups (animal-source foods, vitamin A-rich vegetables, and other vegetables and fruits), had increased between 19% and 62% over the past 10 years. This contrasts with staple crops (grains, roots, and tubers), which did not show any price increase, and with oils, fats, and sugar, whose prices decreased substantially. Similar price trends are seen in rural areas. Given the large influence of price on consumer choice in countries such as Ethiopia, many experts argue that more investment in and attention to the

production of and access to nutritious foods—combined with behavioral change messaging—are needed to increase the affordability and consumption of such foods.

The promotion of healthier food choices has been integrated into several past and ongoing large projects in Ethiopia (MoH et al., 2016). Examples include large-scale extension programs with community health workers, the women development army (female health extension workers), and development agents, as well as media campaigns, for example, on the radio and TV and mobile messaging.

Several specific projects also included nutrition campaigning and education at the core of their activities, for example, ENGINE and Growth for Nutrition, Smart Food campaigns, and Alive and Thrive. A growing evidence base is showing that exposure to such large-scale social and behavior change communication interventions in Ethiopia is associated with improvements in infant and young child feeding practices (Kim et al., 2016). Gebremedhin et al. (2016) also show that in predominately food-insecure areas, nutrition education and husband involvement in infant and young child feeding practices can improve children's diet diversity. If and to what extent demand-side interventions influence youth and adult diets as well is much less known (**Research Question 7**) (Zerfu et al. 2016).

Despite the growing number of programs promoting healthier food choices, there are not yet any dietary guidelines adapted to the Ethiopian context, nor any regulations regarding adequate food labeling. This limits efforts to promote adequate, healthy diets.

Ethiopia's Productive Safety Net Program (PSNP) is a large-scale social protection intervention aimed at improving food security and stabilizing asset levels for the most vulnerable households. While the PSNP has been successful in improving household food access and caloric food security (Gilligan et al., 2009; Berhane et al., 2013), there is no indication to date that the previous phases of the PSNP improved diets or reduced chronic or acute undernutrition (Berhane et al., 2014). The new phase of the PSNP has been made explicitly nutrition-sensitive and aims to improve not only caloric security but also diet diversity and nutritional status. Ongoing monitoring and evaluation of the PSNP will provide insights

on how the program contributes to diet quality in the presence of food price fluctuations or other shocks (**Research Question 8**).

During the stakeholder consultations, participants said there is a need for testing of food environment innovations. For example, the potential effect of food labeling on raising demand, awareness, and consumers' trust was suggested as a topic for further research (**Research Question 9**).

### **Food supply systems**

In the framework applied, the food supply is channeled through four connected subsystems: (1) the agricultural production subsystem; (2) the storage, transport, and trade subsystem; (3) the food transformation subsystem; and (4) the food retail and provisioning subsystem.

#### ***Agricultural production subsystem***

Ethiopia is a very diverse country in terms of agroecological zones, with varying opportunities and constraints for agricultural production across different settings. Agriculture is a main driver for economic growth, and a large government-led Agricultural Growth Program (AGP) promotes agricultural intensification, growth, and the transformation from subsistence to commercial agriculture. AGP-1 ran from 2010/2011 to 2015/2016, and AGP-2 will run from 2016/2017 to 2020/2021. AGP-2 has a nutrition-sensitive focus and aims to reach more than 1.5 million smallholder farmers who live in areas with the highest potential for agricultural growth. This program shapes an agricultural growth corridor across the four regions of Amhara, Oromia, SNNPR, and Tigray.

In general, local agricultural production and dietary consumption are still closely coupled in Ethiopia, at both the national and household levels. Using a representative survey for rural Ethiopia, Sibhatu and Qaim (2017) estimate that subsistence production accounts for 58% of calorie consumption of rural households. However, disaggregation of the diet into different food groups reveals considerable variability in the role of markets. While cereals and tubers (which are rich in calories) are largely sourced from own production, the opposite is true for food groups that are rich in protein and various micronutrients; more than 50% of vegetables, fruit, meat, and eggs consumed come from the markets.

Interestingly, more than 80% of the milk consumed in rural Ethiopia comes from own production, suggesting that dairy markets are largely absent in rural Ethiopia. Still, dietary diversity is higher among households that produce a larger diversity of food items, which is partly explained by weak market integration, especially in mountainous areas. This relationship changes and weakens as access to markets improves, and purchased foods are becoming more important (Hirvonen et al., 2014; Sibhatu et al., 2015; Worku Hassan et al., 2017). This trend reflects the transition from traditional food systems to mixed and modern food systems, particularly in peri-urban and urban settings (HLPE, 2017).

Beyero et al. (2016) undertook a systematic literature review on the linkages between agriculture and nutrition in Ethiopia in the framework of the Leveraging Agriculture for Nutrition in East Africa (LANEA) program. Study participants voiced their perception that there is an overall lack of knowledge and evidence on agriculture-nutrition pathways in Ethiopia (**Research Question 10**), with particular emphasis on the lack of nutrition knowledge within the agricultural sector.

Most existing studies focus on agriculture's role as a direct source of food and demonstrate that local production of a certain food group often results in increased consumption of that food group (Beyero et al., 2016). However, the effect on the diet as a whole is often not clear, nor is it clear how such specific production practices influence diets when market integration strengthens (**Research Question 11**).

