



IFPRI Discussion Paper 02018

May 2021

Food Systems for Healthier Diets in Nigeria

A Research Agenda

Busie Maziya-Dixon, Thom Achterbosch, Delana Adelekan, Olutayo Adeyemi, Victor Ajieroh, Dare Akerele, Adebayo Akinola, Emmanuel Alamu, Siemen van Berkum, Kendra Byrd, Aafke Nijhuis, Makuachukwu Ojide, Adeyinka Onabolu, Johnson Onyibe, Ireen Raaijmakers, Folake Samuel, Harriette Snoek, Adekunle M. Yusuf, and Inge D. Brouwer

CGIAR Research Program on Agriculture for Nutrition and Health (A4NH)

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

The International Food Policy Research Institute (IFPRI), a CGIAR Research Center established in 1975, provides research-based policy solutions to sustainably reduce poverty and end hunger and malnutrition. IFPRI's strategic research aims to foster a climate-resilient and sustainable food supply; promote healthy diets and nutrition for all; build inclusive and efficient markets, trade systems, and food industries; transform agricultural and rural economies; and strengthen institutions and governance. Gender is integrated in all the Institute's work. Partnerships, communications, capacity strengthening, and data and knowledge management are essential components to translate IFPRI's research from action to impact. The Institute's regional and country programs play a critical role in responding to demand for food policy research and in delivering holistic support for country-led development. IFPRI collaborates with partners around the world.

AUTHORS

Busie Maziya-Dixon (b.maziya-dixon@cgiar.org) is a Senior Food and Nutrition Scientist at the International Institute of Tropical Agriculture (IITA) in Ibadan, Nigeria. She leads A4NH Country Coordination and Engagement Team in Nigeria.

Thom Achterbosch (t.achterbosch@wur.nl) is a Senior Researcher in development economics at Wageningen University & Research in The Hague, The Netherlands.

Delana Adelekan (d.adelekan@yahoo.com) is a Professor of Public Health Nutrition at the Federal University of Agriculture in Abeokuta, Nigeria.

Olutayo Adeyemi (adeyemiolutayo@gmail.com) is an Independent Consultant, formerly of the Food and Agriculture Organization of the United Nations, Abuja, Nigeria.

Dr. Victor Ajieroh (Victor.Ajieroh@gatesfoundation.org) is a Senior Program Officer for Nutrition at the Bill & Melinda Gates Foundation Country Office in Abuja, Nigeria.

Dare Akerele (akereled@funaab.edu.ng) is a Senior Lecturer at the Federal University of Agriculture in Abeokuta, Nigeria.

Adebayo Akinola (bayokinola2013@gmail.com) is a Professor in the Department of Agricultural Economics at the Obafemi Awolowo University in Ile-Ife, Nigeria.

Emmanuel Alamu (e.alamu@cgiar.org) is an Associate Scientist at International Institute of Tropical Agriculture (IITA), Southern Africa Research and Administration Hub (SARAH) Campus PO Box 310142, Chelstone, Lusaka 10101, Zambia.

Siemen van Berkum (siemen.vanberkum@wur.nl) is a Senior Researcher in agricultural economics at Wageningen University & Research in Wageningen, the Netherlands.

Kendra Byrd (k.byrd@cgiar.org) is a Nutrition Scientist at WorldFish in Malaysia.

Aafke Nijhuis is a former research assistant at Wageningen University & Research in Wageningen, the Netherlands.

Makuachukwu Ojide (embracegod1@yahoo.com) is a Lecturer in the Department of Economics & Development Studies at Alex Ekwueme Federal University in Abakaliki, Nigeria.

Adeyinka Onabolu (aonabolu@gainhealth.org) is a Senior Advisor on Food Security and Nutrition to the Honourable Minister of Agriculture and Rural Development in the Federal Ministry of Agriculture and Rural Development in Abuja, Nigeria.

Johnson Onyibe (jeonyibe@yahoo.com) is a Professor of Agronomy and Director of Research and Planning at the National Agricultural Extension and Research Liaison Services (NAERLS) at Ahmadu Bello University in Zaria, Nigeria.

Ireen Raaijmakers (ireen.raaijmakers@wur.nl) is a Senior Researcher in consumer behavior at Wageningen University & Research in The Hague, the Netherlands.

Folake Samuel (samuelfolake@yahoo.co.uk) is an Associate Professor in the Department of Human Nutrition and Dietetics at the University of Ibadan in Ibadan, Nigeria.

Harriette Snoek (harriette.snoek@wur.nl) is a Senior Researcher in consumer behavior at Wageningen University & Research in Wageningen, the Netherlands.

Adekunle M. Yusuf (am.yusuf@cgiar.org) is a Research Associate at IITA in Ibadan, Nigeria.

Inge D. Brouwer (inge.brouwer@wur.nl) is an Associate Professor in the Division of Human Nutrition and Health at Wageningen University & Research in Wageningen, the Netherlands.

Notices

¹ IFPRI Discussion Papers contain preliminary material and research results and are circulated in order to stimulate discussion and critical comment. They have not been subject to a formal external review via IFPRI's Publications Review Committee. Any opinions stated herein are those of the author(s) and are not necessarily representative of or endorsed by IFPRI.

² The boundaries and names shown and the designations used on the map(s) herein do not imply official endorsement or acceptance by the International Food Policy Research Institute (IFPRI) or its partners and contributors.

³ Copyright remains with the authors. The authors are free to proceed, without further IFPRI permission, to publish this paper, or any revised version of it, in outlets such as journals, books, and other publications.

Contents

ABSTRACT	iv
ACKNOWLEDGMENTS	v
ACRONYMS	vi
I. INTRODUCTION	1
II. DIET QUALITY AS AN ENTRY POINT	6
III. CONSUMER BEHAVIOR AND PURCHASING POWER	11
3.1. Introduction	11
3.2. Motivation	11
3.2.1. Cultural norm, beliefs and taboos	11
3.2.2. Product characteristics affecting food choices	12
3.2.3. Aspiration	13
3.3. Ability	13
3.3.1. Knowledge	14
3.3.2. Skills	14
3.4. Opportunity	15
3.4.1. Income/ purchasing power	15
3.4.2. Gender issues	16
3.4.3. Globalization and foreign influences	16
IV. FOOD ENVIRONMENT	18
4.1. Overview	18
4.2. Access to Markets	18
4.3. Promotion	20
4.4. Food Safety Regulations	21
4.5. Economic Access	22
V. FOOD SUPPLY SYSTEMS IN NIGERIA	24
5.1. Agricultural Production Subsystem	24
5.2. Storage, transport and trade subsystem	29
5.3. Food transformation subsystem	32
5.4. Food retail and provision subsystem	38
VI. DRIVERS OF FOOD SYSTEM CHANGE IN NIGERIA	41
6.1. Introduction	41
6.2. Indirect drivers of Nigeria's food systems	41
6.2.1. Biophysical and environmental drivers	41
6.2.2. Demographic drivers	42
6.2.3. Economic drivers	46
6.2.4. Innovation and technology drivers	48
6.2.5. Increased infrastructure	50
6.2.6. Sociocultural drivers	51
6.2.7. Political drivers	53
VII. SYNERGIES AND TRADE-OFFS BETWEEN DIETS AND OTHER OUTCOMES OF FOOD SYSTEMS IN NIGERIA	60
VIII. SYNTHESIS AND THE WAY FORWARD: AN AGENDA FOR POLICY RESEARCH	63
Annex 1. Overview of Research Questions	75
References	78

Tables

Table 1. Gaps in Demand and Supply of Major Food Products in Nigeria (2016 Estimate).....	32
Table 2. Description of the Categories of Processed Foods.....	34

Figures

Figure 1. Framework of the High-Level Panel of Experts on Food Systems and Nutrition.....	5
Figure 2. Ecologies and Crops Produced in Nigeria	25
Figure 3. Agro-ecologies and animal protein sources in Nigeria	26
Figure 4. Percentage of population in urban and rural areas of Nigeria	43
Figure 5. Urban population by size class of urban settlement in Nigeria	44

ABSTRACT

Malnutrition, mostly resulting from poor food, health, and care practices, is related to physiological, socioeconomic, and psychological factors and remains one of the leading causes of mortality in children under five years of age in low- and middle-income countries. Nigeria, as with many parts of the world, is experiencing a multiple malnutrition burden, where undernutrition, including micronutrient deficiencies, exists alongside overweight, obesity, and associated diet-related non-communicable diseases. Recent data show that 37 percent of children under five years of age are stunted while 68 percent suffer some degree of anaemia. Overweight and obesity are also common among adults with prevalence rate of about 33 percent. The Nigerian government embraces sustainable food system approaches in its policy and programmes to address malnutrition problems in the country. Food systems approaches take a holistic understanding of all activities and processes involved in food production, processing, storage, transportation, trade, transformation, retail, and consumption.

In this paper, we identify and discuss the types of research that can support the operationalization of food systems approaches to improving the quality of diets in Nigeria. Specifically, we structured a consultative workshop with key stakeholders, reviewed the literature, and applied food systems framework to the Nigerian context. The process enabled us to identify 39 research questions crucial to: understanding how changes in food systems can lead to healthier diets; identifying and testing entry points for improving availability and effective demand for healthier food; and creating at scale a supportive policy and market environment for achieving healthier and sustainable diets in Nigeria.

Keywords: food systems, diet quality, consumer behavior, food environment, food supply systems, Nigeria

ACKNOWLEDGMENTS

This work was undertaken as part of, and funded by, the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH). This paper has gone through the standard peer review procedure of A4NH's Lead Center, IFPRI. The authors express a deep appreciation to Namukolo Covic, Olivier Ecker, and other anonymous reviewer from IFPRI for helpful review and comments. Much gratitude also goes to Janet Hodur for excellent editorial work on the paper. The inputs and contributions of different stakeholders during the workshops, meetings, and symposiums on Food Systems for Healthier Diets in Nigeria are well acknowledged. The opinions expressed here belong to the authors, and do not necessarily reflect those of A4NH or CGIAR.

ACRONYMS

ACSE	Abuja Securities & Commodities Exchange
AFSNS	Agricultural Sector Food Security and Nutrition Strategy
AKIS	Agriculture Knowledge and Innovation System
ARC	Agricultural Research Council
DHS	Demographic and Health Survey
FAO	Food and Agriculture Organization of the United Nations
FBDG	Food-based dietary guidelines
FCAFH	Food consumed away from home
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GHS	Government Household Survey
HLPE	Committee on World Food Security High-Level Panel of Experts on Food Systems and Nutrition
ICT	Information and Communication Technologies
IFAD	International Fund for Agricultural Development
LMIC	Low- and middle-income countries
LSMS	Living Standard Measurement Study
MAO	Motivation, Ability and Opportunity model
MIS	Market Information Service
NAFDAC	National Agency for Food and Drugs Administration and Control
NCD	Non-communicable disease
NCN	National Council on Nutrition
NFCMS	National Food Consumption and Micronutrient Survey
NHGSFP	National Home Garden School Feeding Program
NSA	Nutrition-sensitive agriculture
SCPZ	Staple crop producing zone
SME	Small- and medium-scale enterprises
SON	Standards Organization of Nigeria
SUN	Scaling Up Nutrition
UN	United Nations
USDA	United States Department of Agriculture
WHO	World Health Organization

I. INTRODUCTION

According to the World Bank, Nigeria's gross domestic product (GDP) grew at an average rate of 5.7 percent per year between 2006 and 2016 (World Bank, 2019). Despite strong economic growth over the last decade, poverty has remained significant, with increasing inequity and regional disparities. Poverty incidence rose from 27.2 percent in 1980 to 40.09 percent in 2019, with urban poverty consistently lower than rural poverty. Hence, while 18.04 percent of urban residents were considered poor in 2019, more than 52 percent of rural dwellers fell into the same category (NBS, 2020). Poverty also appears to be more prevalent in the northern part of the country, with the highest rates hovering between the north-east and north-west zones. Reports further show that a large number of Nigerians are clustered around the poverty line, suggesting that a small positive or negative shock could substantially change the poverty rate (World Bank, 2016).

Malnutrition, mostly resulting from poor food, health, and care practices, is related to physiological, socioeconomic, and psychological factors and remains one of the leading causes of mortality in children under five years of age in low- and middle-income countries (LMIC). Children in Nigeria suffer from high rates of chronic malnutrition; in 2018, (National Population Commission (NPC) and ICF, 2019) 37 percent of children under five years of age were stunted and 19 percent were severely stunted. Analysis by age groups showed that the prevalence of stunting increases with age, peaking at 47 percent among children aged 24-35 months. Severe stunting showed a similar pattern, with children aged 24-35 months having the highest proportion of severe stunting (27 percent). Also, stunting was higher in male children (40 percent) than in female children (34 percent). In addition, children in rural areas were more likely to be stunted (46 percent) than those in urban areas (27 percent), and the pattern was similar for severe stunting (26 percent in rural areas and 11 percent in urban areas). The north-west had the highest proportion of children who were stunted (60 percent), followed by the north-east (52 percent) and north central (29 percent). Only two percent of children under the age of five were overweight, while 33 percent of adults are overweight or obese. For micronutrient deficiency, in 2018, 68 percent of children suffered some degree of anaemia, with

27 percent mildly anaemic, 38 percent moderately anaemic and three percent severely anaemic. This was higher among children residing in the rural areas (73 percent) than among those in the urban areas (62 percent). About 47 percent of non-pregnant women of reproductive age were anaemic and 31 percent were iodine deficient (National Population Commission (NPC) and ICF, 2019).

Nigeria is also witnessing a significant rise in the incidence of diet-related non-communicable diseases (NCDs): the prevalence of overweight/obesity, and type II diabetes in adults was 33.3 percent and 7.9 percent respectively (NPC(National Population Commission) and ICF International, 2014). Diet-related NCDs are increasingly becoming the leading causes of morbidity and mortality worldwide. They encompass a cluster of illnesses which include diabetes mellitus, cancers, chronic respiratory diseases, cardiovascular disease, and musculoskeletal disorders. The impact of NCDs is great on the poor countries of sub-Saharan Africa, among which Nigeria occupies a significant position. NCDs in Nigeria accounted for an estimated 28 percent of all mortality in 2008. The most prevalent NCDs in Nigeria are cardiovascular diseases, which accounted for 12 percent of total deaths across all age groups in 2008. Cancers, non-communicable variants of respiratory diseases, and diabetes contributed four, three, and two percent, respectively, to total mortality in 2008. The number of people with type II diabetes in Nigeria is forecast to double from 3.1 million to 6.1 million between 2011 and 2030 (Development Initiatives, 2017).

The Government of Nigeria has taken some strategic steps towards promoting the improvement of nutrition in Nigeria. These include the launch of the National Policy on Food and Nutrition (Ministry of Budget and National Planning, 2016) that employs a multi-sectoral and multi-disciplinary program approach, including various interventions at the community as well as the national level. Among other approaches, the National Policy on Food and Nutrition includes leveraging of food systems to combat malnutrition, and is supported by the recognition of nutrition as a key impact domain for agriculture in the Agriculture Promotion Policy (the Green Alternative) (FMARD, 2016); the launch of the Agricultural Sector Food Security and Nutrition Strategy (AFSNS) 2016–2025 in 2017; and the Transformative Partnership for High Energy Nutritious

Foods for Africa, together with a strategic plan to support the initiative. Other critical efforts include the priority accorded to the expanded access and use of biofortified crops such as pro-vitamin A cassava and orange fleshed sweet potato, and the linking of the National Home-Grown School Feeding Programme with local agriculture. Efforts likewise include the preparation of a National Strategic Plan of Action for Nutrition – Health Sector Component that built on other strategic documents, while setting targets to reduce malnutrition (Federal Ministry of Health, 2014). There is also the National Health Policy to strengthen the primary health care sub-system and address the health-related causes of malnutrition.

Although reducing malnutrition and improving food systems are high on the government's agenda, the economic burden of malnutrition, as well as economic measures necessary for addressing malnutrition (GLOPAN, 2016), have not been given sufficient priority as it is not explicitly mentioned in the Economic Recovery and Growth Plan for 2017–2020 (Ministry of Budget & National Planning, 2017). While the AFSNS 2016–2025 addresses some of the priority gaps, implementing economic measures are necessary for achieving the AFSNS targets, including the enhancement of food environments for improved nutrition in Nigeria (Global Panel, 2017a; Global Panel, 2017b). Better data about the impact of economic factors on the quality of food environments in Nigeria, and the interactions with diet quality, is likewise necessary (Global Panel, 2017a). There is, therefore, an urgent need to appraise the diet, food environment, and food supply systems and create recommendations for improvement.

In this paper, we identify and discuss the types of research that can support the operationalization of food system approaches to improving the quality of diets in Nigeria. To this aim, we learn from major research agenda-setting examples from Ethiopia, which employed a process documented by Pretty, et al (2010) and Lachat, et al., (2014) and applied the following methodology. First, a review of literature was performed to structure a consultative workshop with key stakeholders. Second, a consultative workshop was held to review the nature of the food systems landscape of Nigeria, identify knowledge gaps, and to guide further analysis of the literature. Using the food systems framework of the High-Level Panel of Experts (HLPE)

on Food Systems and Nutrition as shown in Figure 1, we identified key words for each of the dimensions of the framework, serving as input for systematic searches. Third, given the conceptual food systems framework, further literature analysis was performed, and research questions were formulated and grouped in three areas. Fourth, the findings were written up in the form of a manuscript, followed by circulation of the draft paper to key national stakeholders involved in the consultative processes to serve as a validation process. Finally, a stakeholders' workshop was held to validate the findings and reach an agreement on the research questions. It is expected that this paper will add value to the literature by contextualizing food systems research in Nigeria, as a case study to apply global food systems thinking to a concrete setting and stimulate in- and cross-country learning.

Following this introductory section, the paper is divided into seven additional sections. Sections 2 to 6 each highlight an element of the conceptual framework of food systems and nutrition depicted in Figure 1, within the Nigerian context. In Section 2, the concept of diet quality and its fundamental role in reducing malnutrition is highlighted. Section 3 describes the part consumer behavior plays in food systems, while Section 4 examines the food environments that interface between food supply systems and consumers. In Section 5, an overview of the subsystems of food supply systems is presented, and Section 6 discusses food system drivers. Section 7 identifies trade-offs and potential synergies between diets and other food system outcomes in Nigeria, and Section 8 summarizes and concludes the paper. Although identified research questions are incorporated into the sections, the paper also includes an annex that compiles the research needs.

Figure 1 Conceptual framework of food systems for diets and nutrition

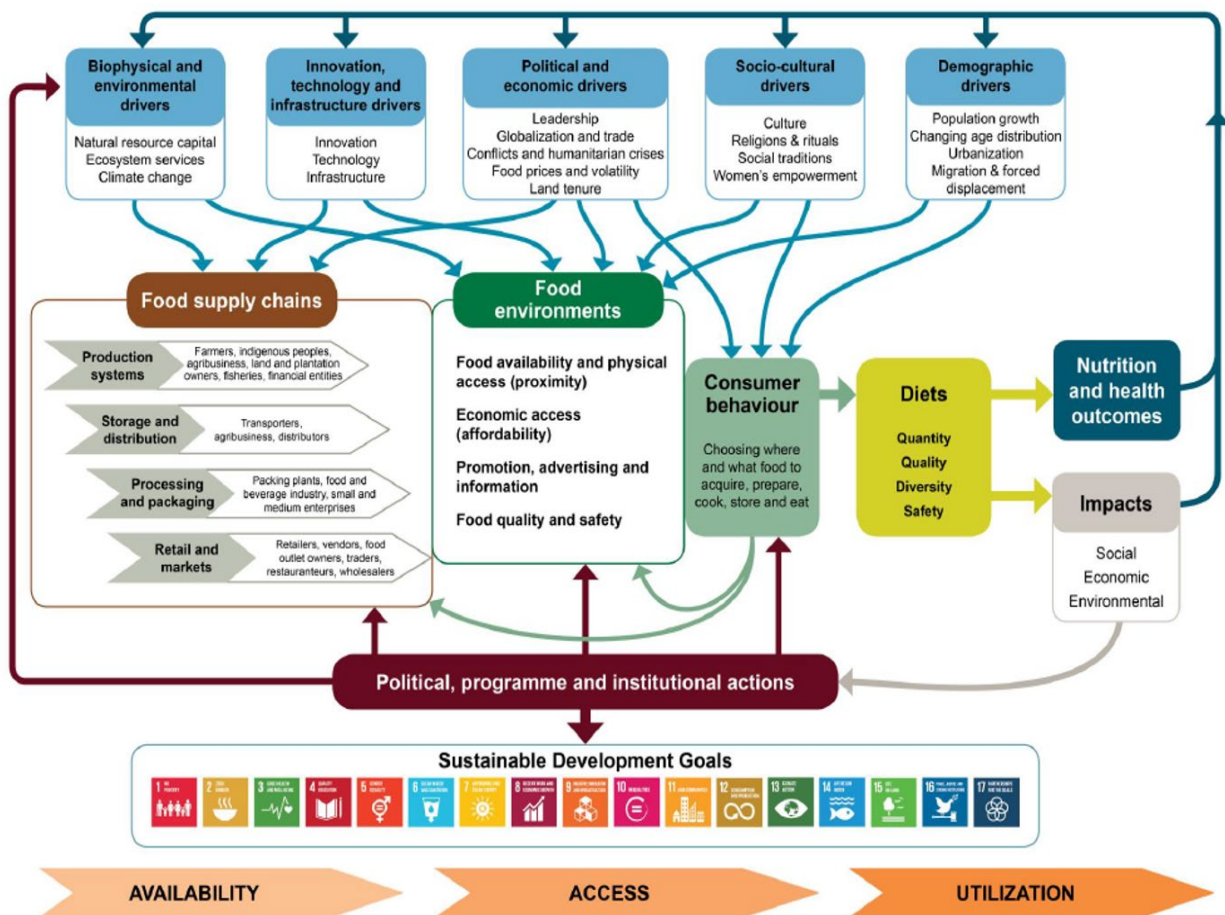


Figure 1. Framework of the High-Level Panel of Experts on Food Systems and Nutrition

Source: HLPE. 2017. Nutrition and Food Systems, Rome. <http://www.fao.org/3/a-i7846e.pdf>

II. DIET QUALITY AS AN ENTRY POINT

Diet quality is pivotal and instrumental to healthy diets and emphasizes adequacy, diversity, moderation, and safety. Adequacy refers to meeting energy, macro, and micronutrient needs. Diversity encompasses accessing diverse foods or food groups (whole grains, fruits, vegetables, fish, meat, nuts and seeds, beans and legumes, milk, eggs, and dietary fiber) that provide the required nutrients, antioxidants, as well as taste and variety to meals. Moderation emphasizes limited consumption or avoidance of unhealthy foods, food components, or nutrients such as red or processed meat, fat (especially saturated fat), cholesterol, sugar, sugar-sweetened beverages, and sodium (Alkerwi, 2014; Herforth , et al., 2014).