Livestock ownership has been associated with higher milk consumption, linear growth, and dietary diversity in children, through access both to animal-source foods and to other foods (e.g., fresh vegetables) purchased with profits from the sale of livestock products (Okike, Jabbar, Abate, & Ketema, 2005; Sadler et al., 2012; Sadler & Catley, 2009; Hoddinott et al., 2013; Pachón et al., 2007; Headey et al., 2014; Beyero et al., 2016). Recent research, however, also suggests that elevated exposure to livestock—particularly poultry and poultry feces—may be an important risk factor for diarrhea, environmental enteric disorder, and respiratory infections, all of which may seriously retard linear growth in young children (Headey & Hirvonen, 2016; Headey et al., 2016; Kaur et al., 2017). Good livestock management practices that minimize infection risk, as well as water, sanitation, and hygiene and healthy



dietary habits (Beyero et al., 2016), therefore seem critical to optimize the positive benefits of livestock ownership for nutrition.

Few studies focus on other pathways between agriculture and nutrition, such as agriculture as a source of income and agriculture as a driver for women's empowerment (Beyero et al., 2016), though those pathways will be increasingly important in the current context, with stronger market integration and more commercial agriculture. Overall, researchers have found that it is difficult for households that depend entirely on agriculture to achieve nutrition security through home production alone (Beyero et al., 2016). An evaluation of a national strategy to introduce new agricultural technologies such as water harvesting, fertilization, and improved crop varieties showed an increase in income and higher caloric intake (from cereals) among rural highland communities (Yigezu & Sanders, 2008), but the evaluation did not assess effects on diets or nutritional status.

Drawing on these lessons learned, the Ministry of Agriculture (MoA, 2016) has developed a comprehensive nutrition-sensitive strategy that considers the various pathways between agriculture and nutrition. The strategy aims to maximize the positive impact of the food system on nutrition outcomes while minimizing any unintended negative consequences of agricultural policies and interventions for the population. The document acts as a guidance tool to ensure that the AGP and other MoA policies, programs, interventions, and implementations apply nutrition-sensitive food- and agriculture-based approaches to contribute to the National Nutrition Program objectives of improving nutrition at the household level. The nutrition-sensitive agriculture strategy is particularly important because Ethiopia's national agriculture research and development strategy has traditionally focused on increasing caloric security and on agriculture as a driver for economic growth, with an emphasis on improving the productivity of major staple crops. Together, cereals account for more than 85% of total crop production (USAID, 2010), and the productivity as well as the overall production of cereals has increased tremendously over the last decade (Bachewe, Berhane, Minten, & Taffesse, 2015). It is unclear whether the same holds true for the production of other food groups, but the rapid increases in the prices of these products (Bachewe et al., 2017) suggest that production has not kept pace with increased demand (Worku

Hassen et al., 2017). Therefore, a key question, as emphasized by the Ethiopian Institute of Agricultural Research (EIAR), is how to diversify and increase production of—and at the same time local demand, functional value chains, and markets for—food groups other than cereals, particularly vegetables, fruit, pulses, and animal-sourced products, alongside further cereal intensification (Agriculture, Nutrition, and Health [ANH] Academy, 2016) ([Research Question 12](#)).

For vegetable and fruit production, the main constraints include water management, distance to markets (particularly important for perishable items), and access to quality seeds and suitable varieties to grow in the highlands (ANH Academy, 2016). New foreign investments in horticulture, mainly vegetables and flowers, are attracted to Ethiopia by the low-cost, disciplined, and trainable labor force; the size of Ethiopia's domestic market; and the numerous river basins affording great potential for irrigation (Hunde, 2017). Products are not directly aimed at the local markets, but to make those investments more nutrition-sensitive it will be necessary to understand how they are changing and can contribute to local food systems and diets.

Improving the production of and access to animal-source foods has been especially challenging in the Ethiopian context. Ethiopia is one of few countries in Africa known for its large number of livestock. Despite this resource, Ethiopia is not able to meet the growing domestic demand for basic and processed animal products (USAID, 2013). The lack of investment in appropriate animal feed is often mentioned as a key cause, but an interplay of various factors contributes to the challenges of Ethiopia's livestock sector. Farmers and pastoralists often view livestock as a buffer investment rather than as a business and do not generally plan to use their own land for grazing but depend on dwindling communal lands. This attitude contributes to a low livestock offtake rate, since farmers and pastoralists sell their livestock only when they need money. The informal trade of live animals across the borders with neighboring countries is another factor contributing to the weak supply of livestock to the local market. In addition, long fasting periods (see also above) make the market unstable, with fluctuating prices and demand.

Currently, most agricultural production takes place during the major rainy seasons. The reliability of these seasons is, however, decreasing over time, due to climate change and related El Niño effects,

which have caused long periods of drought as well as sudden floods in Ethiopia. Another major research question, expressed in the nutrition-sensitive agriculture strategy, is how and what to produce more efficiently during the dry season (MoA, 2016) and how to ensure functioning markets and reliable demand for those products (**Research Question 13**). Again, enhanced water management is a critical factor for achieving this goal in the Ethiopian context (ANH Academy, 2016).

### ***Storage, transport, and trade subsystem***

Storage studies are scarce, but the topic is gaining increasing attention in the agriculture sector (AGP-II, 2016). A study by Minot and Mekonen (2012) shows that most farmers sell their grain soon after harvest because either they lack storage capacity or they need the cash for daily expenses or to repay fertilizer loans or pay taxes. This contributes to the high price volatility as well as the strong seasonal trends in food security and diets.

Many cooperatives have storage facilities, but there is little information on the capacity and condition of these facilities (Minot & Mekonen, 2012). The government is exploring options to increase grain storage, at either the national, cooperative, or household level (AGP-II, 2016). A solid understanding of the capacity and quality of current storage facilities, for grains but also for other food groups, and how they are connected to local and urban markets, will support this process (**Research Question 14**).

In terms of international trade, analysis of national-level data shows that the domestic food supply in Ethiopia comes primarily from production within Ethiopia, except for the supply of cereals, of which a significant amount is imported as aid and trade, to help address food insecurity. In terms of quantity, international trade is still limited but has been increasing over the last two decades. Coffee is the main export crop in terms of economic value, but export of oil crops, pulses, and vegetables has also been growing. While oilseeds are exported, palm oil is imported to meet local demand.

In terms of subnational trade, food is mostly consumed in the region where it is produced, and food miles are typically limited (Belwal & Tafesse, 2010; Soethoudt et al., 2013). Exceptions are oil,

sugar, beverages, and highly processed foods. There are also an increasing number of efforts to strengthen longer value chains for other commodities, particularly cash crops (coffee, vegetables for export), and along primary rural-urban nodes. Value chains in Ethiopia are receiving increasing attention. Examples include analyses of the value chains for staple foods (USAID, 2010; Minten et al., in press; Rashid et al., 2015), vegetables (Giziew, Negatu, Wale, & Ayele, 2014; Daniels and Fors, 2015; Hailu 2016), potatoes (Emana & Nigussie, 2011; Alemu et al., 2015), legumes (van den Broek et al., 2014), dairy products (USAID, 2013; Debele & Verschuur, 2014; Hoddinott et al., 2014; Beyene, 2015), and meat and animal-products (Addisu et al., 2012; USAID, 2013). Many of these studies focus on describing the functionality and performance of the value chains, with the aim of identifying actors, constraints, and interventions for improving the respective chains. A meta-analysis across multiple value chains would offer an opportunity to identify entry points into the food system to benefit multiple food chains simultaneously and increase diversity in the markets and in the diet as a whole (**Research Question 15**).

An initial qualitative assessment across value chains indicates that the Ethiopian food transport system is hampered by several challenges. First, the rugged mountainous topography, particularly in the north, makes transport especially challenging. Second, options for efficient packaging, to control quality and safety, are very scarce. Often fertilizer or chemical bags are used, as no specific food bags are available. Third, lack of adequate infrastructure—storage facilities, roads, cold chains, marketing facilities, and price information systems—has severely limited the transport and trade of food across the country (USAID, 2010). Over the last decade, the government has invested considerably in infrastructure, making new roads, railways, and air transport options available. Understanding how the new infrastructure investments affect food transport and distance traveled, and how this influences the food environment, is important in order to leverage the benefits of the new infrastructure for healthier diets (**Research Question 16**). Emerging evidence indicates that improved road connectivity does indeed improve diet diversity and food security through improved market access (Stifel & Minten, 2017) and that urbanization creates enhanced incentives for agricultural investments in rural areas that are well connected to cities (Vandercasteelen, Beyene, Minten, & Swinnen, 2017). This is in line with research in

Central America and Asia, where farmers with better access to roads and water benefited more from improved value chains in agricultural marketing systems (Michelson, 2016).

Wastage and postharvest losses in food value chains are increasingly being debated, along with the design of policies to try to reduce this waste (FAO, 2013). Despite the presumed importance of food waste, estimates of its actual importance and volume vary considerably (Minten, Engida, et al., 2016). As countries transition through economic growth, wastage before the farmgate decreases, but wastage after the farmgate, particularly at the consumer level, increases (Hodges et al., 2011). In Ethiopia, Minten, Engida, et al. (2016), performed a study on postharvest losses in rural-urban value chains of teff, Ethiopia's most important cash crop, using self-reported losses by different value chain agents. The study estimates that postharvest losses in the most prevalent pathway in the rural-urban value chain amount to between 2.2% and 3.3% of total harvested quantities, a rate much lower than commonly assumed for staple crops. This can possibly be explained by the rather good storage characteristics of teff, but the study also points to the need to gather further solid information on postharvest losses for different food groups in Ethiopia (**Research Question 17**) (Minten, Engida., et al., 2016).

### ***Food transformation subsystem***

Food transformation is defined as the processing of raw ingredients, by physical, chemical, or biological means, or a combination of these, into marketable food products that can be easily prepared and served by the consumer. Food transformation typically involves processing activities such as mincing and macerating, liquefaction, emulsification, extraction, and cooking (such as boiling, broiling, frying, or grilling); pasteurization, sterilization, and many other means of preservation, such as salting, pickling, drying; and may be followed by appropriate packaging.

Food processing currently dominates Ethiopia's (relatively small) industrial manufacturing sector—making up 60% of its value added—and it is estimated that almost 1 million people are employed in food processing enterprises in the country (around 2% of the economically active population) (Minten, Assefa, et al., 2016). The milling, baking, and sugar refining industries are especially important, and the

top products of food processing are wheat flour (314 kilotons in 2010), sugar (283 kilotons), and biscuits (193 kilotons) (Soethoudt et al., 2013). However, little is known about the way this sector functions, how it is changing, and how these changes impact people's diets (**Research Question 18**).

In the new Growth and Transformation Plan and the Agricultural Growth Program (AGP-II), Ethiopia has planned to invest strongly in agro-processing, aiming to become a leader in agro-manufacturing industries in Africa (Sisay, 2016). Incentives such as tax-free import of machinery, export duty exemptions, cheap labor, and access to partial initial investment loans from the government bank are offered to attract investors in agro-processing.