While there is no universal ‘diet quality index,’ there is general agreement on what a healthy or high-quality diet should include, i.e. a diversity of foods that are safe and provide levels of energy appropriate to age, sex, disease status, and physical activity as well as essential micronutrients. High-quality diets also need to be safe so they do not cause foodborne disease (GLOPAN, 2016). Food and water containing harmful bacteria, viruses, parasites, or chemical substances constitute unsafe food and are responsible for several diseases, ranging from diarrhoea to cancers.

In Nigeria, multiple nutritional deficiencies exist (**Research Question 1**), and diet diversity is very low. In 2018, only 22.6 percent of children age 6-23 months received an appropriately diverse diet (five food groups or more). Urban infants and young children (29.0 percent) were better off than rural (18.6 percent) and an increase was seen when the education level of the mother and wealth index of the household increased (National Population Commission (NPC) and ICF, 2019). Only 10.6 percent of children age 6-23 months were fed a minimum acceptable diet considering both diversity and frequency of feeding (National Population Commission (NPC) and ICF, 2019). Nationally representative data on diversity of diets among women showed that just 55.6 percent of women age 15 to 49 years in 2018 met the minimum dietary diversity of at least five out of 10 food groups. The same pattern observed in children was also observed among women with urban, more educated and women from richer households having higher dietary

diversity (National Population Commission (NPC) and ICF, 2019). Data on dietary diversity of men is not available (**Research Question 2**).

Consumption of fruits, vegetables and animal source foods is especially low in Nigeria. The 2003 National Food Consumption and Nutrition Survey (Maziya-Dixon, et al., 2004) reported a low percentage of households consuming fruits once or twice per week (17.9 percent), leafy vegetables (12.4 percent) and non-leafy vegetables (16.3 percent). This is confirmed by more recent smaller studies (Chibuikwe, Okaka, & Okoli, 2013; Hart, Azubuikwe, Barimalaa, & Achinewhu, 2005; Adeyemi & Shittu, 2017). The 2018 DHS reported that 36.9 percent of breastfed children age 6-23 months consumed fruits and vegetables rich in vitamin A and 13.5 percent consumed other fruits and vegetables. These numbers were higher in non-breastfed children compared to breast-fed children (57.0 percent versus 25.2 percent, respectively) (National Population Commission (NPC) and ICF, 2019). Fruit and vegetable consumption is region- and season-dependent, and products are eaten fresh since storage possibilities are few and great losses occur due to inadequate preservation and transport (Adegboye, Smith, Anang, & Musa, 2016). Animal source foods were consumed more than one time per week by only 11.8 percent of the population for meat, 6.8 percent for dairy products, and 7.4 percent for fish. Only 27.2 percent of breastfed children age 6-23 months consumed meat, fish, and poultry (grouped together) and 12.7 percent consumed eggs (National Population Commission (NPC) and ICF, 2019).

The contribution of wild foods to the Nigerian diet is considerable, especially fish from small-scale fisheries (Funge-Smith, 2018). Fish caught from streams, rivers, and the ocean provide an important animal-source food for many vulnerable populations in Nigeria, though there is room to increase both production and consumption (Kolding, Van Zwieten, Marttin, Funge-Smith, & Poulain, 2019; Selig, et al., 2018). Additionally, consumption of other wild foods has frequently been reported, not only as a coping strategy in times of food shortage (Frances & Salisu, 2003) but also as a regular part of the diet (Alamu, Amao, Nwokedi, Oke, & Lawal, 2013; Frances & Salisu, 2003). However, consumption of wild foods might be

underreported in food consumption surveys and the actual contribution of wild foods might be larger than reported.

Street foods may also contribute significantly to dietary intake, but recent data on the contribution to diet quality are not available (**Research Question 3**). Street food consumption is thought to be common in Nigeria, especially in urban areas. A study from 1999 shows 63 percent (in weight) of food consumed by urban market women originated from street food (Oguntona & Tella, 1999), and a study among adolescents from 1995 shows that street foods contributed 25 percent of total energy intake (Oguntona & Kanye, 1995).

Knowledge of the extent of consumption of unhealthy dietary components is limited in Nigeria (**Research Question 4**), although anecdotal evidence suggests an increase in intake. No nationally representative data are available, but fat intake above 30 percent of energy intake has been reported (Glew, et al., 2004). Elite, middle class, and younger people are expected to transition from a traditional little or no sugar-added diet to a Western diet, which contains high quantities of sugar and fat (Gourichon, 2013). Sugar consumption has increased in the past 10 years (Gourichon, 2013), but exact quantities consumed are not known. In 2018, 21.8 percent of women reported consuming sugar-sweetened beverages and 15.5 percent consumed sugary foods (National Population Commission (NPC) and ICF, 2019). There are no data on current salt intake levels, and no studies are available that show the sources of salt in the Nigerian diet (Mezue, 2014).

Furthermore, the composition of processed food consumption is changing in Nigeria. Fast food or ultra-processed food intake is increasing in Nigeria. Several studies report on consumption of processed foods, pointing to the need to differentiate consumption by the degree of processing and the locus of consumption. Analysis of Nigerian Living Standard Measurement Study (LSMS) data over five years (2010/2011, 2012/2013, and 2015/16) show a decline of about 6.8 cents per annum in consumption of unprocessed foods, while low-processed foods show the strongest positive growth of 15.4 cents per annum, over the study period (de Braw & Herskowitz, 2020). Highly-processed food is flat. However, splitting between

highly-processed food at home and foods consumed away from home (FCAFH), strong and opposite trends were observed. Over the five years of the study, per capita expenditures on highly-processed foods at home declined by 18 percent, while FCAFH exhibited a nearly identical opposite trend, increasing by 17 percent. The authors also observed a large increase in the consumption of low-processed foods across all income levels and geographical locations. This study finds contrasting annual growth rates between consumption of low-processed foods (15.4 percent increase per annum), highly-processed food consumed at home (18 percent decline per annum), and food consumed away from home (FCAFH) (17 percent increase per annum), adding precision to earlier work conducted by Saweda et al., (2016).

Highly-processed food expenditures, consumed at home, are falling across all areas. By contrast, FCAFH shows considerable regional variation, exhibiting the most dramatic growth in both the urban and rural South. More modest increases are also evident in the urban North (though only marginally statistically significant) whereas there is no discernible trend in the rural North, potentially reflecting limited access to such foods in these areas. Fast food consumption has gradually become part of the lifestyle of Nigerians, especially those in urban centers (Akindutire & Konwea, 2013), where people are reported to be more likely to consume processed foods and foods that have high salt and fat content (Mezue, 2014). Fast foods have been shown to be a major contributor to the nutrient intake of undergraduates in Abeokuta, however, excess energy and the low intake of micronutrients from fast foods place the students at risk of malnutrition (Afolabi, Towobola, Oguntona, & Olayiwola, 2013).

The safety of food is of high concern in Nigeria. Diarrhoeal diseases are responsible for 70 percent of foodborne diseases in the African Region, where non-typhoidal Salmonella, which can be caused by contaminated eggs and poultry, causes many deaths (WHO, 2003). The general state of water and sanitation facilities available to households in all wealth categories in Nigeria is very poor, with consequent health implications (Kuku-Shittu, Mathiassen, Wadhwa, Myles, & Akeem, 2013). In 2011, 45 percent of households did not have access to decent toilets, and 85 percent had no proper means of refuse disposal

(Kuku-Shittu, Mathiassen, Wadhwa, Myles, & Akeem, 2013). Diarrhoea prevalence was high at 12.8 percent among children under age five in the 2018 Demographic and Health Survey (DHS) (National Population Commission (NPC) and ICF, 2019). Urbanisation is thought to put the urban poor at higher food safety risks (GLOPAN, 2016) but there isn't sufficient information on the occurrence of microbial pathogens, foodborne macro parasites and toxins or chemicals in food in Nigeria, nor their impact on health outcomes (**Research Question 5**). One study reported a high content of aflatoxins in commercial weaning foods, hypothesising that exposure of children to aflatoxins may be high in Nigeria (Oluwafemi & Ibeh, 2011). Indeed, laboratory analyses of Nigeria core foods prepared as consumed, with food samples obtained from Lagos and Kano States, have showed considerable pesticide and mycotoxin contamination (Ingenbleek, et al., 2019a; Ingenbleek, et al., 2019b).

To improve healthy eating habits of individuals and populations, the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) recommend developing and implementing country-specific food-based dietary guidelines (FBDGs). Nigeria has national FBDGs, but these guidelines need urgent review and updating as they were based on resources from the 1990s (**Research Question 6**). As diets differ significantly across regions in Nigeria (Ene-Obong, et al., 2013; Ajani S. , 2010), adapting the FBDGs to regions, locations (urban vs rural) and target groups should be considered (**Research Question 7**). The need for appropriate FBDGs for healthy living is recognized in the National Policy on Food and Nutrition and the Agricultural Sector Food Security and Nutrition Strategy 2016–2025.

III. CONSUMER BEHAVIOR AND PURCHASING POWER

3.1. Introduction

Consumer behavior defines when, why, how, what, and where consumers buy or do not buy products. A well-known framework to describe aspects related to consumer behavior is the Motivation, Ability and Opportunity (MAO) model (Olander & Thøgersen, 1995). This model (originally elaborated to analyze how to entice people to protect the environment) assumes that consumers' behavior is determined by an interplay of motivational factors, their ability, and/or their opportunities to change their behavior (Rothschild, 1999). The MAO-model is integrated in this section.

3.2. Motivation

Motivation represents the drivers of an individual's behavior or willingness to change behavior. The motivational factors determining an individual's behavioral incentives are the attitude toward and social norms regarding the behavior. Major factors driving motivation of consumer behavior are thus the cultural and social norms the individual is susceptible to.

3.2.1. Cultural norm, beliefs and taboos

The United Nations Children's Fund (UNICEF) Food-Care-Health conceptual framework that serves as a guide in assessing and analysing causes of malnutrition opines that cultural norms, taboos and beliefs constitute major factors affecting food intake (UNICEF, 2013). Foods avoided based on cultural taboos and religious beliefs have been reported in many communities in Nigeria; and most often apply to pregnant women and children (Oluleke, Ogunwale, Arulogun, & Adelekan, 2016; Ekwochi, et al., 2016; Sholeye, Badejo, & Jeminusi, 2014; Abidoye & Akinpelumi, 1997; Onuorah & Ayo, 2003). These restrictions and avoidances could contribute to inadequate nutrient intake, since foods that are avoided are (mainly animal-sourced) proteins and vitamin-rich foods, such as snails, grass-cutters, eggs, beans, walnuts, cassava (fufu), and plantain (Sholeye, Badejo, & Jeminusi, 2014; Onuorah & Ayo, 2003; Ekwochi, et al., 2016; Maduforo, 2010; The Nation Nigeria Newspaper, 2016). There is no empirical evidence that justifies the avoidances; rather claims can be related to the appearance of foods. For example, snails are avoided because it is

believed that they make babies sluggish and salivate excessively like a snail. Madufuro (2010) observes that pregnant women often hold onto the food taboos handed down from generation to generation. Other cultural beliefs are regional, rather than specific to certain groups. For example, in some areas in Southwestern Nigeria, eating dog meat is restricted, while it is seen as a delicacy in other areas (Fagbuaro, Oso, Edward, & Ogunleye, 2006; Oluleke, Ogunwale, Arulogun, & Adelekan, 2016). Next to cultural beliefs, religious beliefs affect food choice and dietary intake. Eating pig meat is forbidden in Northern Nigeria as well as among the Muslims in Southern Nigeria.

Other motives are related to ideas and perceptions regarding health, mood, weight control, natural content of foods, familiarity, and ethical concerns. Urban Nigerian consumers reported that the motives – health, mood, and familiarity – were most important to them in food purchases (Raaijmakers, Snoek, Maziya-Dixon, & Achterbosch, 2018). Also, the importance attached to these motives was associated with a higher vegetable consumption.

3.2.2. Product characteristics affecting food choices

Food choices are based on consumers' perception and awareness about product attributes such as organoleptic attributes of foods, nutritional and health contents, packaging and labelling. For instance, two studies conducted in Lagos State (Akpoymare, Adeosun, & Ganiyu, 2012; Kesinro & Oyende, 2015) indicated that consumers compare competing products and make purchases based on their perceptions of the strength of several attributes. Interestingly, the perceptions regarding some foods may change over time. This is what happened, for example, to Ofada rice, once considered as “poor man’s food” but now appreciated as a special dish. The recent preference for Ofada rice is perhaps attributable to some improvement to the product (such as removal of stones, better packaging); the perception that it is more nutritious or safer to consume than some imported/foreign rice; and the renewed interest in the need to embrace *traditional foods* (sense of “nationalism”; it is our own rice). More in-depth studies of such cases would reveal how consumers' preference for diet quality in the Nigerian context could change with food

product attributes other than the traditional price and income changes and variation in demographic characteristics (**Research Question 8**).

3.2.3. Aspiration

Aspiration is one of the core determinants of consumer behavior. Aspiration makes consumers act in a manner to achieve their goals (Lant, 1992). Social psychological models incorporate an individual's aspiration as a major factor for action or behavior (Sreejesh, 2015). Aspiration tends to make consumers emulate the consumption pattern of a particular reference class to which they desire to belong (Dholakia & Talukdar, 2004). Aspirations, therefore, influence motivation, and in turn consumer behavior (Truong, 2010). Food satisfaction does not often depend on what an individual actually has as much as it depends on socially shaped aspirations (Vasantha, Vijaylakshmi, & Kiran, 2015). Smeets-Kristkova, Achterbosch, and Kuiper (2019) assert that unlike demographic change which is included in terms of population growth rates, consumers' aspirations are hardly captured in the Nigerian food system and studies. However, it has been identified that an increasing number of households, especially the middle- and higher-incomes classes as well as consumers who use digital media, are giving more attention to a set of aspirational-driven food preferences (Ali, Sanjeev, & Janakiraman, 2010). Nigeria has been identified as one of the countries where consumption of unhealthy foods and soft drinks is relatively low but growing at a fast pace with Westernization aspiration as a key driver (Rockefeller Foundation, 2013).

3.3 Ability

The individual's ability to carry out the intentions is the second component in the MAO model and incorporate both a habit and a knowledge element. Both elements could substantially influence diet quality. Motivation leads to a change in behavior, only if the individual can engage in the behavior change. Increased knowledge about nutritional content of foods and practical skills to prepare foods are considered key elements in inviting consumers to make (more) healthy food choices.

3.3.1. Knowledge

Education seriously affects the quality of people's diets (Cruwys, et al., 2012). An empirical study in Nigeria shows that access to higher formal education, typically above primary school level, had a significant and positive effect on child nutritional outcomes (Fadare, Amare, Mavrotas, Akerele, & Ogunniyi, 2017). In addition, maternal nutrition and health knowledge obtained outside school may substitute for formal education in enhancing nutritional wellbeing, particularly in a population characterized by a low level of, or lack of access to, formal education (Block, 2007; Fadare, Amare, Mavrotas, Akerele, & Ogunniyi, 2017). In a survey of 668 women, 43 percent said they get their nutrition information from the antenatal visit, and 23 percent reported the information was passed down from their families (Byrd et al, unpublished data). Knowledge dissemination about diet quality should therefore receive the attention of nurses, nutritionists, researchers and policy makers as a way of addressing the threats to healthy eating (Arzoaquoi, 2014). To what extent better knowledge of the nutritional content of foods would contribute to consumers buying healthier, more diverse foods, is little researched in Nigeria (**Research Question 9**).

3.3.2. Skills

People may lack skills or habits to exhibit certain health-related behaviors (Olander & ThOgersen, 1995). Interventions aimed at developing those skills can facilitate behavior change through the development of practical skills such as planning for grocery shopping, cooking techniques and recipes, etc. In addition, targeting people's beliefs that they can eat healthily by being able to purchase, cook and eat the right amounts is a way to improve diet-related behavior (Prestwich, et al., 2014). In a recent study by (Raaijmakers, Snoek, Maziya-Dixon, & Achterbosch, 2018) self-efficacy was positively associated with vegetable consumption in urban Nigeria. Similarly, cultural habits related to food preparation have been reported as a limiting factor for nutrient retention in foods, especially vegetables. During the dry season, the dry form of many vegetables (including okra, peppers, onions, tomatoes, and pumpkin) is used. Other vegetables have been reported to be overcooked during the preparation process (Adeyemi & Shittu, 2017).

3.4. Opportunity

Opportunity represents the environmental or contextual mechanisms that enable behavior change. Availability of food and access to food depend largely on the food culture and people's practices among other factors, such as the food environment. Beyond the issue of food availability, access to food, and the preparation process, other factors such as the health care system and environment that supports good hygiene practices must be in place (UNICEF, 2013) to enhance diet quality and good nutrition.

3.4.1. Income/purchasing power

In low- and middle-income countries (LMICs), including Nigeria, economic ability of an individual (in terms of purchasing power) is a crucial determinant of the amount, variety and safety of food consumed/purchased. Purchasing power reflects household income as well as food prices. Households with higher incomes can purchase more and better food at any price, while lower prices will enable households to purchase more and/or better food at the same income level. Higher food budget share may reflect poor economic wellbeing of an individual or household. For example, poor households in Nigeria spend more than 70 percent of total household budget (income) on food, whereas the wealthiest groups spend up to 35 percent of the total household budget on food (World Bank Development Indicators). The U.S. Department of Agriculture (USDA) reports that an average Nigerian spends 56.4 percent of their household income on food – the highest in the world (USDA, 2012). The high budget share of food is due to a combination of low incomes and high food prices, and the Nigerian food system has been described as not providing very affordable food (IFPRI, 2015). National statistics claim that about two-thirds of the rural poor's household expenditures on food is mainly starchy, such as maize, rice and other cereals categories, and tubers and plantain (NBS, 2012). A much more disaggregated analysis indicates that the share of total budget devoted to food varies across different regions/geo-political zones in Nigeria. Households in the North–East and Northwest zones of Nigeria spend approximately 72 percent and 73 percent of total expenditure on food, those in North Central and South-East spend between approximately 66 and 68 percent while the two remaining zones spend less than 60 percent on food (NBS, 2012). Most of the poor consume less varied, monotonous foods that are largely staples with inadequate animal proteins, fruits and vegetables (Akerele

& Shittu, 2015). Household food spending data provide useful insights on the current link between purchasing power and food consumption patterns and could be the basis for predictions on consumer purchasing power and dietary change under various scenarios in the future. Little research has been done in Nigeria on the link between socio-economic features of the population and dietary patterns (**Research Question 10**), except for Akerele and Shittu (2017) and (Dillon, McGee, & Oseni, 2014). The latter study indicates a positive relation between education and diet quality (measured as diet diversity), whereas Akerele and Shittu (2017) point to a positive relation between income and household size on dietary diversity. The authors found mixed effects of food prices on diet quality, with increasing prices of cereals, roots and tubers, fish, meat and pulses having a negative impact on dietary diversity and that of milk exerting a positive effect.

3.4.2. Gender issues

Opportunities for women to participate in food choices and purchases have been hypothesized to affect the quality of household diets. However, evidence for this association is not supported by the limited studies available. Available studies suggest that although women participate in decision making on food expenditures, health, and education, in Nigeria, men are still the main decision makers in these areas (Angel-Urdinola & Wodon, 2010). Also, a study by Aromolaran (2010) showed that a redistribution of income from men to women (enhancing women's financial ability) within the household may not substantially increase food calorie intake among households in South West Nigeria. Previous reports (SPRING, 2014; Sraboni, Malapit, Quisumbing, & Ahmed, 2014) document that the use of women's income to purchase better quality and more quantities of food is consistently an intermediate variable in the pathway from women's empowerment to improved nutrition. Whether intra-household (women-biased) resource allocation, power sharing and decision making may substantially enhance diet quality in Nigeria remains a matter of empirical investigation (**Research Question 11**).

3.4.3. Globalization and foreign influences

Globalization is another important factor that is gradually changing the perspective of people about diets. Globalization manifests in the cross-border interactions of the flow of goods and services, finance, and

international trade. It has cultural, ideological, demographic, and other similar aspects. In Nigeria, there has been slow but steadily increasing access to Western lifestyles as occasioned by education, the availability of cable television, and the internet, thereby changing the mode of awareness creation about different categories of diets and their benefits (Prasad & Prasad, 2007). Nigerians seem to be very sensitive to brands: although open to experimentation, they tend to remain loyal to their favorite brands. Approximately 70 percent indicated they are brand loyal compared to 59 percent reported for Africa as a whole (Fiorini, Hattingh, Maclaren, Russo, & Sun-Basorun, 2013). For the upper-income consumers, brand loyalty is driven by the perceived quality of brands while unwillingness to try new things seems to be responsible for brand loyalty among low-income consumers. Foreign products, generally perceived to be of better quality than products made in Nigeria, are also increasingly being consumed by a growing middle class (Hillbruner & Egan, 2008).

IV. FOOD ENVIRONMENT

4.1. Overview

The food environment represents the “range of foods that can be accessed in the context where people live and can enable or restrict healthy dietary choices” (FAO, 2016). According to the HLPE, food environments are considered healthy when they “enable consumers to make nutritious food choices with the potential to improve diets and reduce the burden of malnutrition” (HLPE, 2017). Therefore, working toward making food environments enablers of healthy food choices offers an untapped opportunity to positively impact diet quality and nutrition (FAO, 2016; Global Panel, 2017).

In Nigeria, the government launched the Agriculture Sector Food Security and Nutrition Strategy 2016-2025 to improve the food environment in the country. The Strategy embodies a set of recommendations on the best way of managing the interface between consumers and food suppliers and is aimed at improving consumer access to diverse and quality diets. The strategy necessitates the active participation of the private sector, civil society and government for its success. Some of the measures included in the Strategy are the increased marketing and promotion of high-quality diets, processing of foods in ways that increase their nutritional value and safety, and nutrition labelling of foods. The Strategy was launched in May 2017 and implementation commenced recently. Also, the physical features of the food environment, i.e. the proximity and hygiene situation of markets, food shops, restaurants, and other food services should be directed toward promoting consumer choice for safe and healthy food. Consumer-oriented rural and urban planning remains underdeveloped.

4.2. Access to Markets

Access to markets and distance from markets are key determinants of diet diversity and levels of consumption. Access to market has been abysmally poor in Nigeria. Markets are characterized with scattered value chains and weak value chain linkages between consumers, processors, and farmers (UNDP, 2013). In spite of some improvement over the years, levels of access to paved roads are grossly insufficient.