From a diet perspective, it is critical to investigate if and how the new investments in agro-processing can contribute to increasing nutritional value along the value chain, in terms of food composition, safety, acceptability, and diversity, and how the potential trade-offs of processing—for example, nutrient loss, added amounts of unhealthy components, and contamination from processing equipment (e.g., lead)—can be avoided. It is also unclear how different levels of processing, such as refined versus virgin oil, refined versus brown sugar, refined versus whole-corn flour, and extruded products versus bakery products, will be considered by regulatory bodies.

An important initial finding is that in parallel to the increase in food processing, out-of-home consumption is rising and already represents 16% of the budget of urban consumers (Minten, Assefa, et al., 2016). This percentage is much higher for the rich than the poorer quintiles, indicating that out-of-home consumption will rise further with income growth. This development has seemingly important implications for the structure of the food service sector, as well as possibly for consumption, as consumers know less about what goes into the food (e.g., enjera is now made by increasingly mixing rice in it, though few consumers are probably aware of this) (Minten, Assefa, et al., 2016).

Participants in the consultation further stressed that certain current food preparation / cooking practices in Ethiopia involve very long cooking times, which are hypothesized to cause significant nutrient losses. There is little documentation on this, and further research is required to identify potential entry points for avoiding such quality losses.

Considering all these factors, the transition toward more agro-processing in Ethiopia should be supported with research that monitors how increased processing drives changes in the food system and influences diet quality. There is also a need to understand if and how agro-processing investments that contribute to healthier diets ([Research Question 19](#)).

### ***Food retail and provisioning subsystem***

In Ethiopia there are many types of outlets where food can be bought. Unlike in the United States or European countries, where supermarkets rule the supply chain, in Ethiopia, traders in the food supply chain who sell directly to consumers are still dominant in the food system. The identified outlet types are listed in Box 1 (Soethoudt et al., 2013).

Regular markets and farmers' markets are the main outlets for selling outside the place of production. Sales on the roadside are also very common. Farm markets that involve selling at the place of production are not common, except among fellow villagers. The role and number of high-value and organized supermarkets is very low, and most existing supermarkets are concentrated in Addis Ababa. Many supermarkets do not belong to chains. No large fast-food company chains operate in the country, but small fast-food shops are widespread. The power of supermarkets in Ethiopia can therefore not (yet?) be compared to the situation in Western countries, where retailers have economies of scale in purchasing and hence dominate the food supply chain (Woldu et al., 2013).

Currently, the main actors in the food distribution and marketing sector are primarily smallholder producers, rural assemblers, cooperatives, primary processors, wholesalers, brokers, and retailers. Small-scale retailers represent the largest number of actors in the food supply chain. Wholesalers often do not specialize in certain commodities, but they mostly focus on the main crops grown in their respective areas of operation. Brokers, particularly those who operate in main terminal markets like in Addis Ababa, coordinate intermarket flows of grains and other agricultural produce (Gebre-Madhin, 2001). In addition to coordinating intermarket interactions, brokers provide very important services to wholesalers, such as supplying market information and arranging transport services. The Ethiopian Grain Trade Enterprise

(EGTE), which is a government enterprise, is another important actor in food distribution and marketing in the country. It aims to contribute to the stabilization of markets for farmers' produce so that they will be encouraged to increase their output. At times, EGTE distributes imported grains to domestic consumers and retailers at government-fixed prices to stabilize prices.

With this model of multiple outlets, a key research question is which outlets can most effectively be leveraged to increase access to and consumption of a diversity of nutritious and safe foods while avoiding excesses, unhealthy food components, and food waste ([Research Question 20](#)).

Food waste management is a growing public challenge in Ethiopia (Abebaw, 2008). In many cities of the country, waste management remains poor, and solid waste is often dumped along roadsides and into open areas, endangering health and environmental quality (Tadesse et al., 2008). In Ethiopia, the possibility of recycling food waste as a resource has not yet been explored to a significant degree; instead, current efforts are focused on achieving proper disposal of waste ([Research Question 21](#)).

Across the four food supply subsystems, governmental and nongovernmental projects that seek to influence the supply side (production, value chains, markets) toward healthier food choices in Ethiopia have been growing over the last five years, particularly through stronger integration of nutrition into agriculture (see also above). Examples include efforts to increase access to a diversity of seeds and nutrient-dense varieties of major staples (e.g., sweet potato, maize, legumes); small-scale irrigation and gardening projects for vegetables and fruits; value chain improvements for livestock; support for cooperatives to enhance the production, scale and marketing of a diversity of products; and new standards for food fortification.

Despite the growing number of projects, during the consultation process various stakeholders articulated a need to integrate various efforts into a systems approach that links consumption, markets, processing, transport, trade, and agricultural systems in order to target the multiple burdens of malnutrition simultaneously, as well as the potential future social, environmental, and economic trade-offs. Concrete examples of suggested projects include overcoming adoption constraints and creating markets for fruits and vegetables, strengthening urban agriculture pilots and related fresh markets, and



improving waste and water management throughout the food system. Further, practical methods and human capacity are needed to investigate how these food system innovations (supply and demand side) will influence the food basket consumed, that is, identifying the net nutritional impacts of specific innovations ([Research Questions 22](#)).

### **Drivers of food system change in Ethiopia**

Many changes are taking place throughout Ethiopia that influence the food system or can influence the food system in the future. It is beyond the scope of this paper to describe them all, but below we discuss a few underlying factors that are hypothesized to be important drivers of food system transformation and dietary transitions in Ethiopia ([Research Question 23](#)).

First, rapid urbanization and population growth is a major driver of food system and diet transformation and will continue to play a dominant role. Ethiopia is the second-most-populous country in sub-Saharan Africa, with a population of 96.5 million in 2014 (as compared to about 30 million in 1980) and a population growth rate of 2.5% (as compared to 1.9% in 1980) (Ozlu et al., 2015). In 2015, approximately 20% of the population lived in cities. While this is still much lower than the urbanization levels seen in the rest of the world and Africa, cities are growing rapidly (Ozlu et al., 2015). Twenty-five years ago, only about 10% lived in urban areas. In particular, Addis Ababa has been expanding rapidly. Urbanization drives changes in demand, relocates labor, requires longer value chains, and creates large markets. Urbanization opens opportunities for developing economies of scale for a diversity of products but also brings threats such as increased access to unhealthy ultra-processed foods, reduced physical activity, and vulnerability to fluctuating food prices as net consumers.

The shift toward urban living changes people's relationship with food, including how they shop and what they buy, as well as their ideas about sanitation and freshness. Most of what we know about how urbanization affects food systems is focused on the physical expansion of urban areas (food supply side) and changes in diet due to changes in income, lifestyle, and culture (food demand side) (Seto & Ramankutty, 2016). However, we need to move beyond understanding urbanization's direct effects on

diet and toward examining its indirect effects on resource use and the environment, such as embodied energy for food production, transport, packaging, cold storage, food waste, and the rest of the entire food supply chain, from farm to fork. For example, in Ethiopia the distance to a city was found to have important effects on intensification decisions by farmers, indicating that cities are increasingly becoming engines of agricultural and food system transformation in rural areas (Vandecasteele et al., 2017). Producer prices also decline in line with transportation costs; the farther farmers live from the city, the more expensive their use of agricultural inputs (Minten et al., 2016).

Second, over the past decade, Ethiopia has been one of the fastest-growing economies in the world, yet its per capita income of \$707 remains substantially lower than the regional average (World Bank, 2018). One of the drivers of Ethiopia's growth has been agricultural modernization through investment in an agricultural growth corridor (AGP-I and AGP-II), which has resulted in a substantial rise in agricultural productivity (Bachewe et al., 2015). Ethiopia is also increasingly opening up in terms of improving its businesses, investments, and finance sector (e.g., for local small enterprises to access credit) (World Bank, 2009; consultation process). However, enterprises along the agriculture value chain that deliver food to rural and urban local markets continue to face major constraints, such as limited market penetration and poor storage, transport, and distribution infrastructure (see above). Participants in the consultation process suggested that there is a need to understand how this economic growth changes the dietary patterns and consumer behavior of different population groups.

Third, environmental concerns relevant to Ethiopian food systems were raised repeatedly during the consultation, in particular climate change and variability—and the consequent water shortages, seasonality and unpredictability, and land degradation—as well as related soil infertility and biodiversity loss. Ethiopia's Climate-Resilient Green Economy strategy and the Sustainable Land Management Program aim to address these challenges, but the linkages between these programs and food and nutrition programs are unclear. Taking a sustainable food systems approach can provide an opportunity to strengthen such linkages and explore opportunities for synergies and minimizing trade-offs between food system and diet transformations, climate change adaptation and mitigation, and land degradation. For

example, linking efforts to improve water management (e.g., water harvesting, drip irrigation) to strengthening a diversity of value chains and fresh markets for fruits and vegetables could benefit both diet and environmental outcomes. Adaptation to changing climate patterns will require management of risks not only in production landscapes but also in food storage, trade, and transport systems.

Fourth, two large national government-led food programs are shaping food systems development. First, the Growth and Transformation Plan targets large agricultural and agro-industrial investments, through the AGP, to high-potential areas in four regions of the country, thereby enabling an agricultural growth corridor (see above). Second, the Productive Safety Net Program (PSNP) helps the most vulnerable households in rural areas cope with food insecurity and manage risks. The impact of these large national programs on food system dynamics and dietary changes is not yet known. Ongoing evaluations led by the Ethiopian Development Research Institute and IFPRI will help shed light on these trends, particularly on changes in diets. However, knowledge of or research on how food systems operate and change in Ethiopia, and how those systems interact with large governmental programs, is much more limited and was identified during the consultation as a key knowledge and research gap. Several existing databases (see examples in Table 2) can be mobilized for that purpose and complemented with new specific food-system data-collection efforts. Such food systems research could help identify leverage points for food-basket interventions in Ethiopia by taking into account different contexts, needs, and dynamics.

Fifth, in terms of institutional innovation, several active Ethiopian multistakeholder platforms drive and enable interactions between multiple disciplines. The presence and activities of these platforms set the stage for innovative thinking, policies, actions, and alliances. Examples include the National Nutrition Coordination Body, led by the Ministry of Health and engaging nine ministries, donors, United Nations agencies, nongovernmental organizations, and private-sector and research institutions. The National Nutrition Coordination Body drives the national nutrition strategy. Other examples of multistakeholder, multisector platforms include the CASCAPE platform (coordinated by Wageningen University and Research), the ReSAKSS East and Central Africa platform (facilitated by the International

Livestock Research Institute and IFPRI), and the ATONU-FANRPAN network. Yet experts still need to understand and identify which policies and institutional innovations can be leveraged to help scale certain successful food system innovations and how local capacity and institutions can be supported and contribute to this end ([Research Question 24](#)).