Only about 16 percent of the country's roads are paved (Bello-Schünemann & Porter, 2017). In Nigeria, the development of modern grocery retailers remains in its early stages, with food purchases at open informal markets and the smaller traditional food shops dominating. Street foods have become a common phenomenon among semi-urban dwellers and the inhabitants of cities (Okojie & Isah, 2014). Street foods are foods prepared by vendors at home or in designated centers but offered for sale in open or semi-open conditions near the streets. Despite the better taste and relative accessibility and affordability associated with street food, their preparation is fraught with unhygienic practices. Subsequently, consumption of street foods has been associated with public health risks, food poisoning, and other related diseases (Okojie and Isah 2014).

The quality of diets in Nigeria, and some other African countries is also being influenced by emergence of road-side restaurants and street food vending/marketing. The roadside food vending is an age-long practice and has become a viable small and medium scale enterprise along the food chain (Okojie & Isah, 2014). Road-side food vending provides ready-to-eat, relatively cheap meals by sellers in streets and public places for immediate consumption (Fellows & Hilmi, 2011). Urbanisation is one of the major factors responsible for the rapid growth of street foods and road-side vending in many developing worlds (Okojie & Isah, 2014). Some vendors make food available in packs, while others offer it unpackaged. Issues about the quality and safety of food sold by these ubiquitous outlets have always been of great concern. Presence of flies, carbon fumes and dust which settle on foods make them unhygienic for human health (Onyeneho & Hedberg, 2013). In most cases, waste water and garbage are disposed of very close to restaurants and road-side food vending sites, which serves as breeding site for vermin and microbes (Fellows & Hilmi, 2011; Proietti, Frazzoli, & Mantovanni, 2014); thus increasing the risk to consumers of typhoid, dysentery, diarrhea and cholera (FAO, 2007; Nunes, et al., 2010; Rane , 2011).

Availability of a well-maintained and efficient road network is crucial for food systems to deliver healthy diets. With good transportation infrastructure, a larger share of the foods produced can be brought directly

by farmers to urban areas more quickly and at a better quality. Where the transportation system is efficient, fewer losses and less food waste are incurred. Road transportation is the primary means of transportation in Nigeria (Ogwude, 2011), and constitutes about 90 percent while air, rail and water constitute the remaining 10 percent (Amiegbebor & Dickson, 2014). As of 2017, total road network was estimated between 193,000km and 195,000km, where 32,000km were Federal Highways, 31,000km State Highways and 130,000km to 132,000km local government and feeder roads. The total length of paved roads was estimated at a little over 60,000km (World Bank, 2019). Substantial shares of food crops, including grains, vegetables and fruits, get spoiled after harvest because many farmers are unable to readily access markets as a result of lack of access to feeder roads and/or bad roads; which often cause vehicle breakdowns and delayed delivery of food to its destination. It is estimated that as much as 25 percent of fruits, 40 percent of vegetables and about 20 percent of grains are lost after harvest (Matemilola & Elegbede, 2017).

Based on the forgoing, there is need for more in-depth empirical work linking market access for farmers to dietary quality in the Nigerian context (**Research Question 12**).

4.3. Promotion

Advertising can influence food choices and, by extension, diet quality. It is one of the promotional strategies that serve as a major tool in creating product awareness in the mind of a potential user who will eventually make a purchase decision about the products or services (Asemah, Edegoh, & Ojih, 2013; Apejoye, 2013; Uwem, Iniobong, & Inyene, 2015). In Nigeria, advertising is shifting rapidly away from the traditional means of television, radio, newspapers and magazines and toward online/social media (Otugo, Uzegbunam, & Obikezie, 2015; Olotewo, 2016). This shift is most pronounced in online businesses. In Nigeria, the engagement and use of new digital technologies are increasing, thereby encouraging social media marketing. Multinational companies, including the food industry and telecommunications providers as well as small- and medium-scale enterprises (SMEs) such as coffee shops, restaurants, information curators etc., now use social media to reach customers (Ekwueme & Okoro, 2018). Direct messages through email and

text messages to phones are also new ways of product advertisement in the country. Celebrities like film stars and professional athletes have not only been successful in generating huge public attention, but also in increasing sales volume (Zippora & Mberia, 2014). Some former star athletes have been featured in multi-category endorsements of foods in the country. Given that advertising is a veritable marketing strategy used to create awareness and gain favorable responses about products and services, its influence on foods choice and diet quality cannot be overemphasized.

4.4. Food Safety Regulations

Another important factor that affects the food environment and dietary quality relates to legislation and the enforcement of food laws. Inadequate or poorly enforced regulatory standards have been noted as limiting factors to good quality foods (WHO, 2015). Rehabilitation of food systems, inclusive of the agricultural sector, through sound government policies is necessary. Concerns for food safety and compliance to standards have motivated many governments and other interest groups to join forces together, playing regulatory and surveillance roles to ensure that food available for consumption is safe and healthy. With this in view, FAO and other United Nations (UN) organizations have been making efforts to ensure that member countries apply food standards in order to protect consumers. In Nigeria, regulation of food safety is carried out by the Federal Ministries of Health and Agriculture, the Standards Organization of Nigeria (SON), and the National Agency for Food and Drugs Administration and Control (NAFDAC). Like several other LMICs, Nigeria is confronted with the problem of foodborne diseases with their attendant social, economic and health costs (Omotayo & Denloye, 2009). There is a National Policy on Food Safety and an associated implementation strategy launched in 2014 to promote health through control of foodborne diseases, and reduction and final elimination of the risk of diseases related to poor food hygiene.

NAFDAC has several regulations in line with Nigerian Industrial Standards and the Codex Alimentarius Commission's Standards, one of which is mandatory fortification of some food items to prescribed levels. Examples of such regulations include iodization of salts and the fortification of sugar, flour and vegetable

oils with vitamin A. Some other regulations relating to foods include (pre-packaged food) Labelling Regulations 2005, and Pesticide Registration Regulations 2005. Food like bromated bread (from bromate flour) is banned because it has been linked to kidney damage, cancer and nervous system damage. The major reasons for these policies are to ensure that Nigerians have access to good quality foods. However, the extent of enforcement and compliance remains a big challenge as many of the foods are still seen in Nigeria's markets. There has been poor supervision and monitoring by food safety officers, and the enforcement of food hygiene regulation has been weak (Okojie & Isah, 2014). An important question is what the effects will be on food consumption patterns and on the informal open markets (as an important food marketing channel), when policies and enforcement of food hygiene and safety regulations become more stringent (**Research Question 13**).

4.5. Economic Access

Food prices, and their volatility, affect affordability and therefore access to and use of food. Food access is problematic in Nigeria (see Section 3.4.1). While farm households generally benefit from rising farmgate prices, production costs may well increase simultaneously. Food price inflation can hamper consumers' ability to buy enough food for their families. Food price volatility is a concern, in particular for low-income households that spend a large share of their budgets on food under normal market conditions. Uncertainty about prices makes it more difficult for farmers to make sound decisions about how and what to produce. Food prices in Nigeria generally fluctuate often, not only from year to year, but also on a seasonal basis (NMMB, 2017). The price transmission from global and neighboring commodity markets depends on the crop and the region (Hatzenbuehler, Abbott, & Abdoulaye, 2017).

Government interventions in the past have aimed to safeguard food access against the backdrop of high and volatile food prices, for instance via building food stocks or reducing import tariffs. Nigeria is a net importer of a wide range of food and is dependent on world market developments. In their analysis of the impacts of the 2007 and 2008 international price peaks on Nigeria imports and markets, Odozi and Omonona (2012)

point at the limited impact of the Nigerian public grain price stabilization scheme in reducing the volatility of prices due to a lack of financial means and poor management of the responsible government agency. In line with the widespread economic evidence on ineffective market management, Nigeria has reoriented the use of strategic grain reserves toward emergency reserves linked to safety net programs. Research on government options and instruments for effective measures to safeguard access to nutritious food and healthy diets during short-term and protracted food security crises are largely missing in Nigeria (**Research Question 14**).

Seasonality is another factor affecting dietary quality in terms of production (availability) and consumption of (or accessibility to) more varied foods. Seasonality impacts prices as well as price fluctuations. Akerele and Shittu (2015) in one study indicated that the number of foods consumed by an average farm household in the post-harvest season was more than the number of foods produced during post-planting season. However, in a more disaggregated analysis, the same authors found (contrary to expectations) that a greater proportion of households consumed more highly diverse diets during the post-planting (lean) season than in the post-harvest season (Akerele & Shittu, 2017). One of the reasons given to their findings was that households in Nigeria (and many other African countries) sell off some portion (or almost all) of the foods they produce at post-harvest and perhaps save income from sales to meet future food or other consumption needs. The authors caution that findings should be understood with some qualifications, and that other reasons beyond seasonality of agricultural production may be responsible for the observed variation in the seasonal food consumption diversity. Such different outcomes call for further research on households' strategies to cope with both seasonal and annual food price fluctuations (**Research Question 15**).

V. FOOD SUPPLY SYSTEMS IN NIGERIA

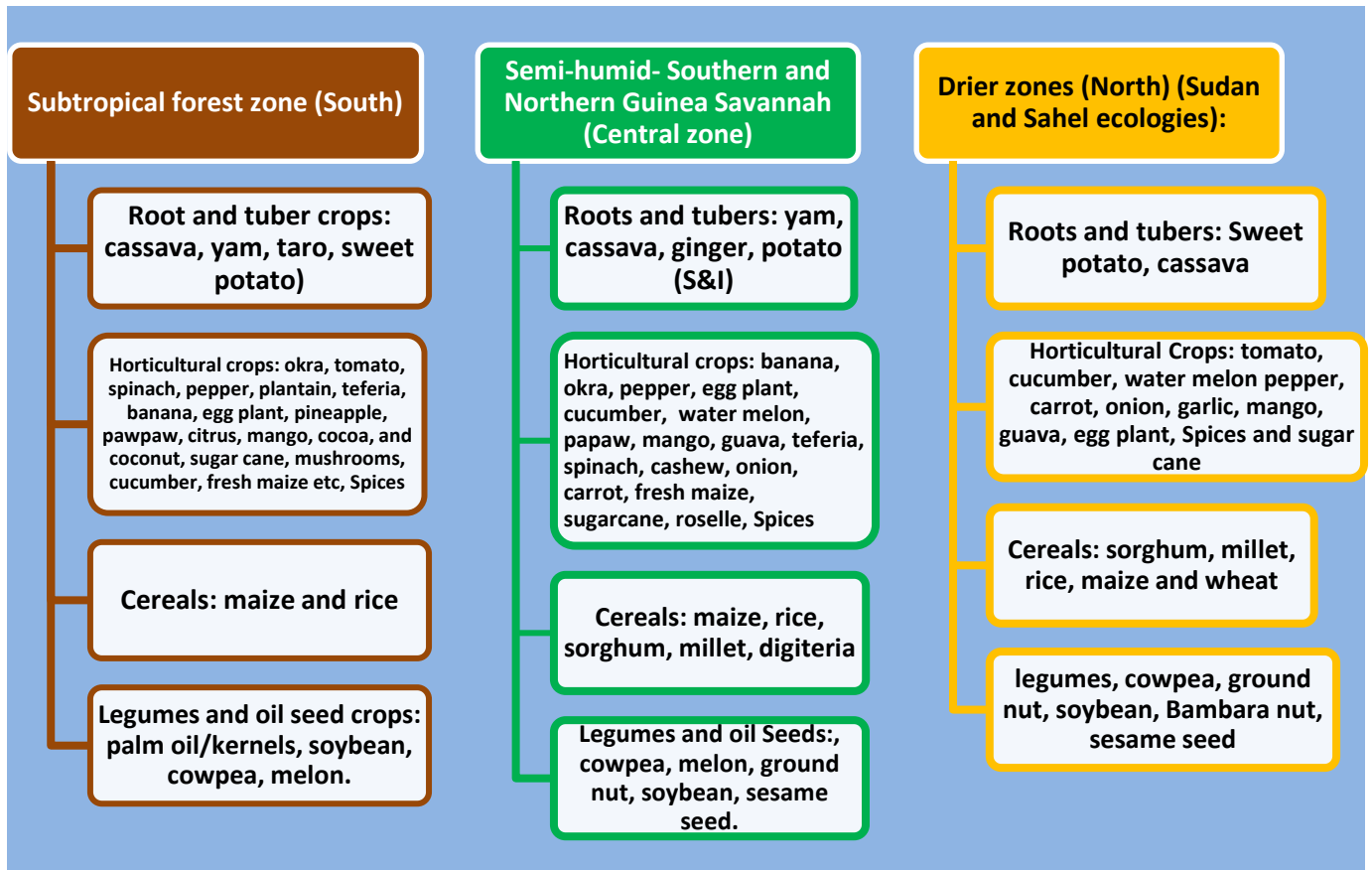
The effect of food supply systems on the food environment and diet quality is determined by the type of food supply system. There are three broad types of food supply systems: traditional, modern, and transitional (Maxwell & Slater, 2013; Reardon, et al., 2019). In the HLPE conceptual framework used to structure this paper, food supply is channelled through four connected subsystems: 1) agricultural production, 2) storage, transport and trade, 3) food transformation, and 4) food retail and distribution. The characteristics of each of these subsystems (described below) are influenced by the type of food system. Overall, Nigeria has been classified as having a transitional food supply system (IFPRI, 2015). The classification of the food system of countries (IFPRI, 2015) was based on seven criteria across five food system features: agricultural productivity, food supply diversity, food accessibility, environmental sustainability, and demographics. The food system in Nigeria was reported to supply a limited range of not very affordable food, using natural resources in an unsustainable manner. Furthermore, while there is room for improvement in agricultural productivity, the food system in some parts of the country is consistent with urbanized systems.

5.1. Agricultural Production Subsystem

Nigeria's food supply systems are a function of several fundamental factors, including available human and material resources, level of technology, government policy, ecological potential, and the skills and preferences of agricultural producers. Nigeria has abundant land resources and diverse ecosystems suitable for growing a broad range of food crops as reflected in Figure 2 (Onyibe, Daudu, & Akpoko, 2005; Blein, et al., 2008; AFD, 2011). The types of foods available at household level are a function of adopted farming systems. Farming systems in Nigeria are highly diversified and differentiated by seasons, ecologies and enterprise combinations. Roots and tubers and a blend of fruit crops, leafy vegetables, poultry and game animals are predominant in the southern regions while the legumes, pulses, cereals and large ruminants are dominant in the northern regions (Figures 2 and 3). Mixed farming that integrates cropping systems with livestock systems across the country are a prime strategy for mitigating climatic shocks and ensuring

household diet diversity. Similarly, farming practices that improve the regular flow of a variety of different foods into the household throughout the seasons enhance food security for its members (Onyibe, Daudu, & Akpoko, 2005; NAERLS and FDAE, 2015).

Figure 2. Ecologies and Crops Produced in Nigeria



Source: Authors

Figure 3. Agro-ecologies and animal protein sources in Nigeria

Agro-ecologies and animal protein sources in Nigeria			
Coastal Mangrove forest zone <ul style="list-style-type: none"> • Fish: Captured and Aquaculture, • Pigs • Snails • Bush meat: alligators, wild birds, squirrels, etc 	Rain forest zone <ul style="list-style-type: none"> • Fish: Aquaculture and captured, imported iced fish • Chicken, turkey, ducks, wild birds • Pigs • Snails • Goats, cow • Bush meats: grass cutters, antelope, alligator, rabbit, birds, etc 	Southern and Northern Savannas <ul style="list-style-type: none"> • Fish: imported iced fish, Aquaculture and captured • Cow, goat and sheep • Chicken, geese, ducks • Rabbit 	Drier zones (Sudan and Sahel Savannas) <ul style="list-style-type: none"> • Sheep and goat • Cow, donkey, Camel • Grasshopper • Geese, chicken • Fish: imported iced fish and captured

Source: Authors

Nigeria has two distinct cropping seasons, wet and dry, each having unique farm enterprise combinations that vary in scale and focus. The two seasons are interlinked, with transient breaks, thus enabling cyclic but highly diversified agricultural systems to thrive and making diverse fresh foods available throughout the year. Across the country, there are green leafy plants such as *Amaranthus* spp., *Teferia* spp., eggplant, *Celosia* spp., *Basella* spp., *Solanum scabrum*, *Solanum americanum*, *Hibiscus sabdariffa* and *Vigna unguiculata*. The leaves of these plants tend to be good sources of protein, phosphorus and iron as well as vitamins A and C and, in some cases, B-group vitamins. A range of fruits, citrus and vegetable crops are cultivated throughout the year, providing a constant supply of micronutrients. This includes yellow and orange perennial fruits (e.g. mango, papaya, and guava), fruit vegetables (e.g. tomato, pumpkin, pawpaw, jackfruit, pineapple, mango squash, gourd and eggplant), some root vegetables (e.g. carrot and yellow/orange-fleshed sweet potato) and dark-green leafy vegetables which are generally moderate to good sources of vitamins A and C.

Fish is an important source of micronutrients, essential fatty acids, and protein. Fish species produced in Nigeria and those imported for consumption vary considerably in composition as well as in size and appearance. Captured fresh water and aquaculture fisheries remain popular in Nigeria, especially in the mangrove forest and rain forest ecologies. Marine fish species are consumed mostly along the coast and in cities. It was estimated that 21 percent of the animal protein consumed in Africa (excluding South Africa) came from fish and fishery products in 1990; this figure had remained stable since 1970 (FAO, 1992) and has progressively risen in Nigeria since 2008 (NAERLS and FDAE, 2015). Fisheries can be found along Nigeria's 850 km of coastline and in inland waters and the Lake Chad Basin, while fish farming (aquaculture) is an expanding activity.

Nigeria's food production remains largely subsistence, depending mostly on family and/or a few hired laborers, with an average farmer cultivating less than 3 ha (Spencer, 2002; Lipton, 2005; Poulton, Dorward, & Kydd, 2005; Sanusi, 2010; ANAP, 2005). Credit markets are largely outside of the reach of farmers, which constrains their use of modern crop inputs: an estimated 3 percent of Nigerian farmers have used any form of credit to buy fertilizer, pesticide or seed (Adjognon, Liverpool-Tasie, & Reardon, 2017). Similarly, animal production is practiced as an extensive free-range system in which pastoralists move with their herds to seek new pastures by following the seasonal rains. Cultivation practices are becoming more intensive following reductions in fallow periods in most cases where crop rotation is practiced.

The country's endowments include large expanses of arable land surface and subsurface and ground water resources. Nigeria has about 70 million ha of cultivable land, of which only an estimated 40 percent is regularly under cultivation (FMANR, 1997), with 2.333 million ha potentially irrigable, although only 25 percent is irrigated annually (FAO, 2014). The country therefore relies heavily on rainfed agriculture to produce its various food crops. Presently, Nigeria is the leading producer of cassava, yam, and taro (cocoyam), and the second largest producer of sweet potato in the world (FAO, 2014). The crop subsector remains dominant, accounting for as much as 36 percent of national agricultural outputs; while the livestock

and fishing subsectors account for 2.6 percent and 1.37 percent, respectively (Funge-Smith, 2018) (Ukeje, 2007; Essien, Alonge, Etop, & Adinya, 2008).

Assessment of various agricultural programs and policies by many authors suggests poor performance by the agricultural sector. Agricultural outputs remain relatively low despite growth in domestic demand for food and food products. The fundamentals for increased outputs are weak, leading to lack of access to food, malnutrition, and a significant shift to massive food imports to augment deficits in food supply. Poor development of commodity value chains and weak market information service (MIS) are partly responsible for poor access to food. These developments necessitate appropriate interventions to provide strong leverage for building an efficient food system to ensure healthy diets for Nigerians (Igwe, 2008).

Generally, there are five main pathways through which agriculture can influence nutrition at the household level: 1) own consumption, 2) income for food, 3) income for health, 4) food prices and 5) women's empowerment (Ruel, Alderman, & Maternal and Child Nutrition Study Group, 2013). To date, linkages between agricultural production and nutrition have been little researched in the Nigerian context (**Research Question 16**), with the most extensive study by Dillion et al. (2014). Their findings suggest statistically significant yet small positive effects of both agricultural revenues and (on-farm) crop production diversity on dietary diversity: a 10 percent increase in agricultural revenues or crop diversity results in a 1.8 percent or 2.4 percent increase in dietary diversity, respectively. Moreover, policy interventions targeted at improving nutrition of agricultural households should be broader than agricultural income expansion alone (e.g., combined with better health and education outcomes). Nigeria's agriculture potential connotes great opportunities upon which sustainable and vibrant food systems for healthier diets could be leveraged (Gomatee, Waseem, & Ashraf, 2013; Onyibe, 2019). A further research question is to investigate how farmers could be tempted to produce foods not normally consumed in local diets that meet the macro- and micronutrient needs of the population (**Research Question 17**).

Empirical evidence on agriculture's contribution to nutrition and how this contribution can be enhanced would also help to effectively implement nutrition-sensitive agriculture (NSA) policy measures in Nigeria. In the country's Agricultural Promotion Policy, introduced in 2016, NSA is one of the guiding principles (FMARD, 2016). While the government program emphasizes improving crop productivity and export competitiveness, it combines measures targeted at the primary agricultural sector to enhance the availability of safe and nutritious food at affordable prices (e.g. promote proper use of agrochemicals, improve storage facilities and encourage bio-fortification of food); with programs to raise awareness about and generate demand for nutritious foods (e.g. promotions on TV and social media, school feeding programs, etc.). The Malabo Montpellier panel report (2017) provides some insights on the impacts policies have had on the country's undernutrition status, pointing at positive trends in reducing malnutrition levels, highlighting large-scale biofortification programs of staple crops (such as maize and cassava) with vitamin A. However, the report also indicates that the double burden of malnutrition is rapidly becoming a challenge and calls for scaling up of interventions and further improvement of the nutritious quality of food supplied.

In order to increase policy effectiveness, i.e. addressing all forms of malnutrition, thorough impact evaluation studies on Nigeria's NSA policy instruments are necessary, in particular those that examine nutrition outcomes per target group, with special attention to women and young children (**Research Question 18**).

5.2. Storage, transport and trade subsystem

Inadequate storage facilities for agricultural commodities result in huge post-harvest losses of farm produce, estimated at 60 percent of perishable crops (FMARD, 2016).¹ Moreover, with few options to store produce after harvest, farmers are forced to sell when supply is abundant and prices are low. Subsequently, off-season products are unavailable or expensive, negatively affecting food and nutrition security.

¹ The measurement of post-harvest losses varies strongly

In 2014, the government introduced the electronic warehouse receipt system to facilitate storage of agricultural products. It is particularly useful in the storage of grains. Farmers and traders are able to store products in certified warehouses, and warehouse receipts are eligible as collateral and can be used to access finance from banks. By 2016, the scheme had engaged 60,000 farmers across eight states (PwC, 2017). The government is aiming to expand storage capacities at the national, regional and household level (FMARD, 2016). A solid analysis of the capacity and quality needs of storage facilities, best practices on financing and operating storage services, and how these facilities are connected to local and regional markets will support the process of building safe and effective storage and related logistics support infrastructure **(Research question 19)**.