Sixth, increased access to education is further changing consumer demand, toward safer and healthier food. In particular, consumers increasingly demand appropriate labeling, including nutritional value, expiry date, and information related to potential risk components such as trans fatty acids, cholesterol, and mycotoxin contamination.

Seventh, recent large investments in enhanced infrastructure, including roads, railroads, and storage facilities, as well as energy and water catchment infrastructure, could be a game changer because they can facilitate market integration and reach in Ethiopia.

**Table 2. Examples of relevant existing national databases for studying food systems and diets in Ethiopia**

<b>National databases</b>	<b>Examples of relevant indicators for food systems</b>	<b>Representative at what scale</b>
National food consumption survey (first time in 2011)	Diet diversity, macro- and micronutrient intake, anthropometrics	Regional, rural and urban, children, women and men
National micronutrient survey (first time in 2015)	Micronutrient serum levels	Regional, rural and urban, children and women
National agricultural sample survey (yearly)	Crop and livestock production, agricultural income	Regional, household level
National market surveys (monthly)	Price data for food items	120 main markets, distributed nationally
National household (income and) consumption survey (every 5 years since 1994/1995)	Household food and nonfood consumption	Regional, household level
Demographic and Health Survey (DHS, every 4 years)	Anthropometrics, infant and young child feeding indicators, diet diversity, disease prevalence	Regional, children and women

Living Standard Measurements Study– Integrated Surveys on Agriculture (LSMS-ISA)	Crop and livestock production, income, assets, household socioeconomic characteristics, diet diversity score	Regional, household level
Spatial: national agricultural atlas	Distance to markets, agroecological zone, roads, population density	Mostly grid-based (10 km <sup>2</sup> x 10 km <sup>2</sup> )
Ethiopian soil information system (EthioSIS)	Land use, soil fertility characteristics, soil degradation	Mostly grid-based (10 km <sup>2</sup> x 10 km <sup>2</sup> )
National meteorological data libraries	Rainfall and temperature patterns and anomalies	Woreda

Source: Compiled by authors.

#### 4. SYNERGIES AND TRADE-OFFS BETWEEN DIETS AND OTHER OUTCOMES OF FOOD SYSTEMS IN ETHIOPIA

There is increasing concern about the impact of food systems on social, economic, and environmental outcomes. It is therefore critical for governments as well as private companies to consider both food system objectives and broader goals and constraints, including the need to build sustainability into a country's agricultural system, conserving limited water supplies and promoting long-term management of soils, forests, and biodiversity (GLOPAN, 2016). In particular, the relationships between diets that are high quality from a nutritional perspective and their potential impacts on the environment, on social inclusion (including gender), and on economic growth need to be considered carefully ([Research Question 25](#)). These relationships and interactions are usually more complex than popularly assumed and are likely to differ considerably in different contexts. Examples can help clarify this complexity.

The production of livestock plays an important role in Ethiopian food systems sustainability. While highly intensified livestock production in industrialized countries and an excess of meat consumption have negative environmental and human health effects, livestock in the Ethiopian context is mostly produced in mixed systems, allows for higher diet diversity, and contributes to several positive environmental effects, such as improved soil fertility, particularly if zero-grazing practices are applied. Transitioning Ethiopian livestock toward higher productivity and market integration while avoiding the negative environmental trade-offs of livestock intensification is a key challenge.

Vegetable and fruit production in Ethiopia is increasingly commercialized, particularly to meet demand on the international markets and from growing urban areas. Several Ethiopian partners suggest that the intensification of vegetable and fruit production is usually accompanied by increased use of pesticides. While no studies have specifically examined the association between fruit and vegetable production and herbicide use, Tamru et al., (In press) show that herbicide use in Ethiopia has more than quadrupled in the last decade. Herbicides are now used on more than a quarter of the cereal area. In particular, 2,4-D, which is banned in some countries because of its harmful effects on the environment and human health, is a very important herbicide that has taken off quickly in Ethiopia. Mekonen et al.

(2015) reported DDT residues in complementary foods and considerable risk for infants consuming maize-based complementary foods in southern Ethiopia. Sheahan et al. (2017) showed that the increasing pesticide use in Africa has started to affect human health (Ethiopia is part of the cross-country study).

Use of chemical fertilizers has increased significantly as well, as shown by Bachewe et al. (2015). The researchers show that chemical fertilizer use has more than doubled over the last decade. While critical for soil fertility, fertilizer can have negative environmental run-off effects if not managed carefully.

Many of the newly produced vegetables and fruits are destined for international and urban markets and are not directly accessible to the rural and urban poor. When food markets strengthen, benefiting diet diversity, production systems can tend to focus locally on specialization, potentially resulting in lower ecosystem diversity and reduced resilience at the farm and/or landscape scale. Across a gradient of agricultural intensification, Baudron, Chavarría, Remans, Yang, & Sunderland (2017) identify synergies between dietary diversity and diversity of ecosystem functions and services. While Ethiopia's agriculture intensifies, it will be important to carefully manage the country's rich ecosystem and agricultural diversity throughout the food system to ensure sustainable, long-term benefits.

Overall, as food systems are transforming in Ethiopia, it is important to investigate synergies and trade-offs between nutritional outcomes on one hand, and social, economic, and environmental outcomes on the other hand.