In addition to the lack of storage facilities, inadequate infrastructure, such as power supply and transportation facilities and networks, hampers the country's agricultural potential (Olukunle, 2013; Staatz & Hollinger, 2016; FMARD, 2016) **(Research question 20)**. The strongest growth in demand for food will continue to come from urban areas. Therefore, investments in transport and marketing infrastructure to improve market access will be critical to allow farmers to capture a large share of this growing demand **(Research question 21)**. Research could guide such investments, showing the paybacks of investing in (hard and soft)² infrastructure through reduced transport costs and enhanced rural-urban linkages to the benefit of urban and rural citizens' nutritional status (through increased incomes as a result of better market access). Understanding how new infrastructure investments affect food transport and distance travelled, and how this influences the food environment, is important to leverage the benefits of new infrastructure to work for healthier diets **(Research question 22)**.

² Soft infrastructure relates to institutions and regulations. Examples include reforming rules restricting competition in the trucking industry that drive up transport costs, improving systems of contracting and contract enforcement among actors at all levels in the food system and designing and implementing grades and standard that provide incentives to producers to invest in upgrading product quality (Staatz & Hollinger, 2016). Improving market information to identify domestic and external opportunities is another one.

Regarding subnational trade, food is mostly consumed in the region where it is produced. This is related to the fact that around 80 percent of farmers are smallholders, producing mainly for subsistence, while surpluses are sold at local open markets and/or to processors near production plots. Subsequently, value chains are generally relatively short, except for some export crops like cocoa and sesame seed. Currently, smallholder farmers (accounting for around 90 percent of the agricultural production), locally operating traders, and small groceries dominate Nigeria's food distribution system. Linkages between smallholders on the one hand and traders and processors on the other are rather loose, with little use of contracts. Examples of interventions enhancing market linkages by contract-farming are the International Fund for Agricultural Development (IFAD)-assisted Value Chain Development Programme³, linking rice farmers with an international rice milling company and cassava producers with processors. Wholesale food markets are few in number, while the country has regional collection points for a number of commodities that are traded intra-regionally (also imports/exports) and for which prices are monitored and made public (NMMB, 2017). The Abuja Securities and Commodities Exchange (ACSE) is the only exchange in the country involved in trading agricultural commodities such as maize, sorghum and millets. Marketing institutions (e.g. market information and quality and food safety standards) are weak.

In terms of international trade, data shows that Nigeria is a huge net-importer of basic food items, such as wheat, rice and maize, and also for protein-rich products like soybeans, fish and dairy. These are all products for which Nigeria's self-sufficiency is rather low (see Table 1). In terms of value, 2016 imports amounted to US\$5.2 billion. Exports were valued at around US\$770 million. Cocoa beans (and butter) is the main export crop in terms of value, followed by manufactured tobacco and sesame seeds.

³ <http://vcdpnigeria.org/?p=179>

Table 1. Gaps in Demand and Supply of Major Food Products in Nigeria (2016 Estimate)

	Self-sufficiency rate (%)	Production (million ton)	Local demand (million ton)
Rice	36.5	2.3	6.3
Wheat	1.3	0.06	4.7
Maize/Corn	93.3	7.0	7.5
Soybeans	80.0	0.6	0.75
Fish	29.6	0.8	2.7
Tomato	36.4	0.8	2.2
Milk/Dairy	30.0	0.6	2.0
Yams	94.9	37	39
Oil Palm	56.3	4.5	8.0
Sorghum	88.6	6.2	7.0

Source: The Agriculture Promotion Policy (2016 -2020)

Over the last two decades, Nigeria’s food imports show a rather rapid increase, with a peak in 2011 due to huge wheat imports. Wheat remains Nigeria’s most important import product over time. Also, the share of imports of (semi-) processed food products tends to increase compared to unprocessed agricultural commodities. Particularly since the early 2000s, there has been an acceleration in the rise of the unit value of imports, which corresponds to an increasing importance of higher-value food in the food import bill.

Nigeria employs tariffs, other levies and taxes, and quotas on imports of many food products. The aim of these import measures is to support farmers to increase domestic production. However, these policies have been shown to be minimally effective as food commodities are traded informally and unregistered and the country’s land borders are particularly porous in the light of smuggling and corruption (Torres & Seters, 2016).

5.3. Food transformation subsystem

The food transformation subsystem transforms or processes agricultural products into more marketable, easily accessible, more storable food products for ease of consumer consumption (GLOPAN, 2016). The traditional system uses technologies that require a lot of labor but little capital, with a fragmented structure, and actors who operate without formal standards. Postharvest handling of food is minimal, the diet is

heavily influenced by seasonality, and undernutrition is prevalent. In transitional systems, technologies are a mix of capital-intensive and labor-intensive, and though quality and food safety standards are evolving, the structure is still fragmented. Modern systems use capital-intensive technologies, are consolidated, and have high quality and food safety standards. Processed foods, including fortified products, are available year-round and undernutrition is low (Gomez & Ricketts, 2013; Reardon, et al., 2019). Processed foods can be divided into four categories based on the degree of processing: 1) unprocessed/minimally processed, 2) basic processed, 3) moderately processed, and 4) highly/ultra-processed (Poti, Mendez, Ng, & Popkin, 2015). Table 2 summarizes these four categories and provides examples of processes relevant and foods belonging to each category. Generally, highly-processed foods are reported to have higher sodium, sugar, and saturated fat content than less-processed foods (Poti, Mendez, Ng, & Popkin, 2015). The type of food transformation subsystem influences the degree of processing of food products and creates challenges but also opportunities for improved diet quality and nutrition (Gomez & Ricketts, 2013). The extent to which the food transformation subsystem will influence diet quality in a particular context depends on the allocation of investments across the degrees of processing, the extent and type of food advertising and promotion, as well as the increased development/coverage of nutrient-dense food products (Gomez & Ricketts, 2013; GLOPAN, 2016).

Table 2. Description of the Categories of Processed Foods

Category	Description	Examples of Processes Used	Examples of Food Products
Unprocessed/minimally processed	Foods have single ingredients and any processing does not change basic properties of the food from its unprocessed form	Cleaning, drying, pasteurization, chilling	Fresh fruits and vegetables, eggs, milk, skimmed milk, brown rice, honey
Basic processed	Foods that remain single foods after processing. Foods are processed to achieve either a) basic ingredients: components isolated from unprocessed form or b) basic preservation	a) Milling, extraction, pressing, refining b) Canning, fermentation	a) Whole-grain flour, oil, sugar, unsalted butter b) Fruit juice concentrate, canned vegetables, white rice, plain yoghurt, powdered milk,
Moderately processed	a) Basic processed foods with flavour additives (salt, fat, sweeteners, or flavouring) included b) Grain products that have been moderately processed	Similar to basic processed	a) Vegetables canned with salt, fruits canned in syrup, salted nuts, jam b) Whole-grain bread, whole grain breakfast cereal with no sugar or fat added
Highly/ultra-processed	Foods have multiple ingredients. Agricultural produce involved in processing are not recognizable	Extrusion, moulding, reshaping	Mayonnaise, margarine, ketchup, chocolate, sausage, instant noodles, breakfast cereal with refined grains,

Source: Poti et al., 2015; FAO, 2015

Reflecting Nigeria's transitional food system, food processing at the community level, especially in rural areas, appears to occur primarily for food preservation. Processing typically involves drying, fermentation, milling, smoking, and other minimal/basic processes, and is done using labor-intensive technologies. Industrial processing by SMEs is also done using simple, labor-intensive technologies (Adeyeba, 2014; Uzoejinwa, et al., 2016). There is, however, an increasing number of large food processing companies,

centered in urban areas, which use capital-intensive technologies (Uzoejinwa, et al., 2016). As a result, some Nigerians have seasonally-constrained diets while others have year-round access to a range of processed foods (**Research question 23**).

Indeed, there is an increasing demand for industrially processed foods in Nigeria, with sales of around US\$20 billion of processed foods in 2012 and a projected growth of 25 percent in the food processing sector in 2013 (Nzeka, Nigeria food processing ingredients market, 2013). The demand is largely met through imports, because of an underdeveloped domestic food processing sector (Nzeka, 2011; Nzeka, 2013). Costs of domestic food processing are noncompetitively high as a result of inadequate infrastructure and the need to import processing inputs. However, domestic processors are progressively developing and improving on products. Against the background of reducing its import dependency, the government promotes policies encouraging crowding in private investments in food processing and marketing (FMARD, 2016). Food processors generally import bulk and intermediate inputs and then undertake additional processing into final products. SMEs dominate the food processing sector, but there are several large indigenous and multinational companies. Overall, 90 percent of the total sector output is supplied by less than 150 companies (Nzeka, 2013). Wheat flour, poultry and meat, and bakery and confectionary industries dominated the sector in 2012, but there was an increasing focus on biscuit, fruit juice, and pasta. In 2012, the top food processing products were flour (19 percent of sector total); vegetable oil/fat (16 percent); alcoholic beverages, including beer (15 percent); non-alcoholic beverages, including fruit juice and soda (14 percent); and bread/snacks (7 percent). The products with the highest annual average growth rate in 2012 were snacks (20 percent growth rate); confectionery (19 percent); breakfast beverages like tea, coffee, and cocoa drinks (15 percent); poultry meat (10 percent); and wheat flour and ice cream with about 9 percent growth rate each (Nzeka, 2013).

The top five food processing companies in Nigeria – Indofood, Royal Friesland, Promasidor, Dangote, and Flour Mills – accounted for 23 percent of the total sector revenue in 2009 (UNDP, 2012). A visit to the

website of each of these five companies and other important food processing companies (UNDP, 2012; Nzeka, 2013) showed products that are reflective of the entire food processing sector as earlier described. The most reoccurring products were flour, pasta, instant noodles, milk, yoghurt, fruit juice, and snacks. While some of the products, like flour, pasta, and some milk, yoghurt, and fruit juice brands, were only basically processed, the majority appeared to be ultra-processed. There were quite a number of milk, yoghurt, and juice brands to which other ingredients such as coloring had been added. Instant noodles and snacks were all ultra-processed. There is no Nigerian food consumption survey data to identify contribution of each processed food category to diet and nutrient intakes. It was also not possible to quantify the investments in each of the various products. However, Nzeka (2013) reported that, by 2012, Coca-Cola had invested more than US\$200 million in food processing, including fruit juice processing in Nigeria; Olam International spent US\$66.5 million in acquiring a dairy firm and US\$167 million in acquiring a confectioneries company; and Flour Mills planned to invest US\$600 million over five years.

Although flour, oil, and sugar have mandatory fortification requirements in Nigeria, and many processed foods are voluntarily fortified, investments in nutrient-dense processed foods are still quite inadequate (Robinson, Akinyele, Humphrey, & Henson, 2014). The compliance with standards of mandatorily fortified foods has remained consistently poor (Ogunmoyela, Adekoyeni, Aminu, & Umunna, 2013; Aaron, et al., 2017). In fact, food vehicles that are expected to be mandatorily fortified are only considered fortifiable if they are industrially processed by large enterprises, and these large enterprises have poor compliance with expected levels of micronutrients in fortified foods. Food vehicles processed by the SMEs that dominate the Nigerian system are not considered fortifiable because the fragmented structure makes fortification technically, operationally, financially, and logistically unfeasible (Aaron, et al., 2017). There is little regulation of voluntarily fortified foods, so the level of compliance of these products with their touted nutrient content is unknown (Robinson, Akinyele, Humphrey, & Henson, 2014). In addition to challenges with compliance, there are different perceptions about the real or perceived price premiums that fortified foods command (Robinson et al., 2014) and coverage of actually fortified foods may not be even across the

various food segments (Aaron, et al., 2017). For voluntarily fortified foods and other nutrient-dense products, the physical (distribution) and social (promotion) costs of reaching the poor may be prohibitive as final prices will be unaffordable for the poor (Nwuneli, Robinson, Humphrey, & Henson, 2014). There are recent efforts to better understand the business case for food fortification in Nigeria (TechnoServe, 2019). Key challenges facing the food transformation subsystem which limit the provision of nutrient-dense foods and improvement of diet quality include: inadequate nutrition knowledge and awareness among the populace; little to no mechanisms that allow consumers to recognize that a processed food is nutrient-dense; high production costs as a result of inefficiencies in the agricultural production subsystem; high distribution costs, especially for reaching the most vulnerable; and ineffective institutions with inconsistent policies and ambiguous regulations (Robinson, Akinyele, Humphrey, & Henson, 2014).

Based on an analysis of LSMS data, Liverpool-Tasie et al (2016) observe rapidly transforming diets in urban and rural areas in Nigeria, including an increasing reliance on food markets for purchases of food. This shift in consumption of purchased foods would increase opportunities for the food processing sector and non-farm employment opportunities as well, particularly for women who traditionally spend much time preparing food at home. Still, the functioning of agricultural value chains has been largely uninvestigated in Nigeria. Studies on the rice (Michael & Masias, 2016), poultry (Liverpool-Tasie, Adjognon, & Reardon, 2016), dairy and cocoa (PwC, 2017) value chains largely focus on efficiency and economic returns among value chain actors, identifying bottlenecks for improvement of the respective chains' economic performance, yet do not address the potential of value chains to enhance nutrition through interventions. In order to assess the effectiveness of post-farm agri-food value chains at improving the nutrition intake of vulnerable groups, Maestre et al. (2017) propose an analytical framework integrating the value chain concepts with agriculture and nutrition, and identify key outcomes and requirements for value chains to be successful at delivering substantive and sustained consumption of nutrient-dense foods to poor households. The conceptual framework has informed a series of 10 case studies in South Asia to identify the challenges and successful strategies in agri-food value chains contributing to reducing under nutrition. It may be

worthwhile to consider the application of this framework in the Nigerian context (**Research question 24**).

From a diet perspective, it is critical to investigate if and how new investments in agro-processing can add nutritional value, in terms of food composition, safety, acceptability, and a diversity of food products, along the value chain, and how potential trade-offs of processing, e.g. nutrient loss, added amounts of unhealthy components, contamination from processing equipment (e.g. lead), can be avoided. It is also important to evaluate the role of relevant government policies in promoting the food industry to supply nutritious foods (**Research question 25**). For instance, Nigeria has a national food safety policy, with food safety legislation and institutions in place (Omojokun, 2013), yet application of regulations and compliance with standards by food processing and service industry is hampered by poor enforcement (also related to the large informal sector) and the industry's limited means to invest in food safety standards due to the sector's fragmented structure.

5.4. Food retail and provision subsystem

Well-functioning food markets are important for improving diet quality. The food retail structure in Nigeria is highly fragmented, with traditional open markets remaining the major food distribution channels, accounting for two-thirds of overall food retailing (USDA, 2011). Both rural and urban consumers depend on local informal markets, as well as elaborate formal markets, such as grocery and supermarkets. When markets, especially rural ones, are well developed and easily accessible (e.g. only small fees for permits), many farmers can bring their products to markets. This increases supply and availability of foods both in quantity and variety and diversity for consumers. Nigeria's retail food sector is made up of supermarkets, convenience stores/small groceries, and traditional, open-air markets making up 1.0, 34 and 65 percent of the total retail food sales, respectively. Most retailers purchase more than 80 percent of their stock of consumer-oriented foods from importers and wholesalers located in traditional open markets.

The number of modern grocery retailers in the form of super- and hypermarkets continues to grow with several foreign chains active in the country, but in terms of market share, modern grocery is still rather low

(Euromonitor, 2016). As the middle class grows, the role of the formal food market, including supermarkets, is expected to become much more significant, with subsequent important consequences for the supply chain structure. Moreover, Nigeria's business environment is now creating customers who seek more convenience-type foods such as potato chips, tortilla chips, cereal snacks, pretzels, popcorn and various other snacks and fast foods, which has resulted in an increase in boutique hotels, restaurants, and shopping malls in main cities across the country (GAIN, 2013).

Urban patterns of food choice are noticeably different from rural patterns, and include reduced consumption of traditional staples, more animal and dairy products, more processed food, and a greater proportion of food consumed outside of home. These patterns have far-reaching impacts on food systems and consumption in rural areas as well. Ready-to-eat fast food consumption is already an established public dietary habit in urban areas, including cities such as Lagos, Ibadan, Awka, Onitsha, Asaba, Port Harcourt and Abuja. Fast food business and consumption is prevalent because of factors including the fast pace of life, long hours of work, women's employment outside the home, the youthful population, increased mobility, and diversity of available foods. (Olutayo & Akanle, 2009; Arulogun & Owolabi, 2011; Olootu & Awoseila, 2011; Salami & Ajobo, 2012; Olise, Okoli, & Ekeke, 2015).

At the same time, two case studies (Nwuneli, Robinson, Humphrey, & Henson, 2014; Pittore & Reed, 2016) have revealed a tension between producing nutrient-dense foods and retailing these products to poor populations. Several constraints, such as high distributional costs, building demand, and signalling to consumers that products are of high nutritional quality, made it difficult for mid-size businesses to build commercially sustainable models around nutrient-rich foods for the poor. Businesses in the case studies, however, had some success by working with nonprofit donor-funded organizations who distributed products to vulnerable groups free of cost. Nevertheless, chronic undernutrition is so widespread in the country that nonprofit distribution will never be able to cover all those affected. A fundamental question is to determine (market and regulatory) conditions and requirements under which companies can establish

profitable business models to provide nutrient-rich food to those who need it the most, knowing that in general these are the poorest of the poor. Indeed, within the model of multiple retail outlets in Nigeria, 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 26**).

VI. DRIVERS OF FOOD SYSTEM CHANGE IN NIGERIA

6.1. Introduction

Nigeria is one of the most dynamic economies in Africa. Strong GDP growth, high fertility rates suggesting an unfinished demographic revolution, and urbanization trends place tremendous pressure on natural resources and the food systems dependent on them. Understanding the impact of these “mega trends” on nutrition and food security in the country is therefore highly relevant both for decision makers in the private sector and in public administration (GLOPAN, 2016; van Dijk & Meijerink, 2014). In the literature on drivers of food systems, there is often little attention for changes that originate “from within.” However, innovation in production, resource use efficiency, organization of value chains, distribution and marketing are major sources of dynamics in food. The ways entrepreneurs, regulators and consumers respond to external drivers, and the interplay between their behavior, is what makes the food system complex to understand. A useful distinction can therefore be made between the indirect and direct drivers in the food system. This classification follows a governance perspective on drivers: it separates those that can be influenced by food system actors (direct drivers) from those that cannot (indirect drivers) (Zurek, et al., 2016). In the food systems framework presented in Section 1, indirect drivers appear as the key factors driving changes in the food system. Such drivers are commonly grouped into the following categories: biophysical and environmental; demographic; economic; technological; sociocultural; and political (GLOPAN, 2016; van Dijk & Meijerink, 2014). This section focuses on the indirect drivers of the food systems in Nigeria.

6.2. Indirect drivers of Nigeria’s food systems

6.2.1. Biophysical and environmental drivers

The Nigerian population is an estimated 180 million. The interactions among these people are expected to have great effects on the landscape, including urbanization, deforestation, desertification, overpopulation, and all kinds of pollution. Tradeoffs on land use demand careful consideration; for example clearing the forest to grow agricultural products may reduce fish consumption (Lo, Narulita , & Ickowitz, 2019). In

terms of land cover, agriculture in Nigeria is approaching its limit: more than 90 percent of available agricultural land is occupied, that is, of the total 79 million ha of available agricultural land, 70 million ha are being cultivated. Of this, about 40 million ha are arable land and the rest are pastures and other agricultural land (as per data from the IMAGE Database). Extensive use of land for pasture competes with expanded cropping or other land uses such as urban expansion. These challenges have both negative and positive effects on the natural environment and are expected to contribute to shaping food system transformation. Effects could even be more adverse when consideration is given to emerging climate change and related variability in water shortage, seasonality, and unpredictability, as well as land degradation with related soil infertility and loss of biodiversity (**Research question 27**). A food systems approach aimed at resilience and environmental sustainability can reduce the effects of these environmental menaces, thereby offering opportunities for effective adaptation and mitigation (**Research question 28**).

6.2.2. Demographic drivers

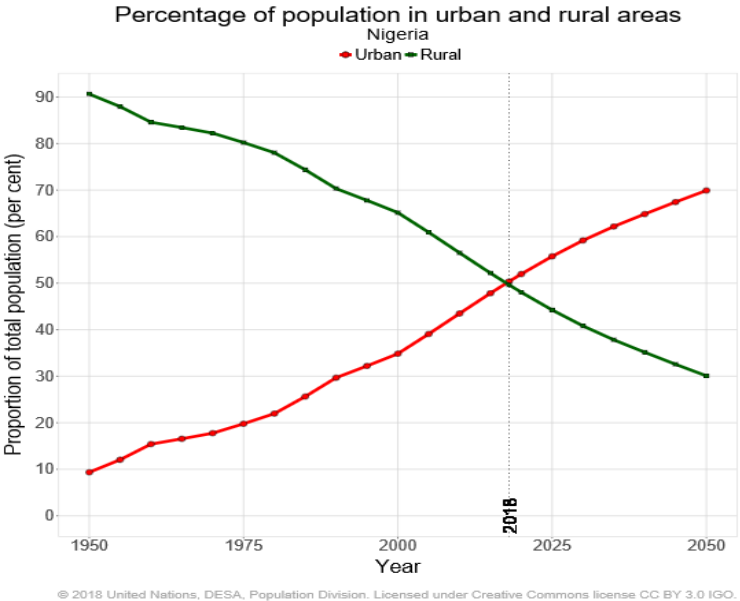
Most of the recent increases in global population can be attributed to a small number of countries, including Nigeria. From 2017 to 2050, it is expected that half of the world's population growth will be concentrated in just nine countries: India, Nigeria, Democratic Republic of the Congo, Pakistan, Ethiopia, the United Republic of Tanzania, the United States of America, Uganda and Indonesia – ordered by their expected contribution to total growth (United Nations, 2017). Nigeria, with a population of about 180 million, is currently the seventh largest country in the world, and is growing the most rapidly. The population is projected to surpass that of the United States shortly before 2050, at which point it would become the third-largest country in the world. The demographic profile shows the number of men and women are split almost equally, with the male population being slightly larger than the female. The population is largely youthful, with a median age of 17.9 years. Children under 15 years of age represent 40.9 percent of the population, while people aged 65 and over account for 3.1 percent. More than half the population are of working age. The age composition provides specific challenges to the food system, which must increasingly cater to young consumers with their attendant nutritional needs and aspirations. It also creates opportunities: with

many young people, targeting relatively few mothers or caretakers and schools has a strong leverage on younger generations.

Nigeria’s population is outgrowing its food system, and the challenge to face is how Nigeria will feed and nourish its teeming population in a sustainable manner, given the various variables in the complexity of local and global food systems. At the same time, the uncurbed population growth will also exert its own effects on the food systems.

Following on the heels of the dramatic population growth is rapidly increasing urbanization in recent decades. In 1991, one in three Nigerians was an urban dweller, compared to 40 years earlier when it was just one in 10. The proportion of urban to rural dwellers in Nigeria was about equal in 2018, with the urban population expected to be larger than the rural by 2025 (Figure 4) (United Nations, 2018).

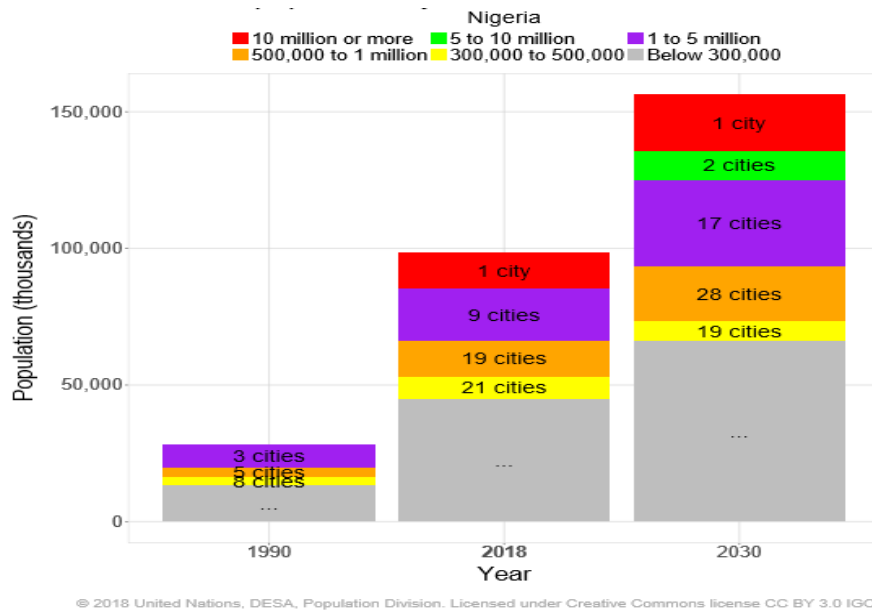
Figure 4. Percentage of population in urban and rural areas of Nigeria



Source: United Nations, DESA, Population Division (2018)

Although other African countries are undergoing urbanization, the situation in Nigeria shows some important differences. While many countries have just two or three major cities after their country’s capital, Nigeria has numerous cities of major size and importance, including some that are larger than most other national capitals in Africa. Lagos has a population of more than 10 million people, while nine other cities have between 1 and 5 million people each (Figure 5).

Figure 5. Urban population by size class of urban settlement in Nigeria



© 2018 United Nations, DESA, Population Division. Licensed under Creative Commons license CC BY 3.0 IGO.

Source: United Nations, DESA, Population Division (2018)

The urbanization process has had a fundamental impact on Nigeria’s food systems. Urban development affects average dietary patterns, leads to longer and more complex supply chains, and alters the linkages between cities and agricultural production regions (**Research question 29**). Rapid urbanization is expected to contribute to changing people’s perspectives and attitudes about food. This could change the ways people shop, including what, how, and where they buy. Urban living by its very nature impacts resource use, the environment (including hygiene and generation of food waste), and infrastructure and facilities. Additionally, it may bring positive changes in education, income, and quality of life. Although cities serve

as hubs of concentrated population and activity, they also have effects on the rural space, as rural and urban areas become much more closely linked by infrastructure and information networks.

Another dimension of urbanization is haphazard urban development, manifesting as wide population density and socio-economic differentials existing in urban areas in Nigeria, with noticeable inequities in the access to resources including food and a healthy diet. The food system therefore has to cater to the various food choices of the urban poor, the middle class, and the wealthy. There has been rapid expansion of most cities' areal extent, which is now sometimes ten times their initial point of growth (Egunjobi, 1999), and this is often without matching infrastructure provided to support such growth. A typical example is Ibadan, which has become a large, sprawling city with no discernible pattern of development. It consists of a traditional inner city core and peripheral informal settlements that are largely immigrant suburbs to the west and north of the core area, which have developed with the slum characteristics of the core areas (Chokor, 1986). Several suburban slums have further developed, characteristically without adequate infrastructures (Tomori, 2012). An estimated 70 to 80 percent of households in Ibadan exist in virtual slum conditions (Arimah, 1994). In addition, extensive areas earlier characterized by rural features have either been incorporated into the city or transformed into peri-urban areas (Adelekan, Olajide-Taiwo, Ayorinde, Ajayi, & Babajide, 2014). This growth has important consequences for the food system, not only from the supply angle, but also on the food environment and constrained consumer food choices. Slums and socioeconomically-deprived areas represent forms of spatial exclusion in cities (Arimah, 2001). Dake et al (2016) observed the proliferation of poor foodscapes among the urban poor in Accra, Ghana, with the local food environment in the study communities being characterized by an abundance of out-of-home cooked foods, convenience stores, and limited fruits and vegetables options. The foodscapes of Nigerian cities have not yet been explored. How does the food environment vary in the cities, by geographical location, population density and cultural affiliation?

Human-induced crises such as forced displacement of people due to environmental pollution (especially in crude oil-rich southern Nigeria), armed conflicts, insurgency, forced evictions, and more recently, herdsman-farmer clashes are also taking their toll on Nigerian food systems. These have led to loss of life, farmlands and produce. Internal displacement has led to decreased crop production (Ayuba & Ayuba, 2015); similarly, the Boko Haram insurgency has had negative implications for agricultural development, especially as it relates to food security in the affected areas (Tari, Kibikiwa, & Umar, 2016). In terms of scale, there are more than 1.7 million internally displaced persons (IDPs) in northeastern Nigeria alone, and the number of displaced people within the country has nearly doubled since 2014. IDPs find their way to neighboring communities or cities, and this sudden and rapid influx of large numbers of people places pressure on the existing food systems in these host locations (**Research question 30**).

Given the foregoing, the different demographic realities in Nigeria challenge the food system in various ways. While some demographic realities present levers or opportunities to innovate within the food systems, others represent hurdles that must be overcome in order to make systems work to bring about healthy and sustainable diets.

6.2.3. Economic drivers

6.2.3.1. GDP growth and implications for consumption patterns

Nigeria's macroeconomic development is led by oil-related activities and manufactures. In recent decades, the country has been one of the fastest growing economies in Africa, which has wide implications for the food systems in the country.

Economic development, usually summarized by growth in GDP, largely affects food systems through its impact on food demand. Household incomes in Nigeria have increased over the past 20 years by five percent on average per annum, pushing average income levels squarely into the upper middle-income range. Often, as people become wealthier, they switch from simple starchy plant-dominated diets to more varied foods that include a range of vegetables, fruits, dairy products, and especially meat (Bennett's law). In Nigeria,

however, diet composition has remained surprisingly stable over time, raising questions on the relationship between increased affluence and consumption and diet quality (**Research question 31**). Moreover, as wealth increases, dietary patterns turn to more convenience, pre-packaged, chilled and processed food, that is transported over longer distances, implying a generally fossil fuel-intensive process and a food system with a web of nodes of specialized companies and value chains. Wider availability and better affordability of nutritious foods will depend in part on success in transforming current agricultural practices and post-harvest handling to a higher standard and adding consumer value to food (**Research question 32**). However, the economic growth in Nigeria has been unequal across the population and poverty remains widespread (World Bank poverty data, 2009 data), both in urban centers and rural areas, particularly in the northern regions. Hence, there remains a continued significant demand for staple food in the country as well.

6.2.3.2. GDP growth and changing structures of the economy

With incomes rising, consumers spend a decreasing proportion of their budget on food (Engels law) and spending on non-food products increases relatively and in absolute levels. Consequently, the country's economic structure changes, with a declining share of agriculture in the national GDP and employment.⁴ With wages increasing, labor flows out of the agricultural sector as wage increases are generally most significant in non-agricultural sectors. This will result in labor substitution for capital in the agricultural sector and a drive toward increasing scale of production. The speed of the restructuring and modernization processes in the agricultural sector depend on the relative price of labor and capital. In Nigeria, labor is rather abundant due to rapid population growth, driving down wages earned by less-skilled workers, who are mainly employed in the agriculture and food sectors. Real interest rates have fluctuated greatly in recent decades, yet with an annual rate of five to six percent on average over the last two decades, they have been relatively high (see <https://www.indexmundi.com/facts/nigeria/real-interest-ratecapital>). The relatively high costs of finance, together with institutional bottlenecks to gain access to credit (CBN, IFC, 2017), hamper the modernization process of Nigeria's food system. An improvement in the investment climate

⁴ In Nigeria, the agricultural sector's share in GDP has declined from 33% in 2005 to 22% in 2016 (World Bank Development Indicators)

will likely be conducive to economic growth: in the World Bank's Ease of Doing Business, Nigeria ranks 145th out of 190 countries (**Research question 33**).

6.2.3.3. *GDP growth, trade and competitiveness*

Due to its crude oil product exports (accounting for about 90 percent of the country's export earning), Nigeria has had a positive balance of trade for many years. Generally, a positive trade balance results in a relative stable, firm valuation of the country's currency against foreign currencies, allowing imports of goods the country is short. Under this windfall, which lasted for more than a generation, the structure of Nigeria's economy has adjusted to the sustained imports of tradable goods from the manufacturing and agricultural sectors. This has contributed to Nigeria's import dependency in grains, protein crops for feed, dairy and fish. Since 2014, as global oil prices plunged and domestic oil production dropped, Nigeria has undergone a macroeconomic crisis and a process of adjustment in the trade balance in which agriculture is key to export diversification and import compression (Arndt, et al., 2018). As international crude oil prices fluctuate heavily, the value of Nigeria's currency (naira) swings as well. In order to stabilize the country's exchange rate, Nigeria has a long history of exchange rate interventions, which has effectively resulted in an overvalued naira in the last two decades (Obi, Oniore, & Nnadi, 2016; Essien, Uyaabo, & Omotosho, 2017). As a result, exports of non-oil products are discouraged, while foreign exchange is in shortage (because companies and people hold off in anticipation of an expected revaluation), further impeding imports. The overall consequence of Nigeria's exchange rate policy is that it could affect opportunities to trade, thereby hindering economic growth. Food system dynamics are negatively affected by Nigeria's currency policy as it adds to instability and uncertainty, discouraging, for instance, foreign investments that have been important drivers of food system modernization in many LMICs (Reardon & Timmer, 2012) (**Research question 34**).

6.2.4. *Innovation and technology drivers*

Innovation and technology development are important drivers of economic growth and therefore have significant impact on food system dynamics. Most literature on food system dynamics refers to the 'state of technology used' in describing the transformation of the system. For instance, the earlier characterization

of food systems as traditional or modern, while also noting transitional system (UNEP, 2016; Reardon, Lu, & Zilberman, 2017), is closely linked to innovation and technology. This food system typology (obviously an oversimplification of local realities) points at the evolution in food systems from labor-intensive towards capital- and other external input-intensive systems, where traditional systems are defined as being on the spectrum where labor is dominant over capital, and the modern system the other way around.

Innovation and technology development are promoted by savings and investment but make a critically important contribution to economic growth when combined with human development, meaning that technological change and innovation are linked with education, health and other such inputs (Ranis, 2011). The quality of the Nigerian educational system is, however, poor, illustrated by the fact that the country possesses the largest number of out-of-school youth in the world (Abdullahi & John, 2014; WENR, 2017). Political instability and the rapid population growth of population are reasons for the relatively few resources invested in the country's education system. Moreover, weak financial institutions, high costs in doing business and the lack of an innovation culture hamper investments in research and innovations in the private sector as well (Radwan & Pellegrini, 2010).

Research, extension, training and education are all extremely important for agricultural development and in enabling the sector's transformation toward efficiently operating nutritious value chains. These activities come together in an Agricultural Knowledge and Innovation System (AKIS) which is a useful concept to describe a system of innovation, emphasizing the organisations involved and the links and interactions between them. Nigeria has a large agricultural research system, with the Agricultural Research Council (ARC) coordinating the activities of 17 mainly commodity-based institutes. The connection between public research, education and extension services is, however, generally considered weak (CTA, 2011; ASTI, 2014; DLEC, 2017). Also, the linkages and interactions of Nigerian public institutions with nongovernmental organizations and the private sector (including farmers' organizations) are generally poor. Moreover, most investments in research focus on technology change without much attention to

socioeconomic and institutional (policy and legislative) contexts that to a great extent determine the adoption rate of knowledge, skills and technology in the sector (Agwu, Dimelu, & Madukwe, 2018; Ajani & Igbokwe, 2014; DLEC, 2017). Reviews of the current agricultural knowledge and innovation system in Nigeria call for a more comprehensive approach to analyzing technological development and processes, which is multidisciplinary, and should include all relevant public and private actors and their interactions.

A key question is how the Nigerian AKIS can be more effective in fostering the generation, diffusion and application of knowledge in the agricultural sector. The role of information and communication technology (ICT) is vital as an information and networking medium to be used as a knowledge management tool that helps gather, store, and retrieve data and information, and adapt, localize and disseminate innovations needed by rural farm families. However, in Nigeria's agricultural research and extension domain there is little ICT readiness, due to lack of ICT infrastructural facilities, and also because of computer illiteracy among researchers, extension workers and farmers (Nnadi, Chikaire, Atoma, Egwuonwu, & Echetama, 2012). In an empirical survey of ICT diffusion and adoption patterns in the Nigerian agricultural system, it was observed that the mobile phone constitutes the most widely adopted ICT device by the agricultural researchers, extension agents, and rural farmers. ICT usage in the Nigerian agricultural system is challenged by less development and exploration of communication technologies, poor electric power supply, and poor human operational skills development for effective utilization of the information-driven technologies (Lawal-Adebowale, 2013).

6.2.5. Increased infrastructure

Before now, Nigeria's core infrastructure stock was extremely low (about 20-25 percent of GDP). It was estimated to be less than US\$100 billion in 2012. This was consequent upon low public and private spending. However, investment in infrastructure has greatly increased in the last four to five years. New developments in the major cities are accompanied by aggressive infrastructural changes. Increased investments in infrastructural developments such as roads, railways, storage facilities are ongoing, as well as energy and ICT. These are expected to be drivers of food system transformation that could ameliorate

many current major challenges and foster the increased growth and market development of food-related products.

Increased food-related programs are anticipated. Its exploding population is making Nigeria a business hub in Africa, thereby attracting programs that could develop the food system. The activities of research institutes and NGOs are creating increased awareness. The outputs of these research activities could serve as effective leverage points for food-basket interventions by taking into account different contexts, needs, and dynamics.

6.2.6. Sociocultural drivers

Socio-cultural factors are also important drivers of food choices. Local cuisine and diets, personal preferences, food sharing within the household, child feeding, and food restrictions and taboos are shaped by factors which have to do with culture, tradition, religion, lifestyles and social norms. Food choice is deeply entrenched in behavior, which is in turn influenced by culture, beliefs and practices regarding what to or not to eat, and why. Food culture is expressed in many layers, regionally and globally, urban and rural, among and within various ethnicities. It exists in different settings, including the home, workplace, motor parks/bus stations, streets, restaurants, religious groups, and many others. It is also shaped by resources (climate, land, soil, water, and fuel); belief and information (religion, education and literacy, communication); ethnicity (indigenous or immigrant); technology (hunting, gathering, agricultural, horticultural, aqua cultural, fishing, food processing and storage, transport, cooking); colonization; and health status and health care (Wahlqvist & Lee, 2007).

Certain beliefs and practices have been documented in the Nigerian literature from the distant past, but it is observed that many of these are of less importance in contemporary times due to the influence of education, cosmopolitanism and globalization. Respect for tradition manifests in the status accorded to different foods as staples for survival (maize, yam), or as symbolic foods for cultural identity (kola nut, palm wine), religious restrictions (pork), child feeding practices (water and herbal teas for newborns) and food taboos.

Culture is continuously changing, adapting to altered circumstances and incorporating new information (Fieldhouse, 1995). Change occurs over time because of ecological and economic changes leading to altered availability, discovery or innovation of foods and diffusion or borrowing of food habits from others. .“Notwithstanding this, every culture resists change; food habits, though far from fixed, are also far from easy to change” (Fieldhouse, 1995). Globalization has been viewed as a phenomenon by which the experience of everyday life, as influenced by the diffusion of commodities and ideas, reflects a standardization of cultural expressions around the world (Globalization, cultural, 2018). The globalization of food culture is a reality which must be factored into any food system innovation being planned. The diversity of available foods is constantly expanding, due to food trade liberalization, establishment of franchises, advertisement and marketing and, in combination with increasing incomes and purchasing power, these are significant food choice drivers, particularly among the younger generation. Given the predominantly youthful demographic profile of Nigeria, there is a need to explore socio-cultural drivers from the lens of the young consumer, especially in the light of fast food culture, exposure to social media and the internet, as well as their current needs, to establish and nurture new and young families (**Research question 35**).

Social institutions such as food markets are important aspects of the sociocultural drivers of food choice. The predominant form of space for marketing food commodities is the open market, with open and covered stalls, vehicle-shops and hawkers. These daily, periodic or farmers’ markets could be morning, afternoon, evening or all-day markets. Lyon and Porter (2009) discussed the importance of informal social institutions (such as the role of traders, credit systems and market associations) as well as their socio-cultural contexts which can influence the economic behavior of consumers. The picture was aptly painted: “The Nigeria domestic food system presents a fascinating case... Considering the difficult business conditions with no recourse to legal systems, corrupt and ineffective police force, minimal banking infrastructure, poor communications and a highly degraded transport infrastructure, the movement of food from over 70 million food producers to over 60 million urban consumers is a feat of ingenuity. Trust and the social institutions

in which trust is embedded, underpinned by a range of moral norms, shape the economic behavior in markets and allow the food supply system to operate.”

Additionally, gender constructs need to be examined as a crucial part of sociocultural drivers. Although gender roles and constructs vary widely in Nigeria, especially between the northern and southern parts of the country, it is universally held that women are responsible for preparing food for the family. This persists despite the increasing employment of women outside the home and increasing responsibilities in society. The effects of this on food provision at the household level is a research question from the three points in the food system: the food supply, the food environment, and consumer choices. Are there new vulnerabilities of men, women and children as a result of the multiplying roles of women? What implications does women’s increased income have on women’s and family diets? What consumer-driven demand can be observed in terms of moving toward processed and convenience food, reduced cooking time, out of home consumption and institutional/school meals for children? What are the gender disparities in household chores for girls and women vis-à-vis other family members, and how does this shape food choices?

Many socio-cultural factors essentially provide the local context within which food systems can be fully understood. Socio-cultural underpinnings of food systems in Nigeria need to be better understood, so these drivers can be leveraged to transform food systems. Are there under-used opportunities? What socio-cultural buttons can be pushed to help reinvent food systems in an innovative way that takes advantage of the benefits of both the traditional and the contemporary? It is also necessary to document the traditional food systems in Nigeria; only a few studies have focused on this, such as Okeke et al (2008), which provided a premier baseline documentation of the traditional food system of the Igbo culture area of Nigeria.

6.2.7. Political drivers

Political food system drivers include leadership and governance; globalization; agriculture, food and nutrition policies; land tenure systems; and conflicts/humanitarian crises (HLPE, 2017).

Leadership and governance: Within food systems, there are often asymmetries in the power of actors to influence political decisions. For instance, large agribusinesses are often able to lobby governments into enacting policies that favor them, even when the policies are detrimental to smallholder farmers and/or consumers (IFPRI, 2015). In fact, the action or inaction of leadership can drive food system changes, depending on the actions of other actors in the system. Adequate leadership and governance are therefore important for ensuring sustained investments for the design and implementation of interventions which will achieve universal population coverage of nutritious food systems and healthy diets (IFPRI, 2015; HLPE, 2017).

In Nigeria, several bodies are responsible for providing the leadership and governance necessary for adequate food and nutrition (MB&NP, 2016). The Ministry of Budget and National Planning is responsible for coordinating food and nutrition interventions, including enacting necessary policies. However, key aspects of the food supply system fall under the purview of the Federal Ministry of Agriculture and Rural Development, as well as the Federal Ministry of Industry, Trade and Investment. Recognizing that nutrition is a multifaceted issue requiring leadership across multiple sectors, a National Council on Nutrition (NCN) was approved in May 2007. The Vice President of Nigeria is the Chairman of the NCN, and the Ministry of Budget and National Planning is its secretariat. The NCN is expected to lead policymaking for national food and nutrition security. NCN membership includes the Ministers of the three ministries mentioned above, as well as Ministers of others, including health, education, information, communications, and science and technology. Furthermore, a National Committee on Food and Nutrition, which also has its secretariat at the Ministry of Budget and National Planning, is expected to be the technical unit of the NCN. There are analogous State Committees on Food and Nutrition, and Local Government Committees on Food and Nutrition (MB&NP, 2016). Indeed, the Scaling Up Nutrition (SUN) Movement 2017 scorecard rates Nigeria relatively high for enabling environment and legislation for food and nutrition (Haddad, 2017).

Nevertheless, leadership and governance for food systems in Nigeria is still quite inadequate. Though approved in May 2007, the NCN was only formally inaugurated in November 2017. Committees on Food and Nutrition at different levels have been criticised as having inadequate skills for effective leadership (Benson, 2008; Akinyele, 2009). Government budget allocations for all nutrition interventions were only 0.2 percent of the budget in 2017 (Development Initiatives, 2017). In fact, the establishment of a “*Nigeria Zero Hunger Forum*” has been suggested for facilitating the realization of Zero Hunger goals, rather than relying on existing leadership and governance for food and nutrition (H.E Chief Olusegun Obasanjo, 2016). Seven food systems-related bills, including a Food Security Bill and Right to Food Bill, presented to legislators between 2013 and 2016 are either pending assent or pending passage (H.E Chief Olusegun Obasanjo, 2016).

Moreover, the leadership and governance processes and structures mentioned thus far focus more on nutrition and not food systems specifically. While improved nutrition is an expected outcome of food systems that achieve healthier diets, a focus on nutrition does not automatically imply that all aspects of food systems will be addressed. The National Policy on Food and Nutrition (MB&NP, 2016) considers food systems; and the Nigerian Agricultural Sector Food Security and Nutrition Strategy 2016–2025 (FMARD, 2017), which elaborates the agriculture sector component of the nutrition policy, explicitly adopts a food systems perspective. It will be necessary to leverage these existing frameworks to ensure NCN provides leadership that directly addresses diets and nutrition using a food systems lens. An NCN that provides leadership in demanding accountability for the implementation of various nutrition policies and strategies may be more impactful.