## 5. DISCUSSION AND CONCLUSION

Recent Ethiopian government policies and programs call for more sustainable food systems approaches to achieve better nutrition for all. Such food systems approaches imply actions that include but also go beyond agriculture to consider the many processes, actors, activities, and outcomes involved in food production, processing, storage, transportation, trade, retailing, and consumption. Many of these aspects of food systems transformation beyond the farm are still in their infancy.

In this paper, we aimed to identify research that can support operationalizing such food systems approaches in Ethiopia. Based on a scoping review and engagement with stakeholders, we identified and prioritized 25 research questions (Table 1). We can group those questions into three broad categories.

A first area, diagnosis and foresight, aims to better understand and characterize dietary gaps and how diet changes and food system transformations interact and influence each other. This area of research should characterize dietary patterns across influential parameters (agroecological zone, urban-rural gradient, ethnicity) and model trends in dietary patterns; their transformation (or lack thereof); their drivers; and their implications in terms of diet quality, food systems, and, where possible, socioeconomic and environmental trade-offs.

A second area for food systems research focuses on testing demand-, market-, and supply-side interventions/innovations that focus on nonstaples for their impact on overall dietary patterns; potential trade-offs in terms of economic, social, and environmental outcomes; and interactions between food system actors.

A third area focuses on institutional and policy research and explores enabling factors and private or public policy anchors that can take food systems approaches for healthier diets to a regional or national scale—anchoring and scaling. This area would build on systems analysis in the first area and follow up small-scale innovation studies in the second area.



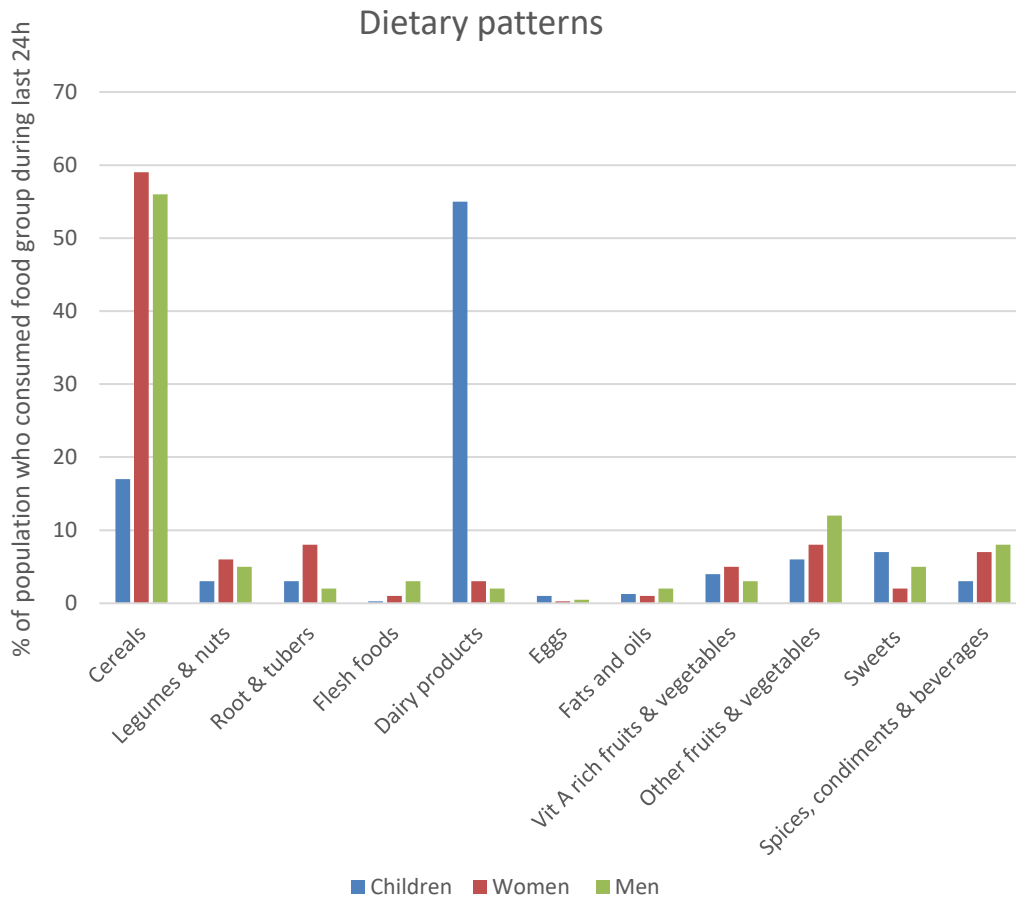
To address these food systems research questions in the Ethiopian context, we explored how existing research methodologies and resources can be strengthened and/or complemented. To this end, we identified six recommendations for applied research and research capacity:

- **Increased focus on the processes that happen after the farmgate:** storage, transport, and trade; food transformation; food retail and provisioning subsystems; and consumption patterns and drivers of choice.
- **Integration of food systems frameworks in curricula of studies in nutrition, economics, agriculture, trade and industry, and environment.** This will build systems thinking, capacity, and a common language across sectors.
- **Consideration of the dynamic nature of food systems and diets.** What is changing? What drives or limits change?
- **Combination of quantitative, qualitative, and participatory research methodologies.** This allows researchers to capture and consider the various dimensions and perceptions of food systems.
- **Integration of various national and subnational databases.** Ethiopia is data-rich, and a number of existing Ethiopian datasets (Table 2) that were not collected or performed with a specific food-systems research goal in mind can be mobilized to start addressing various critical questions in this knowledge field. This is already planned to some degree in the newly launched National Information Platform for Nutrition. Of course, the existing databases have some limitations for food systems applications, such as (1) most are representative only at the national or regional level; (2) most data are at the household level and provide very limited insights into intrahousehold dynamics; and (3) the various datasets are often collected at different time points or using different spatial units, which makes investigation across datasets limited.
- **Monitoring of systems indicators that can be tracked across the food system,** for example, food diversity (of the diet, the market, the production system) and food safety (of the various diet ingredients, in market outlets, from different production systems).