Globalization: The “interconnectedness” of the world as a result of technological, communication, and transport advances has greatly increased the international trade of foods, and drives consumer choices to converge towards diets associated with development and affluence (Von Braun & Diaz-Bonilla, 2008; HLPE, 2017). This globalization has fostered the integration of international markets and moved many

companies from national to global sales of food, leading to increased foreign direct investments (FDI) in food production, transformation and retail (Senauer & Venturini, 2005). Globalization influences both foods imported into a country as well as those exported out of it and appears to have significantly influenced food system change in Nigeria. Agricultural trade liberalization in Nigeria, among other factors, has been cited as major contributor to the country's current status as a net food importer (Abdullateef & Ijaiya, 2010; PwC, 2017a).

Regarding foreign direct investment (FDI) in the food system, there are several multinational companies which lead in the Nigeria agro-food sector, and three of the top five players in the food processing sector in Nigeria are foreign companies (UNDP, 2012). Products for which multinational/foreign companies lead in the country include dairy, instant noodles, breakfast beverage drinks, and confectioneries (UNDP, 2012; Nzeka, Nigeria food processing ingredients market, 2013). A recent study (Fieldler & Iafrate, 2016) of global FDI (excluding joint ventures and mergers and acquisitions) across value chains in the food, beverage and tobacco sector reported that Nigeria received US\$3.4 billion, 15 percent of the FDI in Africa from 2003 to 2014. It was further reported that the majority of the FDI was used for producing or processing foods intended for the Nigerian or West African markets. The existence of business opportunities and favorable market conditions were stated to be the reasons behind the FDI in Nigeria, even though inadequacies in infrastructure and governance continue to be leading challenges (Fieldler & Iafrate, 2016).

Agriculture, food and nutrition policies: As previously indicated, there are a number of policy and associated strategy documents that have been ratified in Nigeria. Chief among these documents is the National Policy on Food and Nutrition (2016–2025 implied); Agricultural Promotion Policy 2016–2020; National Strategic Plan of Action for Nutrition: Health Sector Component 2014–2019; and the Nigerian AFSNS 2016–2025. Policy priorities relevant for the food system include food security and import substitution. Policy tools include increasing agricultural production and productivity, supporting processing and agribusiness investment, and import bans and tariffs. Making the existing agricultural policy framework

supportive of a transformation of the agriculture and food system toward healthier food choice and diets is a multifaceted challenge (**Research question 36**). Specific policy activities related to increasing productivity and production include facilitating access to inputs through increased domestic input production, input subsidies, financing for agro-dealers, and development of irrigation systems. Support for processing and agribusiness investment includes the operationalization of Staple Crops Processing Zones (SCPZs). Key focus foods for domestic consumption are rice, wheat, maize, soya beans and tomatoes, as well as biofortified crops, dairy, fish, and poultry. Focus foods for export include cocoa, cassava, yam, oil palm, sesame, cashew nuts, bananas, avocado, mango and fish (FMARD, 2016).

Still, implementation of these policy activities has been very slow. It has been reported (PwC, 2017a) that an irrigation project expected to annually yield 42,000 tons, 4,800 tons, 2,200 tons, and 800 tons of rice, maize, cowpea, and wheat respectively has stalled for several years. Despite the fact that SCPZs have been in the government project pipeline since 2011, no SCPZ appears to be functional (PwC, 2017b). One policy activity that has been consistently implemented over time, with demonstrated effects on the food system, is import bans or tariffs. The Federal Government of Nigeria has frequently used import bans and tariffs to reduce imports and stimulate domestic production as well as backward integration by industries. Arguably, the food commodity that has experienced the most import bans or tariffs over the years is rice. Rice is a major staple food accounting for a significant proportion of calorie consumption and household expenditure, but domestic production is yet to meet demand. Over the past several decades, import tariffs on rice have ranged from zero to 120 percent, including periods of outright bans. Import quotas have also been used. Studies have shown that these protectionist rice policies increase smuggling and reduce consumer welfare. Yet the bans and tariffs have not led to sufficiently increased domestic rice production because of inadequate complementary action such as investments in enhanced productivity and processing. Moreover, the inconsistent policies on rice importation have created uncertainties for producers and resulted in reduced investments (Obi-Egbedi, Okoruwa, Aminu, & Yusuf, 2012; Johnson & Dorosh, 2015; Sahel Capital, 2015). Despite these studies, a recent review (His Excellency Chief Olusegun Obasanjo, 2016)

recommended expanding importation tariffs beyond rice to include corn starch, cassava starch, groundnut oil, and juice concentrates.

FBDGs are another policy that can have impacts on food systems (HLPE, 2017). Nigeria has FBDGs, but they have been criticized as being couched in vague language that is very susceptible to personal interpretations. The current FBDGs are therefore not a useful tool for planning, assessing, or communicating necessary dietary intakes, and need to be revised.

Land tenure systems: The land tenure system in Nigeria has been critiqued as expensive, cumbersome, time-consuming, and risky, creating a major bottleneck for improving the food supply system (UNDP, 2012; PwC, 2017a). It has been reported that it took three years for a top indigenous player in the Nigeria agro-food sector to acquire 10,000 hectares of land for increasing maize production and tomato processing (UNDP, 2012). Another indigenous investor who was unable to acquire a long lease on 10,000 hectares of land for pineapple production in Nigeria invested instead in Ghana where such constraints did not occur (UNDP, 2012). The challenges with securing land in Nigeria were considered in the Agricultural Promotion Policy 2016–2020 (FMARD, 2016) and several policy options were proffered.

Conflicts/humanitarian crises: Conflicts and humanitarian crises disrupt the food system in several ways. For instance, there is decreased agricultural production as a result of displacement, reduced labor, destruction of inputs, and loss of institutional support, amongst other factors. Destruction of infrastructure and disruption of basic amenities/services limit food processing, storage, transport, and trade. Further, households lose their livelihoods and access to food is reduced or non-existent (Kimenyi, et al., 2014; HLPE, 2017). In Nigeria, the major conflicts are communal clashes between farming communities and nomadic herdsmen as a result of indiscriminate grazing of nomadic herds on crops; conflicts arising from religious intolerance and/or extremism, including the terrorism by Boko Haram in North East Nigeria; and battles over resource control in the oil-rich Southern Nigeria (Osaghae, 2015). The terrorism by Boko Haram has degenerated into a humanitarian crisis that has affected more than 15 million people since 2009

(FGN, 2016) and by 2017 put 4.5 million people “at risk of famine” (Von Grebmer, et al., 2017). At the beginning of 2016, agricultural damages due to Boko Haram crises were estimated at US\$3.5 billion (FGN, 2016). While the various conflicts and humanitarian crises have led to devastating effects on the livelihoods, assets, and food systems of communities directly affected, the overall national food system has also been affected (Kimenyi, et al., 2014; Ukamaka, Danjuma, Mbolle, Achonam, & Mbadiwe, 2017). The northern parts of Nigeria, where communal clashes are widespread and Boko Haram terrorism is concentrated, have been reported to produce close to 50 percent of food (crops and livestock) consumed in southern Nigeria. The conflicts have resulted in significant price increases for commodities traded from northern Nigeria to the other parts of the country. In Borno State which is most impacted by Boko Haram, the quantities of key crops (cowpea, maize, millet, sorghum, and rice) produced appeared to have reduced by more than 50 percent by 2014 (Kimenyi, et al., 2014).

VII. SYNERGIES AND TRADE-OFFS BETWEEN DIETS AND OTHER OUTCOMES OF FOOD SYSTEMS IN NIGERIA

There appears to be a global consensus on the need to appraise the synergies and trade-offs among the outcomes of ecosystems, including agricultural and the food systems (Klapwijk, et al., 2014; Qin, Li, & Yang, 2015; Mainali, Luukkanen, Silveira, & Kaivo-oja, 2018). Developing food systems for healthier diets and improved nutrition outcomes has become a front burner issue, an agenda being pursued by many countries across the globe. Yet, the complexities of, and within the food systems present some synergies, opportunities and challenges requiring in-depth examination and reconciliation of nutrition functions with some other food systems functions (outcomes). These other outcomes include, among others, elimination of poverty, raising farm income (productivity) and promoting eco-friendly environment, as enshrined in the sustainable development goals.

Indeed, the agriculture (and the food systems) processes that yield improved nutrition and/or economic welfare outputs are also those responsible for the production of certain non-market (environmental) goods (such as farm production diversity, improvement/sustainability of soil health, and habitat for fauna) and/or environmental ‘bads’ (such as emission of greenhouse gases, agrochemical residuals in crops, animals, soil and water; due to excessive usage) (Tilman, 1999; Moss, 2008). Thus, a robust framework for analysing food systems must, on one hand, recognise the interrelationship between the various food systems outcomes and the trade-offs between them; and on the other, offer tractable ways forward for the sustainability of the system (Klapwijk, et al., 2014). Such framework should dovetail to policy actions and interventions capable of incorporating and aligning the external (environmental) costs and benefits, social, and otherwise effects of the food systems with the objectives of consumers and other operators within the food systems (Buttel, 2003). This is against the backdrop that policy changes and other transformation in the food systems can result in diverse, and sometimes unintended outcomes.

With diet quality (nutritional standpoint) as the entry point to the food systems, an assessment of the relationship between high quality (healthier) foods and their likely environmental, social, and economic

effects has to be studied carefully, as the complexity (competing or complementary nature) of the relationship among these outcomes are likely to differ substantially in different contexts (**Research question 37**). Giving some examples regarding the competing or complementary nature of the outcomes of the food systems may shed more light on the complexities. For example, in Nigeria, raising the production/supply of animal source foods in order to improve the current low consumption level and meet future demand is a justifiable food and nutrition goal. Nevertheless, excess consumption of animal products can pose adverse effects on health.

In addition, raising livestock production (under controlled grazing) may help improve soil fertility if cow dung and fecal material are used for manure. Yet, livestock and dairy production constitute significant threats for climate change. Likewise, it is a known fact that the consumption level of fruits and vegetable in Nigeria is considerably low compared to WHO recommendation. Efforts to intensify/raise domestic production of fruits and vegetables have been characterised with extensive use of fertilizers and pesticides that have negative effects on human and ecosystem health due to agrochemical residues (Erhunmwunse, Dirisu, & Olomukoro, 2012; Njoku, Ezeh, Obidi, & Akinola, 2017).

The opportunity cost and extent of the trade-off between the more specific (e.g. profit maximising) objective of the producer and a shift towards accommodating consumer (diet quality) objective and more general environmental sustainability goals (public goods) needs to be critically examined. An important question for the farmer who would like to enhance diet quality through diversified farm systems could be: What is the opportunity cost of increasing farm-level diversity, in terms of forgone net revenue on farm production, in keeping nutrition objectives in view or by adopting environmentally sustainable production technologies for the sustainability of healthier food system? (**Research question 38**)

There are also concerns for the safety of foods in Nigeria's informal markets (and some supermarkets). Most marketers (and some other actors in the value/supply chain) are largely motivated by profit at the expense of food safety. The use of dangerous chemicals for fruits ripening, and as food preservatives to

elongate shelf lives of foods, is stimulated, among other reasons, by the conflicts or lack of appreciation for the synergies between private (profit maximising) objectives and public health (goals). A broad question to such marketers is: What is the marginal willingness to keep food safety standards rather than engaging in dangerous practices? **(Research question 39)**

Consumers may also need to be asked about their marginal willingness to pay higher prices for healthier foods, and those produced in an environmentally-friendly manner. The rationale here is to be able to assess what sacrifices and investments various food system actors are willing to make to promote systems that deliver quality diets, considering the multiple system outcomes. This foregoing showcases the importance of trade-off analysis as a veritable approach for evaluating food systems outcomes and prioritizing and devising policy pathways for a sustainable food system. It is therefore critical for governments as well as private companies and other interest groups to look across food system objectives and broader goals and constraints, including the need to sustainably build a country's agricultural system, conserve limited water supplies and promote long-term management of soils, forests and biodiversity (GLOPAN, 2016).

VIII. SYNTHESIS AND THE WAY FORWARD: AN AGENDA FOR POLICY RESEARCH

Transforming Nigeria's food systems is needed to improve food security and achieve healthier diets for all.

Nigeria is making insufficient progress to meet maternal, infant and young child nutrition targets, and off course to meet nutrition-related NCD targets, except for under age five rates of overweight (Global Nutrition Report 2020). Much of the ongoing work to promote better nutrition and health outcomes has been focused on specific nutrition problems and target population groups, while progress toward food and nutrition security for all people has been slow. Given the coexistence of multiple burdens of malnutrition in Nigeria, an integrated approach that addresses the root causes of malnutrition effectively and sustainably is needed. Unhealthy diets are at the root of all forms of malnutrition and drive problems such as persistently high rates of child and maternal malnutrition, widespread micronutrient deficiencies (or hidden hunger), and growing rates of overweight, obesity, diet-related NCDs.

Transforming Nigeria's food systems to promote healthier diets—simply said, advancing how all actors involved produce, handle, distribute, demand, and consume food—is the fundamental part of the solution that is missing. The overarching challenge is to deliver more affordable and safe options to buy nutritious food in the marketplace and to enable the population to redirect its consumption habits towards healthier food choices. Therefore, adopting an integrated approach in designing and implementing interventions is paramount to nudge food systems toward promoting healthier diets.

This paper identifies several research questions critical to understand food system components in Nigeria, toward improving the availability and effective demand for healthier food and creating a supportive policy and market environment for achieving healthier and sustainable diets in the country. In this closing section we build on these questions to come to an agenda for policy research on food systems for healthier diets in Nigeria, focusing on the search for solutions and entry points for intervention.

1. Diet quality

Measuring and data availability	What are Nigeria’s diet quality problems, and the causes?
Measuring and data availability	What do urban and rural people currently eat; are they meeting an adequate diet and how does this reflect for vulnerable groups?
Role of informal markets	How does ‘out of home’ food consumption impact diet quality and safety (in urban, peri-urban, rural areas)? How is street food vending regulated and how can we intervene in this highly informal sector?
Measuring and data availability	How can we determine the extent of consumption of unhealthy diets in Nigeria?
Food safety regulations	What are the current food safety regulations and level of the implementation? What is the impact of food safety regulations on diet quality and health outcomes and how is it influenced by urbanisation (densities)?
Food guides	What is needed to renew the FBDGs and food guides (also on regional level) and facilitate its roll-out, use and policy influence?
Food guides	How can Nigerian FBDGs both account for a high-quality diet and take sustainability into account?

❖ Urgent need to improve the measurement and availability of food consumption, diet quality and nutrition outcomes

On the standard country dashboard of diet-related nutrition indicators, several for Nigeria are missing, causing limits to international comparison and targeting: no data are available yet for key nutrition indicators covering women of reproductive age, including indicators on minimum dietary diversity, and minimum acceptable diet ([Transform Nutrition West Africa, Nigeria Country Profile](#)). Data on dietary diversity of men is also not available (Section 2).

The leading source of policy monitoring on diet quality, the National Food Consumption and Micronutrient Survey (NFCMS), is outdated. There is an urgent need to update information from its latest rollout in 2003. Policy preparations are well underway for a new survey round in 2020–2021, as outlined in the AFSNS 2016–2025. The study will provide understanding into what drives changes in nutrition and consumer diets over time across gender, regions, location, age groups, and socioeconomic strata (Maziya-Dixon & Yusuf,

2020). Building on a food systems perspective, the previous chapters provide a motivation for the integration of new domains of information in the NFCMS and related monitoring studies. These pertain, in particular, to the consumption of food away from home as street food and in the food service sector, the use of retail channels in food purchase, (better mapping to existing data on) the drivers of consumption, food preparation and discarding of waste.

The process of preparing and implementing the NFCMS lays the foundation for a policy review on healthy diet recommendations and recommended food-based dietary guidelines. In order to be in tune with evolving global and regional policy discourses, this process should intersect with the development of in-country perspectives with respect to healthy eating indices and sustainable diets. Among Nigerian consumers, wide-ranging perceptions on food safety risk and missing transparency on quality standards in food supply chains further warrant an integrated perspective on the monitoring of safe and nutritious food consumption.

Due to the fast pace of change in the food systems in Nigeria, frequent national monitoring of dietary patterns is warranted. Several academic studies have successfully used data from household consumption and expenditure surveys – the Government Household Survey (GHS) and related LSMS – to assess changes in dietary intake. Assessments of dietary quality based on LSMS data provide a policy option for the biannual or triannual monitoring of diets in between the anchor points of a full-fledged NFCMS.

❖ High priority to improve diet quality, with tailored perspectives on the diversification of rural and urban diets towards non-staple foods

In Nigeria, multiple nutritional deficiencies exist, and diet diversity is very low. In 2018, only one in five children age six to 23 months received the appropriate diverse diet of five food groups or more; only half the women 15 to 49 years old met the minimum dietary diversity of at least five out of 10 food groups (data from the latest national demographic health survey). Urban infants and young children were better off than rural, and an increase was seen when education level of the mother and wealth index of the household increased.

Interestingly, among large consumer groups, diets have changed in the past decades in response to preferences for convenience. Already in 2003, when the latest national nutrition survey was completed, rice had already replaced yam and cassava as the main staple, and wheat consumption in the form of bread was on the rise. However, this change in diets has not led to a diversification of the diet into a bigger share for non-staples (Ecker, Andrew, Raphael, & Andam, 2020; Mekonnen, et al., 2019): the consumption of legumes, fruit and vegetables, fish, meat and dairy remains low across the board, and well below recommended levels; only beef consumption could be at recommended levels. Underlying this common challenge are widely varying regional diets, and a wide variation in meal choices among consumers and consumer groups depending on culture and socioeconomic status. Understanding these regional and socioeconomic differences in diet quality and defining entry points of intervention in the national and local food system for addressing low-quality diets is a prominent area of research.

2. Consumer behavior and the food environment

Consumer behavior: drivers of change	
Product attributes affecting diets	How can consumer's preference for diet quality in the Nigerian context change with food products attributes other than the traditional price and income changes, and variation in demographic characteristics?
Knowledge	How will better knowledge of the nutritional content of foods contribute to consumers buying healthier and more diverse foods? How do we best communicate nutritional knowledge to influence customer behavior?
Socioeconomic factors and diet	What is the link between socio-economic features of the population and dietary patterns?
Gender	Do intra-household (women biased) resource allocation, power sharing and decision making enhance diet quality? How will we use gender dynamics to influence diet preference?
Food environment	
Access to markets	How does market access for farmers improve dietary quality in the Nigeria?
Promotion, labelling, food safety regulations	What effects on food consumption patterns, and informal open markets (as important food marketing channels), are likely when policies and enforcement regarding food hygiene and safety regulations become more stringent?
Price stabilization	What are the instruments and feasible policy options for safeguarding access to nutritious foods in short term or protracted crises in Nigeria?
Price fluctuations	How do households cope with both seasonal and annual food price fluctuations?

❖ **Ensuring affordable access to nutritious foods**

Poverty and food insecurity are widespread in Nigeria. Poorer households spend as much as 70 percent of their total expenditures on food. Staple foods dominate consumption among the poorer segments of the population. As diets need to become more diverse and nutritious, affordable access to nutritious foods is therefore a prime policy priority, which requires a shift from a strong policy focus on staples.

Working toward making food environments enablers of healthy food choices offers an untapped opportunity to positively impact diet quality and nutrition (FAO, 2016; Global Panel, 2017b). In Nigeria, the government launched the AFSNS 2016–2025 to improve the country’s food environment. This Strategy embodies a set of recommendations on the best way of managing the interface between consumers and food suppliers and is aimed at improving consumer access to diverse and quality diets. The strategy necessitates the active participation of the private sector, civil society and government for its success. Some of the measures included in this Strategy are the increased marketing and promotion of high-quality diets, processing of foods in ways that increase their nutritional value and safety, and nutrition labelling of foods. Policy research will be important for evaluating and guiding the Strategy, which was launched in May 2017 and implementation commenced recently. Under this strategy, measures are in place to ensure consumers have enough access to nutritious foods (including vegetables, legumes, fruit, pulses, milk and fish), especially at times of harvest failure and market shock. More experimentation with better targeting of cash transfer programs and other safety net programs toward diet quality and accessibility is pertinent.

Rural and urban consumers cope with fluctuating prices and other market shocks that affect the availability and affordability of food. For example, under the macroeconomic downturn that Nigeria experienced in recent years, the naira weakened considerably, adding substantially to a rise in the food import bill which is settled in dollar terms. Food price inflation is an important driver of price increases in food and for the rise in the share of food in total expenditures. It is surprising that seasonality effects appear to be of limited

influence on household consumption, both for rural and urban households (Ecker, Andrew, Raphael, & Andam, 2020; Mekonnen, et al., 2019).

❖ **Strengthen policy attention for factors that enable healthy diets in the food environment**

Nigeria is undergoing rapid urbanization: more than half of its rapidly growing population depends on urban food systems. It follows that the food systems in urban and rural areas may grow more distinct, as could the nutritional problems and interventions needed to solve them. For example, the urban poor are more dependent on food purchases, and their diets are more likely to be diverse than those of the rural poor. Urban households tend to consume more food away from home and more processed foods than rural households (de Braw & Herskowitz, 2020) and hence are more vulnerable to health risks from overweight and obesity related to the consumption of processed foods. This process calls for a better understanding of the drivers of aspirational food choice, i.e. food away from home and processed food (Akerele, 2019).

Enabling healthy food choices for food consumed away from home comes with different challenges than food choices in the household. Food away from home involves street food vendors, food service providers, and others, and provides interesting entry points for a reorientation of consumption decisions. An agenda for policy research in this area consists first of measuring the food environment in terms of its components: food availability and physical access; food prices and affordability; convenience and time savings; promotion, advertising and information; food quality and safety. Second and third priorities are to experiment with effective interventions in the food environment and to explore what enabling policy conditions are needed to support or scale positive impact on healthier food choice.

An example of such a condition is the development of a nutrition standard for the National Home-Grown School Feeding Program (NHGSFP). The development of nutrition protocols for home-grown school meals provides an effective orientation toward reducing undernutrition and micronutrient deficiency disorders among pupils at the elementary school level. Similar examples can be applied in workplace canteens in

other government facilities, town halls, universities, hospitals, etc., but such standards would equally well inform meal choices in churches and other community centers.

3. Food supply system

Production-nutrition link	How, and to what extent and under which conditions (or contextual factors) agriculture impacts nutrition in Nigeria?
	How can farmers be persuaded, or incentivised produce foods not normally consumed in local diets that meet macro and micronutrient needs of the population?
Policy evaluation	To what extent does Nigeria's NSA policy instruments impact nutrition outcomes per target group, with special attention to women and young children, young children, and displaced persons?
Storage facilities and nutritious food	How can (the expansion of) cost effective storage facilities contribute to improve functioning of local and regional markets, and enhance availability of and accessibility to healthy foods? At which level should storage facilities be needed (e.g. farm, LGA, state)?
	How do farmers store more nutritious foods before they get picked up to go to market?
Infrastructure	What are the most cost-effective modes and direction of transporting nutritious foods?
	What types of investment would be the most cost effective in improving accessibility of nutritious foods, and who will be the main beneficiaries?
Food transformation system	What value chains for nutritious foods have comparative advantage in each state? How do food flows for nutritious foods work across states in Nigeria?
Nutritional outcomes of value chains	What are requirements for value chains to be successful at delivering substantive and sustained consumption of nutrient-dense foods to poor households?
Role of agro-processing	How can new investments in agro-processing contribute to adding nutritional value? How can existing government policies stimulate food industries to supply nutritious foods? How can local, state, and federal policies be aligned to stimulate food industries for supplying nutritious food?
Food retail and provision	Which food retail outlets can 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?