In conclusion, this paper aims to provide a base for inspiring and strengthening food systems research that is actionable and can help improve the diet quality of Ethiopian consumers in a sustainable way by considering the different pieces of the puzzle. The diversity in the group of coauthors illustrates that this is an effort that bridges the academic, development, and public- and private-sector communities. In addition, the paper aims to add value to the literature as a case study that applies global food systems thinking to a concrete setting, thereby stimulating cross-country learning.

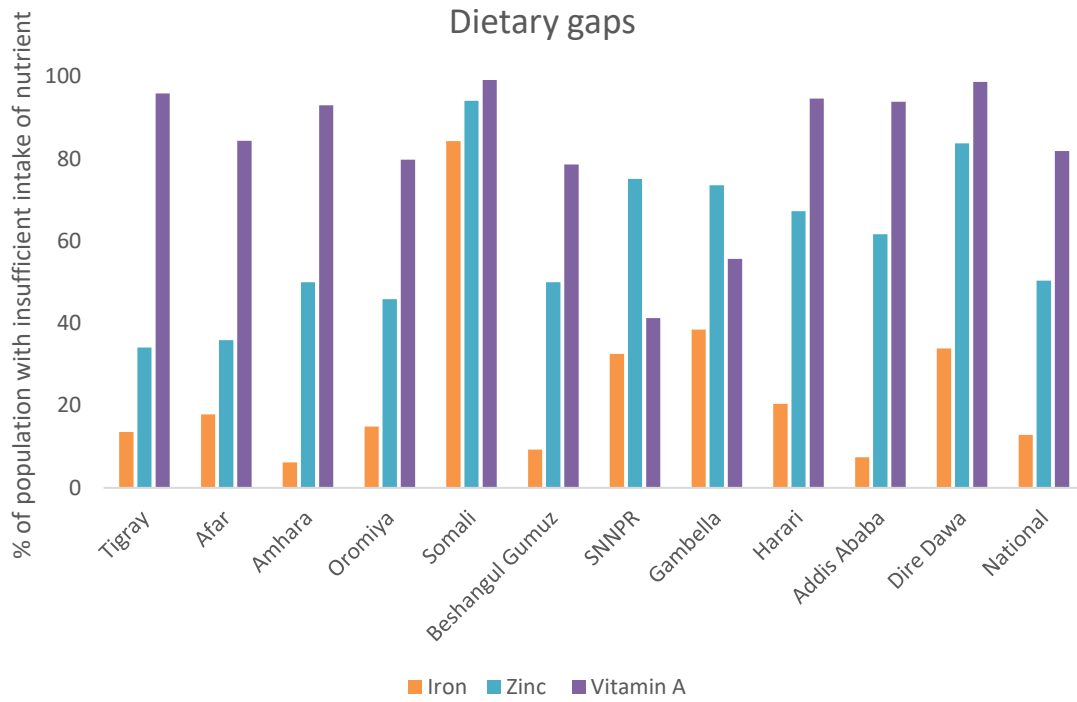
## APPENDIX: SUPPLEMENTARY FIGURES

Figure A. Dietary patterns in Ethiopia



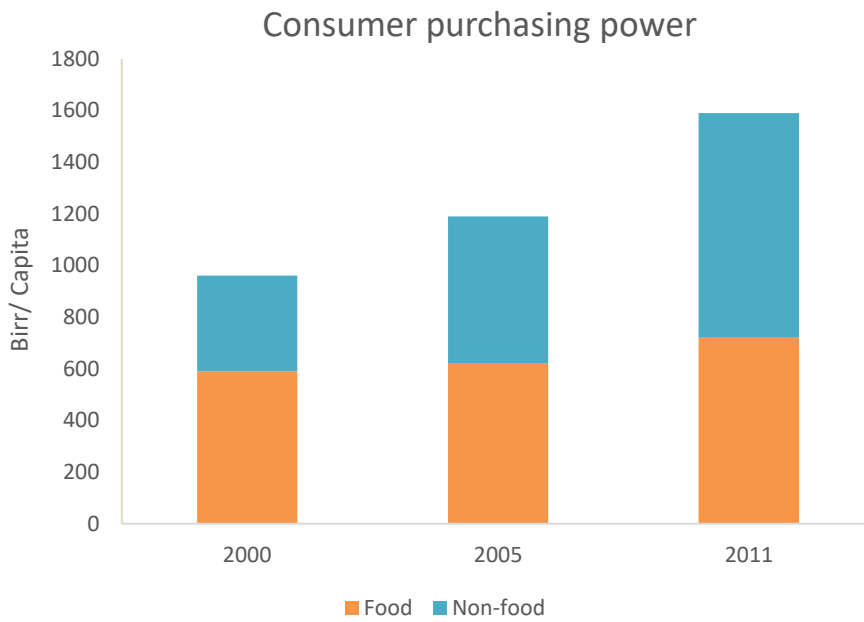
Source: EPHI, 2013.

**Figure B. Dietary gaps in Ethiopia**



Source: EPHI, 2013.

**Figure C. Consumer purchasing power in Ethiopia**



Source: Worku et al., 2017.

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