❖ **Utilize agricultural potential**

Nigeria's food systems provide an inadequate supply of nutritious foods, while the import bill may rise to unsustainable levels on account of imported grains, processed food and feed ingredients. Over the past two decades, domestic supply of staple food has expanded, if largely for root crops and modern cereals, and less so legumes and traditional grains. The supply of animal products has also increased (fish and milk growing quicker than meat), yet insufficiently to curb rising imports. Fruits and vegetables supply are stagnant at the low levels of the 1960s. An important challenge is to strengthen agricultural value chains for nutritious food, and to ensure these foods are being presented as affordable options in the food environment of rural and urban consumers.

Nigeria's lack of supply of nutritious food is a symptom of its underutilized agricultural potential. Agricultural growth in Nigeria is heavily constrained by farmers' limited access to farm inputs such as fertilizers, pesticides, credit and extension services. The linkages of farmers to consumer markets are also weak: there are few coordinated value chains and market brokers to tap into a demand for quality and safety attributes among consumers.

❖ **Strengthen value chains for nutritious crops and animal source food**

Regarding the agri-food value chain pathway, there is a large research agenda in Nigeria on post-harvest loss reduction, breeding and scaling out of micronutrient-rich crops, and food safety enhancement along the agricultural value chain (Maziya-Dixon & Yusuf, 2020). Because of the dominant position of staples in agricultural systems and consumer diets, biofortification of staples is a prominent strategy to reduce micronutrient deficiencies.

The Government of Nigeria's strategy for the strengthening value chains focuses on the following priority crops: maize, sorghum, rice, wheat, cassava, sesame, tomatoes, yam, cowpea, soybeans, cocoa, palm oil, hibiscus, cashew, potatoes, cotton and sugar cane – as listed under National Agricultural Technology and

Innovation Plan (NATIP) 2021–2024. From a healthy diet perspective, several additional crops are relevant, including vegetable seeds, leafy and traditional vegetables. Upgrading agricultural practices and levels of organization in vegetable value chains is considered to be a key point of intervention by selected donors (Posthumus, Just, Mona, Christine, & Gerard, 2018).

According to FAOSTAT, more than 90 percent of the food consumed in Nigeria is produced domestically, but the country also imports food worth between US\$3 billion and \$5 billion annually, especially wheat, rice, fish, and milk. Yet it also bans imports of beef, pork, poultry, and eggs. Agricultural and trade policies influence food supply, farm employment and incomes, and food prices by defining the regulatory framework, setting production incentives, subsidizing/taxing production, and restricting food imports and agricultural inputs, among other levers (Ecker, Andrew, Raphael, & Andam, 2020). Finding the appropriate policy mix for supporting healthier diets from sustainable food systems, requires further research.

❖ Developments in the food business and retail landscape are to be monitored and potentially steered towards the enabling of healthier food choices

An under-developed area of policy research in Nigeria relates to the impact of new business solutions on healthy food choice – potentially except for street food vending. The SUN Business Network supports agri- and food entrepreneurs, and SMEs in the preparation and delivery of healthy food options. Examples of new business solutions in retail are mobile food vending and e-marketing. Policy research can catalyze a process in which these business opportunities are explored as systemic innovations in the food environment. It involves informing the business community on consumer drivers and aspirations for nutritious food, evaluating the impact of the business on food choice, exploring conditions for successful scaling up and scaling out while safeguarding quality control.

Food retail is a key area of policy research. Open markets remain by far the dominant retail channel in Nigeria. The number of modern grocery retailers in the form of super- and hypermarkets continues to grow, with several foreign chains active in the country, but in terms of market share, modern grocery is still rather

low. Using urban planning of food outlets to influence healthier food choice is uncommon in Nigeria and provides a novel entry point for policy.

4. Drivers of change, synergies and trade-offs in food systems outcomes

Biophysical drivers	What is needed in terms of restoration and conservation of Nigeria’s over-exploited ecology and soil system to support healthier diets?
Biophysical drivers	How can the resilience of Nigerian agriculture and food system be strengthened in the face climate change impacts, drought, floods and other shock/disaster?
Demographic drivers	How to nourish the expanding population in urban centers? How much food can be produced in (peri-) urban agriculture and how to best organize logistics and linkages to rural production centers?
Demographic drivers	What is the impact of rural-to-urban migration and internal displacement on the food systems in the locations of origin and destination?
Economic drivers	What current links between purchasing power and food consumption patterns could be the basis for predictions on consumer purchasing power and dietary change under various scenarios in the future?
Economic drivers	How will the cost of a recommended healthy diet evolve, at national and regional level to recognize differences in prices and consumption patterns?
Economic drivers	What is the total value added of Nigeria’s food system; what is it composed of; and how much does the food system GDP extend beyond agricultural GDP? Can food system GDP contribution to total GDP be used to monitor the evolution of the food system over time?
Economic drivers	How would macroeconomic (in)stability and economic restructuring benefit the modernization and restructuring of agriculture and food supply chains?
Cultural drivers	How will the aspirations for a western diet and for convenience affect current and future food choice?
Political drivers	What changes to the existing agricultural policy framework will facilitate a transformation of the agriculture and food system towards healthier food choice and diets?

❖ Explore the economic and biophysical interactions between supply expansion of staples and nutritious foods in the face of land conflict and the food-water-health nexus

A further diversification of the food supply will have to coincide with a higher productivity of staple crops, in particular rice and maize (Smeets-Kristkova , Acterbosch , & Kuiper, 2019). In recent decades, agricultural output growth was mainly based on an expansion of the area under cultivation, adding to conflict over scarce grazing land and water – often at the expense of pastoral livestock farming. Climate

change and a greater occurrence of droughts in North, floods in the South and other forms of extreme weather add to the agricultural challenges. A major question is the extent to which a diversification of supply will in fact create the conditions for a sustainable intensification of food supply and at the same time promote diet quality and resilience in farming communities. Examples to be tested at scale are tree crops providing shade, rotation of maize with a nitrogen-binding legume crop, integrated pest management in relation to biodiversity conservation.

As a more diverse supply introduces more perishable products into the food system, this challenge is entwined with the need to ensure the safety and quality of farm products on their way to the consumer and in consumer homes. Better practices and facilities, including packaging and refrigeration, will help control the environment in storage and at all stages of the supply chain, from farmers to traders to home kitchens. Food processing and preservation also has much potential. As a result, nutrients as well as economic value currently lost in the food system can be retained to the benefit of producers and consumers. Changes in cooking practices can contribute to a further loss of nutrients.

❖ As Nigeria grows wealthier, the consumption of animal source food might change with far-reaching impact on farming and fisheries.

Protein consumption in Nigeria is low. In 2003, average protein consumption in Nigeria was lower than any other West African country, according to FAO. Based on a comparison among West African countries, looking specifically at animal protein consumption, the consumption of meat is the lowest in the region. In the southern states, around half of the total animal protein intake is from fish, and fish is the cheapest among all animal proteins. In the northern states, fish is also widely consumed, although in smaller quantities than in the south. Beef or goat meat are a regular part of diets in the pastoralist regions in the north. A key question is what the impact on future consumption of animal source foods under rising levels of affluence will be. Income growth and urbanization affect diet patterns. A commonly observed pattern in low-income countries is that diets diversify with rising affluence. Surprisingly, however, staple consumption has appeared quite robust in Nigeria under income growth (Ecker, Andrew, Raphael, & Andam, 2020).

Projections of future food demand will need to account for this trend and its sociocultural and agricultural drivers. Nevertheless, looking at income elasticities based on three waves of the GHS-Panel data, growth in per capita income will be expected to lead to an absolute increase in the demand for meat, as well as wheat and rice.

5. Concluding perspective: Food system transformation for healthier diets requires concerted policy efforts across sectors, between government levels, and in collaboration with the private sector.

Food systems go far beyond agriculture (including all crops, livestock, fishery, and forestry) and include the economic activities in upstream and downstream sectors that are linked to agricultural production. Hence, transforming food systems for healthier diets also requires an integrated approach that involves policy efforts in such sectors as agricultural inputs, trade and transport, agro-processing, and food services, in addition to agriculture. In Nigeria, collaboration between the federal government and state-level governments is pivotal for the success of policy reforms, as the two government levels share responsibilities in agriculture, as well as health including nutrition. Entry points for policy reforms are manifold and have been discussed earlier. For example, within agriculture and the related trade sector, reforming the farm support and protective policies offers unique opportunities to achieve the dual goal of agricultural commercialization and provision of more nutritious foods at affordable prices.

Existing policies are targeted at staple food production and hence distort agricultural incentives towards the provision of cheap calories at the expense of more nutritious foods such as legumes, vegetables, and fruits. However, the potential contribution of reshaping agriculture to deliver on healthier diets is becoming more limited as the role of food processing in food supply chains gains in importance, and consumer demand for processed and highly processed foods continues to rise. Here, the responsibility of the food industry in producing and delivering food products, food pricing, and shaping food choices (through e.g. advertisement) is undeniable, and the power of the federal government as regulatory body appears to be underexploited.

ANNEX 1. OVERVIEW OF RESEARCH QUESTIONS

S/N	Chapter	Issue	Research Questions
1	Diet quality as entry point	Measuring and data availability	What diet quality problem is in Nigeria, and the causes?
2		Measuring and data availability	What do urban and rural people currently eat; are they meeting an adequate diet and how does this reflect for vulnerable groups?
3		Role of informal markets	How does 'out of home' food consumption impact diet quality and safety (in urban, peri-urban, rural areas)? How is street food vending regulated and how can we intervene in this highly informal sector?
4		Measuring and data availability	How can we determine the extent of consumption of unhealthy diets in Nigeria?
5		Food safety regulations	What are the current food safety regulations and level of the implementation? What is the impact of food safety regulations on diet quality and health outcomes and how is it influenced by urbanisation (densities)?
6		Food guides	What is needed to renew the FBDGs and food guides (also on regional level) and facilitate its roll-out, use and policy influence?
7		Food guides	How can Nigerian FBDGs both account for a high-quality diet and take sustainability into account?
8	Consumer behavior: drivers of change	Product attributes affecting diets	How can consumer's preference for diet quality in the Nigerian context change with food products attributes other than the traditional price and income changes, and variation in demographic characteristics?
9		Knowledge	How will better knowledge of the nutritional content of foods contribute to consumers buying healthier and more diverse foods? How do we best communicate nutritional knowledge to influence customer behavior?
10		Socioeconomic factors and diet	What is the link between socio-economic features of the population and dietary patterns?
11		Gender	Do intra-household (women biased) resource allocation, power sharing and decision making enhance diet quality? How will we use gender dynamics to influence diet preference?
12	Food environment	Access to markets	How does market access for farmers improve dietary quality in the Nigeria?
13		Promotion, labelling, food safety regulations	What effects on food consumption patterns, and informal open markets (as important food marketing channels), are likely when policies and enforcement regarding food hygiene and safety regulations become more stringent?
14		Safety net	What are the instruments and feasible policy options for safeguarding access to nutritious foods in short term or protracted crises in Nigeria?
15		Price fluctuations	How do households cope with both seasonal and annual food price fluctuations?

S/N	Chapter	Issue	Research Questions
16	Production systems	Production-nutrition link	How, and to what extent and under which conditions (or contextual factors) agriculture impacts nutrition in Nigeria?
17			How can farmers be persuaded, or incentivised produce foods not normally consumed in local diets that meet macro and micronutrient needs of the population?
18		Policy evaluation	To what extent does Nigeria's NSA policy instruments impact nutrition outcomes per target group, with special attention to women and young children, young children, and displaced persons?
19		Storage facilities and nutritious food	How can (the expansion of) cost effective storage facilities contribute to improve functioning of local and regional markets, and enhance availability of and accessibility to healthy foods? At which level should storage facilities be needed (e.g. farm, LGA, State)?
20			How do farmers store more nutritious foods before they get picked up to go to market?
21		Infrastructure	What are the most cost-effective modes and direction of transporting nutritious foods?
22			What types of investment would be the most cost effective in improving accessibility of nutritious foods, and who will be the main beneficiaries?
23		Food transformation system	What value chains for nutritious foods have comparative advantage in each state? How do food flows for nutritious foods work across states in Nigeria?
24		Nutritional outcomes of value chains	What are requirements for value chains to be successful at delivering substantive and sustained consumption of nutrient-dense foods to poor households?
25		Role of agro-processing	How can new investments in agro-processing contribute to adding nutritional value? How can existing government policies stimulate food industries to supply nutritious foods? How can local, state, and federal policies be aligned to stimulate food industries for supplying nutritious food?
26		Food retail and provision	Which food retail outlets can 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?
27	Drivers	Biophysical drivers	What is needed in terms of restoration and conservation of Nigeria's over-exploited ecology and soil system to support healthier diets?
28		Biophysical drivers	How can the resilience of Nigerian agriculture and food system be strengthened in the face climate change impacts, drought, floods and other shock/disaster?
29		Demographic drivers	How to nourish the expanding population in urban centres? How much food can be produced in (peri-) urban agriculture and how to best organize logistics and linkages to rural production centres?

S/N	Chapter	Issue	Research Questions
30		Demographic drivers	What is the impact of rural-to-urban migration and internal displacement on the food systems in the locations of origin and destination?
31		Economic drivers	What current links between purchasing power and food consumption patterns could be the basis for predictions on consumer purchasing power and dietary change under various scenarios in the future?
32		Economic drivers	How will the costs of a recommended healthy diet evolve, at national and regional level to recognize differences in prices and consumption patterns?
33		Economic drivers	What is the total value added of Nigeria's food system; what is it composed of; and how much does the food system GDP extend beyond agricultural GDP? Can food system GDP contribution to total GDP be used to monitor the evolution of the food system over time?
34		Economic drivers	How would macroeconomic (in)stability and economic restructuring benefit the modernization and restructuring of agriculture and food supply chains?
35		Cultural drivers	How will the aspirations for a western diet and for convenience affect current and future food choice?
36		Political drivers	What changes to the existing agricultural policy framework will facilitate a transformation of the agriculture and food system towards healthier food choice and diets?
37	Synergies and trade-offs	Food system outcomes	What are 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 economic growth? What are climate change policies that have impact on food system?
38			What is the opportunity cost of increasing farm level diversity, in terms of forgone net-revenue on farm production, in keeping nutrition objectives in view or by adopting environmentally sustainable production technologies for the sustainability of healthier food system?
39			What is the marginal willingness to keep to food safety standards?

REFERENCES

- Aaron, G. J., Friesen, V. M., Jungjohann, S., Garrett, G. S., Neufeld, L. M., & Myatt, M. (2017). Coverage of Large-Scale Food Fortification of Edible Oil, Wheat Flour, and Maize Flour Varies Greatly by Vehicle and Country but Is Consistently Lower among the Most Vulnerable: Results from Coverage Surveys in 8 Countries. *J.Nutr*, *147*, 984S-994S.
- Abdullahi, D. & John, M. S. (2014). The Political will and Quality Basic Education in Nigeria. *Journal of Power, Politics & Governance*, 75-100.
- Abdullateef, U. & Ijaiya, A. T. (2010). Agricultural trade liberalization and food security in Nigeria. *Journal of Economics and International Finance*, *2*(12), 299-307.
- Abidoye, R. O. & Akinpelumi, B. O. (1997). Implications of Nutritional Beliefs and Taboos - Hausa and Yoruba Pregnant Women in Lagos Nigeria. *Early Child Development and Care*, *138*(1), 71-81.
- Adegboye, O. R., Smith, C., Anang, D., & Musa, H. (2016). Comparing and Contrasting Three Cultural Food Customs from Nigeria and Analyzing the Nutrient Content of Diets from These Cultures with the Aim of Proffering Nutritional Intervention. *Crit Rev Food Sci Nutr*, *56*(15), 2483-2494. doi:10.1080/10408398.2013.862201
- Adelekan, I., Olajide-Taiwo, L., Ayorinde, A., Ajayi, D., & Babajide, S. (2014). Building Urban Resilience: Assessing Urban and Peri-Urban Agriculture in Ibadan, Nigeria. In J. Padgham, & J. Jabbour. Nairobi, Kenya: United Nations Environment Programme (UNEP). Retrieved from <http://www.start.org/upa/ibadan.pdf>
- Adeyeba, A. O. (2014). Storage, Preservation and Processing of Farm Produce. *Food Science and Quality Management*, *27*, 28-32.
- Adeyemi, O. & Shittu, O. (2017). Designing Nutrition-Sensitive Agriculture Value Chain Projects: Nutrition Assessment and Commodity Selection in Nigeria.
- Adjognon, S. G., Liverpool-Tasie, L., & Reardon, T. (2017). Agricultural input credit in Sub-Saharan Africa: telling myth from facts. *Food Policy*, *67*, 93-105. doi:10.1016/j.foodpol.2016.09.014
- AFD. (2011). *Rainfed Foodcrops in West Africa and Central Africa. Points for Analysis and Proposals for Action*. Paris: AFD-Cirad-Fida.
- AfDB. (2011). *The Middle of the Pyramid, Dynamics of the Middle class in Africa*. Retrieved from www.afdb.org
- Afolabi, W., Towobola, S., Oguntona, C., & Olayiwola, I. O. (2013). Pattern of fast food consumption and contribution to nutrient intake of Nigerian University Students. *International Journal of Education and Research*, *1*(5), 1-10. Retrieved October 17, 2017, from <http://ijern.com/images/May-2013/03.pdf>
- Agronigeria. (2017, January 17). Retrieved from Agronigeria: <https://agronigeria.ng/2017/01/17/fg-inaugurates-inter-ministerial-agriculturenutrition-working-group/>
- Agwu, A. E., Dimelu, M. U., & Madukwe, M. C. (2018). Innovation system approach to agricultural development: Policy implications for agricultural extension delivery in Nigeria. *African Journal of Biotechnology*, *7*(11), 1604-1611. Retrieved from <http://www.academicjournals.org/AJB>

- Ajani, E. N. & Igbokwe, E. M. (2014). A Review of Agricultural Transformation Agenda in Nigeria: The Case of Public and Private Sector Participation. *Research Journal of Agriculture and Environmental Management*, 3(5), 238-245. Retrieved from <http://www.apexjournal.org>
- Ajani, S. (2010). An assessment of dietary diversity in six Nigerian States. *African J Biomed Res*, 13(3), 161-167. Retrieved October 19, 2017, from <https://www.ajol.info/index.php/ajbr/article/view/95212/84559>
- Aker, J. C., Klein, M. W., O'Connell, S. A., & Yang, M. (2010). Borders, ethnicity and trade. *NBER Working Paper Series*(15960). Retrieved from <http://www.nber.org/papers/w15960>
- Akerele, D. (2019). Food away from home in Nigeria: consumption, drivers, and nutritional implications of within-day meals. *ANH 2019 Research Conference*. Retrieved from <https://anh-academy.org/anh2019-research-conference-videos>
- Akerele, D. & Shittu, A. M. (2015). Diverse Farm Systems Influence Food Consumption Diversity in Rural Nigeria: Issues For Policy Consideration and Implications for Nigeria's Food Systems. *Proceeding of the National Conference of Agricultural Economists held at Kano State University of Science and Technology*, (pp. 227-232). Wudil.
- Akerele, D. & Shittu, A. M. (2017). Can food production diversity influence farm households' dietary diversity? An appraisal from two-dimensional food diversity measures. *International Journal of Social Economics*, 44(12), 1597-1608.
- Akindutire, I. & Konwea, P. (2013). Consumption of fast food and dietary self-efficacy of university undergraduates in Nigeria. *Int J Heal Promot Educ*, 51(3), 144-150. doi:10.1080/14635240.2012.758882
- Akinyele, I. O. (2009). *Ensuring food and nutrition security in rural Nigeria: an assessment of the challenges, information needs, and analytical capacity*. International Food Policy Research Institute (IFPRI). Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.225.4529&rep=rep1&type=pdf>
- Akpyomare, O. B., Adeosun, L. P., & Ganiyu, R. A. (2012). The influence of product attributes on consumer purchase decision in the Nigerian food and beverages industry: A study of Lagos metropolis. *American Journal of Business and Management*, 1(4), 196-201.
- Alamu, O., Amao, A. O., Nwokedi, C., Oke, O., & Lawal, I. (2013). Diversity and nutritional status of edible insects in Nigeria: A review. *Int J Biodivers Conserv*, 215-222. doi:10.5897/IJBC12.121
- Ali, J., Sanjeev, K. & Janakiraman, M. (2010). Buying behaviour of consumers for food products in an emerging economy. *British Food Journal*, 112(2), 109-124.
- Alkerwi, A. (2014). Diet quality concept. *Nutrition*, 30(6), 613-618. doi:10.1016/j.nut.2013.10.001.
- Allen, T., Heinrigs, P., & Heo, I. (2018). Agriculture, food and jobs in West Africa. *West African Papers No 14*. doi:<https://doi.org/10.1787/dc152bc0-en>
- Alves, d., Cardos, R. C., Goes, J. A., Santos, J. N., Ramos, F. P., & Bispo, d. R. (2014). Street Food on the Coast of Salvador, Bahia, Brazil: A Study from the Socio-economic and Food Safety Perspectives. *Food Control*, 40, 78-84.

- Amiegbebbhor, D. E. & Dickson, O. F. (2014). Review of Modal Transport Operations in Nigeria. *International Journal of Scientific & Engineering Research*, 5(7). Retrieved from <https://www.ijser.org/paper/Review-of-Modal-Transport-Operations-in-Nigeria.html>
- Angel-Urdinola, D. & Wodon, Q. (2010). Income Generation and Intra-Household Decision Making: A Gender Analysis for Nigeria. In J. S. Arbache, A. Kolev, & E. Filipiak, *Gender Disparities in Africa's Labor Markets* (pp. 381-406). Washington DC: World Bank.
- Apejaye, A. (2013). Influence of Celebrity Endorsement of Advertisement on Students' Purchase Intention. *Journal of Mass Communication and Journalism*. doi:10.4172/2165-7912.1000152
- Arimah, B. C. (1994). The nature and determinants of inequalities in housing amenities. In E. O. Albert, *Urban Management and Urban Violence in Africa*. (pp. 119-131). Ibadan: IFRA.
- Arimah, B. C. (2001). *Slums as expressions of social exclusion: Explaining the prevalence of slums in African Countries*. UN Habitat.
- Arndt, C., Chuku, C., Adedeji, A., Morakinyo, A., Victor, A., George, M., & Chukwuka, O. (2018). Nigeria's Macroeconomic Crisis Explained. *Nigeria STRATEGY SUPPORT PROGRAM | WORKING PAPER 52*.
- Aromolaran, A. B. (2010). Does increase in women's income relative to men's income increase food calorie intake in poor households? Evidence from Nigeria. *Agricultural Economics*, 41(3-4), 239-249.
- Arulogun, O. S. & Owolabi, M. O. (2011). Fast food consumption pattern among undergraduates of the University of Ibadan: Implications for Nutrition Education. *Journal of Agriculture, Food and Technology*, 1(6), 89-93.
- Arzoaquoi, S. K. (2014). Common Food Taboos and Beliefs During Pregnancy in Yilo Krobo District, Ghana. *Thesis (MPH) - University of Ghana*. Retrieved from <http://ugspace.ug.edu.gh/handle/123456789/5904>
- Asemah, E. S., Edegoh, L. O., & Ojih, E. U. (2013). Audience perception of portrayal of women in television advertising. *An International Journal of Language, Literature and Gender Studies*, 21-37.
- Assessment of Nigeria Agricultural Policy (ANAP). (2005). *Agriculture in Nigeria: Identifying Opportunities for increased commercialization and investment*. Ibadan: IITA press.
- ASTI (Agricultural Science and Technology Indicators). (2014). *Agricultural R&D Indicators. Factsheet: Nigeria*. Washington D.C: ASTI.
- Ayuba, I. & Ayuba, L. (2015). The Effect of Internal Displacement and Variation in Crop Production in Barkin Ladi Local Government Area of Plateau State. *Journal of Environment and Earth Science*, 6, 35-40.
- Bello-Schünemann, J. & Porter, A. (2017). *Building the future Infrastructure in Nigeria until 2040*. Institute for Security Studies. Retrieved from <https://pardee.du.edu/sites/default/files/Nigerian%20Infrastructure%20.pdf>
- Benson, T. (2008). *Improving nutrition as a development priority: Addressing undernutrition in national policy processes in sub-Saharan Africa*. Washington DC: International Food Policy Research Institute. Retrieved from http://pdf.usaid.gov/pdf_docs/pnadl364.pdf

- Blein, T., Pulido, A., Vialette-Guiraud, A., Nikovics, K., Morin, H., Hay, A., . . . Laufs, P. (2008). A conserved molecular framework for compound leaf development. *Science*, 322, 1835-1839.
- Block, S. A. (2007). Maternal nutrition knowledge versus schooling as determinants of child micronutrient status. *Oxford Economic Papers*, 59(2), 330-353.
- Buttel, F. H. (2003). Internalizing the Societal Costs of Agricultural Production. *Plant Physiol*, 133(4), 1656–1665.
- Carletto, C., Corral, P., & Guelfi, A. (2017). Agricultural commercialization and nutrition revisited: Empirical evidence from three African countries. *Food Policy*, 67, 106-118.
- CBN (Central Bank of Nigeria) and IFC (International Finance Corporation). (2017). *The credit crunch. How the use of moveable collateral and credit reporting can help finance inclusive growth in Nigeria*.
- CFAO, BearingPoint and IPSOS. (2016). *Middle classes in Africa*. Retrieved from www.cfaogroup.com
- Chibuike, N., Okaka, J., & Okoli, E. (2013). Evaluation of vegetable consumption in South Eastern Nigeria. 57-60. doi:10.5897/IJNAM2013.0142
- Chokor, B. A. (1986). City profile – Ibadan. *Cities* 3, 106-116.
- Cruwys, T., Platow, M. J., Angullia, S. A., Chang, J. M., Diler, S. E., Kirchner, J. L., et al. (2012). Modeling of food intake 438 is moderated by salient psychological group membership. *Appetite*, 58(2), 754-757.
- CTA (Technical Center for Agricultural and Rural Cooperation). (2011). *A Case Study Report on Nigeria's Agricultural Extension and Advisory System*. Wageningen: CTA.
- Dake, F. A., Thompon, A. L., Ng, S. W., Agyei-Mensah, S., & Codjoe, S. N. (2016). The Local Food Environment and Body Mass Index among the Urban Poor in Accra, Ghana. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, 93(3), 438-455.
- de Braw, A. & Herskowitz, S. (2020). Income Variability, Evolving Diets, and Elasticity Estimation of Demand for Processed Foods in Nigeria. *American Journal of Agricultural Economics*, 1-20. doi:10.1111/ajae.12139
- Development Initiatives. (2017). *Global Nutrition Report 2017: Nourishing the SDGs*. Bristol, UK: Development Initiatives Poverty Research Ltd.
- Development Initiatives. (2017). *Global Nutrition Report: Nourishing the SDGs*. Bristol, UK: Development Initiatives. Retrieved from https://globalnutritionreport.org/documents/2/Report_2017.pdf
- Dholakia, U. M. & Talukdar, D. (2004). How social influence affects consumption trends in emerging markets: An empirical investigation of the consumption convergence hypothesis. *Psychology & Marketing*, 21(10), 775-797.
- Dillon, M., McGee, K., & Oseni, G. (2014). Agricultural production, dietary diversity, and climate variability. *Policy Research Working Paper No 7022*. Retrieved February 15, 2016, from <http://documents.worldbank.org/curated/en/984981468159331083/pdf/WPS7022.pdf>
- DLEC (Developing Local Extension Capacity) Project. (2017). *Nigeria: In-depth Assessment of Extension and Advisory Services*. Care, Digital Green, IFPRI and USAID.

- Ecker, O., Andrew, C., Raphael, B., & Andam, K. (2020). *Poor dietary quality is Nigeria's key nutrition problem*. East Lansing: Michigan State University. doi:10.2499/p15738coll2.133738
- Egunjobi, L. (1999). Our Gasping Cities. *An Inaugural Lecture delivered at the University of Ibadan*.
- Ekwochi, U., Osuorah, C. D., Ndu, I. K., Ifediora, C., Asinobi, I. N., & Eke, C. B. (2016). Food taboos and myths in South Eastern Nigeria: The belief and practice of mothers in the region. *Journal of Ethnobiology and Ethnomedicine*, 12(7), 1-6. doi:10.1186/s13002-016-0079-x
- Ekwueme, A. C. & Okoro, N. (2018). Analysis of the Use Of Social Media Advertising among Selected Online Businesses in Nigeria. *International Journal of International Relations, Media and Mass Communication Studies*, 4(2), 28-43.
- Ekwueme, C. A. & Okoro, N. (2018). Analysis of the use of social media advertising among selected online businesses in Nigeria. *International Journal of International Relations, Media and Mass Communication Studies*, 4(2), 28-43.
- Ene-Obong, H., Sanusi, R., Udenta, E., Williams, I. O., Anigo, K. M., Chibuzo, E. C., . . . Davidson, G. I. (2013). Data collection and assessment of commonly consumed foods and recipes in six geopolitical zones in Nigeria: Important for the development of a National Food Composition Database and Dietary Assessment. *Food Chemistry*, 140(3), 539-546. doi:10.1016/j.foodchem.2013.01.102
- Erhunmwunse, N. O., Dirisu, A., & Olomukoro, J. O. (2012). Implications of pesticide use in Nigeria. *Tropical Freshwater Biology*, 21(1), 15-25.
- Essien, A. G., Alonge, S. C., Etop, E. E., & Adinya, I. B. (2008). Consumer Preference for Different Poultry Species in Calabar. *Proceedings of the conference of World's Poultry Congress 30th-4th July, 2008*. Brisbane, Australia.
- Essien, S. N., Uyaabo, S. O., & Omotosho, B. S. (2017). Exchange Rate Misalignment under Different Exchange Rate Regimes in Nigeria. Central Bank of Nigeria. *Journal of Applied Statistics*, 8(1).
- Euromonitor Grocery retailers in Nigeria. (2016).
- Fadare, O., Amare, M., Mavrotas, G., Akerele, D., & Ogunniyi, O. (2017). Mother's Nutrition-related Knowledge and Child Nutrition Outcomes: Empirical Evidence from Nigeria.
- Fadare, O., Amare, M., Mavrotas, G., Akerele, D., & Ogunniyi, O. (2017). Mother's Nutrition-related Knowledge and Child Nutrition Outcomes: Empirical Evidence from Nigeria.
- Fagbuaro, O., Oso, J. A., Edward, J. B., & Ogunleye, R. F. (2006). Nutritional status of four species of giant snails in Nigeria. *Zhejiang Univ. Sci. B*, 686-689.
- FAO. (1992). *Risk analysis in dryland farming systems*. Rome: FAO.
- FAO. (2007). *Promises and Challenges of the Informal Food Sector in Developing Countries*. Rome: Food and Agriculture Organization. Retrieved May 20, 2013
- FAO. (2014). *FAOSTAT*. Retrieved from Food and Agricultural Organization of the United Nations: <http://faostat.fao.org/default.aspx>.
- FAO. (2016). *Influencing food environments for healthier diets*. Rome: Food and Agriculture Organization of the United Nations. Retrieved from <http://www.fao.org/3/a-i6491e.pdf>

- Federal Ministry of Health. (2014). *National Strategic Plan of Action for Nutrition (2014 – 2019): Health Sector Component of National Food and Nutrition Policy*. Federal Ministry of Health. Retrieved from <https://www.health.gov.ng/doc/NSPAN.pdf>
- Fellows, P. & Hilmi, M. (2011). Selling street and snack foods. *Diversification booklet number 18 Rural Infrastructure and Agro-Industries Division*.
- FGN. (2014). *National Strategic Plan of Action for Nutrition: 2014 - 2019*. Abuja, Nigeria: Federal Ministry of Health.
- FGN. (2016). *North East Nigeria Recovery and Peace Building Assessment*. Abuja, Nigeria & Washington DC: Federal Government of Nigeria & World Bank.
- Fieldhouse, P. (1995). *Food and Nutrition: Customs and Culture* (2 ed.). Chapman & Hall Ltd. Retrieved from <http://www.cabdirect.org/abstracts/19951409845.html>
- Fieldler, Y. & Iafrate, M. (2016). *Trends in foreign direct investment in food, beverages and tobacco*. Rome: Food and Agricultural Organization of the United Nations.
- Fiorini, R., Hattingh, D., Maclaren, A., Russo, B., & Sun-Basorun, A. (2013). Africa's growing giant: Nigeria's new retail economy. Retrieved 02 23, 2018, from <https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/africas-growing-giant-nigerias-new-retail-economy>
- FMANR. (1997). *National Agricultural Research Strategy Plan: 1996-2010*. Department of Agricultural Sciences, Federal Ministry of Agriculture and Natural Resources (FMANR).
- FMARD (Federal Ministry of Agriculture and Rural Development). (2016). *The Agricultural Promotion Policy (2016-2020): Building on the successes of ATA, Closing Key Gaps*. Abuja FCT, Nigeria: Policy and Strategy Document. Retrieved from http://fmard.gov.ng/wp-content/uploads/2016/03/2016-Nigeria-Agric-Sector-Policy-Roadmap_June-15-2016_Final.pdf
- FMARD. (2016). *Mycotoxin study in sorghum*. Federal Ministry of Agriculture and Rural Development (FMARD), Project Report by Goldagric Nigeria Limited.
- FMARD. (2016). *The Agricultural Promotion Policy (2016-2020): Building on the successes of ATA, Closing Key Gaps*. Abuja FCT, Nigeria: Federal Ministry of Agriculture and Rural Development. Retrieved from http://fmard.gov.ng/wp-content/uploads/2016/03/2016-Nigeria-Agric-Sector-Policy-Roadmap_June-15-2016_Final.pdf.
- FMARD. (2017). *Agricultural Sector Food Security and Nutrition Strategy 2016 – 2025*. Abuja: Federal Ministry of Agriculture and Rural Development. Retrieved from https://www.nesgroup.org/storage/app/public/policies/Agriculture-FSN-Strategy-2016-25_Printed-Version_1562696265.pdf
- Frances, M. A. & Salisu, M. (2003). Relying on Nature: Wild Foods in Northern Nigeria. *AMBIO: A Journal of the Human Environment*, 32(1), 24-29. doi:10.1579/0044-7447-32.1.24
- Funge-Smith, S. J. (2018). *Review of the State of the World Fishery Resources: Inland Fisheries*. Rome: Food and Agriculture Organization. Retrieved from <http://www.fao.org/3/ca0388en/CA0388EN.pdf>

- GAIN. (2013). *Nigeria Food Processing Ingredients Market*. Global Agricultural Information Network. Retrieved February 21, 2020, from https://apps.fas.usda.gov/newgainapi/api/report/downloadreportbyfilename?filename=Food%20Processing%20Ingredients_Lagos_Nigeria_11-20-2013.pdf
- Glew, R., Conn, C., Vanderjagt, T. A., Calvin, C. D., Obadofin, M. O., Crossey, M., & Vanderjagt, D. J. (2004). Risk Factors for Cardiovascular Disease and Diet of Urban and Rural Dwellers in Northern Nigeria. *J Heal Popul Nutr.*, 22(4), 357-369. Retrieved September 12, 2017, from <http://imsear.li.mahidol.ac.th/bitstream/123456789/879/2/jhpn2004v22n4p357.pdf>
- Global Panel. (2017a). *Food environments: a new approach on nutrition in Nigeria*. Global Panel on Agriculture and Food Systems for Nutrition (GloPAN). Retrieved from Global Panel of Agriculture and Food Systems for Nutrition: <https://www.glopan.org/sites/default/files/Downloads/Global%20Panel%20PRESS%20RELEASE%2010%20May%202017.pdf>
- Global Panel. (2017b). *Improving nutrition through enhanced food environments*. London, UK: Global Panel on Agriculture and Food Systems for Nutrition. Retrieved from <https://glopan.org/sites/default/files/FoodEnvironmentsBrief.pdf>
- Global Panel on Agriculture and Food Systems for Nutrition (GLOPAN). (2016). *Food systems and diets: Facing the challenges of the 21st century*. London, UK. Retrieved from <https://glopan.org/sites/default/files/ForesightReport.pdf>
- Globalization, c. (2018). Retrieved June 27, 2018, from Encyclopaedia Britannica: <http://search.eb.com/eb/article-9344667https://www.britannica.com/science/cultural-globalization>
- GLOPAN. (2016). *Food systems and diets: facing the challenges of the 21st*. London. Retrieved from <http://glopan.org/sites/default/files/ForesightReport.pdf>
- GLOPAN. (2016). *The Cost of Malnutrition: Why Policy Action is Urgent*. Global Panel on Agriculture and Food Systems for Nutrition.
- Gomatee, D., Waseem, S., & Ashraf, A. (2013). An empirical analysis of status of food security among vulnerable rural classes of Bulandshahr district. *International Journal of Agriculture and Food Science Technology*, 4(8), 751-762.
- Gomez, M. I. & Ricketts, K. D. (2013). Food value chain transformations in developing countries: Selected hypotheses on nutritional implications. *Food Policy*, 42(C), 139-150.
- Gourichon, H. (2013). Analysis of Incentives and Disincentives for Sugar in Nigeria. *Technical Notes Series MAFAP*. Retrieved September 12, 2017, from <https://agriknowledge.org/downloads/k643b122s>
- Haddad, L. (2017). The state of nutrition in Nigeria: From security threat to economic imperative. Retrieved from <https://www.gainhealth.org/knowledge-centre/state-nutrition-nigeria-security-threat-economic-imperative/>
- Hart, A., Azubuike, C., Barimalaa, I., & Achinewhu, S. (2005). Vegetable consumption pattern of households in selected areas of the old Rivers State in Nigeria. *African J Food Agric Nutr Dev*. Retrieved August 29, 2017, from <http://www.bioline.org.br/pdf?nd05006>.

- Hatzenbuehler, P. L., Abbott, P. C., & Abdoulaye, T. (2017). Price Transmission in Nigerian Food Security Crop Markets. *Journal of Agricultural Economics*, 68, 143-163. Retrieved from <https://doi.org/10.1111/1477-9552.12169>
- Herforth, A., Frongillo, E., Sassi, F., Mireille, S. M., Arabi, M., Tirado, C., . . . Pingali, P. (2014). Toward an integrated approach to nutritional quality, environmental sustainability, and economic viability: research and measurement gaps. *Ann N Y Acad Sci.*, 1332(1), 1-21. doi:10.1111/nyas.12552.
- Hillbruner, C. & Egan, R. (2008). Seasonality, household food security, and nutritional status in Dinajpur, Bangladesh. *Food Nutr Bull*, 29(3), 221-231.
- His Excellency Chief Olusegun Obasanjo. (2016). *Synthesis report of the Nigeria Zero Hunger strategic review*. Ibadan, Nigeria: International Institute of Tropical Agriculture.
- HLPE. (2017). *Nutrition and food systems*. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome.
- IFPRI. (2015). *Global Nutrition Report 2015: Actions and Accountability to Advance Nutrition and Sustainable Development*. Washington D.C: International Food Policy Research Institute (IFPRI).
- IFPRI. (2017). *2017 Global Food Policy Report*. Washington DC: International Food Policy Research Institute. Retrieved from <https://doi.org/10.2499/9780896292529>
- Igwe, H. I. (2008). Effects of selected macroeconomic policies on the output of some major food crops in Nigeria. *Unpublished M.Sc Thesis, University of Calabar*.
- Ingenbleek, L., Hu, R., Pereira, L., Paineau, A., Colet, I., Kone, A. Z., . . . Le Bizec, B. (2019a). Sub-Saharan Africa total diet study in Benin, Cameroon, Mali and Nigeria: Pesticides occurrence in foods. *Food Chemistry*, X(2), 100034. doi:10.1016/j.fochx.2019.100034
- Ingenbleek, L., Sulyok, M., Adegboye, A., Hossou, S. E., Kone, A. Z., Oyedele, A. D., . . . Krska, R. (2019b). Regional sub-saharan africa total diet study in benin, cameroon, mali and nigeria reveals the presence of 164 mycotoxins and other secondary metabolites in foods. *Toxins*, 11(1), 54. doi:10.3390/toxins11010054
- Johnson, M. E. & Dorosh, P. A. (2015). *Optimal tariffs with smuggling: A spatial analysis of Nigerian rice policy options*. International Food Policy Research Institute.
- Kesinro, O. R. & Oyende, A. A. (2015). Product Brand Package and Consumer Purchase Behaviour in Food and Beverages Industry of Lagos State Nigeria. *International Journal of Management and Commerce Innovations*, 3(2), 511-519.
- Kimenyi, M., Adibe, J., Djire, M., Jirgi, A. J., Kergna, A., Deressa, T. T., . . . Westbury, A. (2014). *The impact of conflict and political instability on agricultural investments in Mali and Nigeria*. Brookings Institution Africa Growth Initiative Working Paper, 17. Retrieved from https://www.brookings.edu/wp-content/uploads/2016/06/14-07-22-Impact-of-Conflict-MaliNigeria_FINAL.pdf
- Klapwijk, C. J., van Wijk, M. T., Rosenstock, T. S., van Asten, P. J., Thornton, P. K., & Giller, K. E. (2014). Analysis of trade-offs in agricultural systems: current status and way forward. *Current Opinion in Environmental Sustainability*, 6, 110-115. doi:10.1016/j.cosust.2013.11.012

- Kolding, J., Van Zwieten, P., Marttin, F., Funge-Smith, S., & Poulain, F. (2019). *Freshwater small pelagic fish and their fisheries in the major African lakes and reservoirs in relation to food security and nutrition*. Rome: FAO. Retrieved from www.fao.org/publications
- Kuku-Shittu, O., Mathiassen, A., Wadhwa, A., Myles, L., & Akeem, A. (2013). *Comprehensive food security and vulnerability analysis: Nigeria*. IFPRI Discussion Paper No. 01275. doi:10.2139/ssrn.2310014
- Lachat, C., Eunice, N., Dominique, R., Michelle, H., Karlien, S., & et. (2014). Developing a Sustainable Nutrition Research Agenda in Sub-Saharan Africa—Findings from the SUNRAY Project. *PLoS Med*, 11(1), 1-7.
- Lant, T. K. (1992). Aspiration Level Adaptation: An Empirical Exploration. *Management Science*, 38, 623-644.
- Lawal-Adebowale, A. O. (2013). ICT in Agricultural Development: Its Diffusion and Adoption Pattern in Nigeria's Agricultural System. In *E-Agriculture and Rural Development: Global Innovations and Future Prospects* (p. 8). doi:10.4018/978-1-4666-2655-3.ch006
- Lipton, M. (2005). Can Small Farms Survive, Prosper, or be the key Channel to Cut Mass Poverty? *FAO Symposium on Agricultural Commercialization and The Small Farmer*. Rome.
- Liverpool-Tasie, L. S., Adjognon, S. G., & Reardon, T. A. (2016). Transformation of the food system in Nigeria and female participation in the Non-Farm Economy (NFE). *Agricultural & Applied Economics Association Annual Meeting*. Boston, Massachusetts.
- Lo, M., Narulita, S., & Ickowitz, A. (2019). The relationship between forests and freshwater fish consumption in rural Nigeria. *PLOS ONE*, 1-15.
- Lyon, F. & Porter, G. (2009). Market institutions, trust and norms : exploring moral economies in Nigerian food systems. *Cambridge Journal of Economics*, 33(5), 903-920.
- Maduforo, A. N. (2010). Superstitions and nutrition among pregnant women in Nwangele local government area of Imo state, Nigeria. *Journal of Research in National Development*. Retrieved from <https://www.ajol.info/index.php/jorind/article/view/66832>
- Maestre, M., Poole, N., & Henson, S. (2017). Assessing food value chain pathways, linkages and impacts for better nutrition of vulnerable groups. *Food Policy*, 68, 31-39. doi:<http://dx.doi.org/10.1016/j.foodpol.2016.12.007>
- Mainali, B., Luukkanen, J., Silveira, S., & Kaivo-oja, J. (2018). Evaluating Synergies and Trade-Offs among Sustainable Development Goals (SDGs): Explorative Analyses of Development Paths in South Asia and Sub-Saharan Africa. *sustainability*, 10(815), 1-25.
- Malabo Montpellier Panel report. (2017). Country case study, Nigeria, Dakar.
- Matemilola, S. & Elegbede, I. (2017). The Challenges of Food Security in Nigeria. *Open Access Library Journal*, 4(12), 1-22.
- Maxwell, S. & Slater, R. (2013). Food Policy Old and New. *Development Policy Review*, 21(5-6), 531-553.
- Maziya-Dixon, B. & Yusuf, M. A. (2020). *A4NH-CCE NIGERIA Summary Situation Analysis and Support to Flagship Programmes*. Unpublished Report.

- Maziya-Dixon, B., Akinyele, I., Oguntona, E., Nokoe, S., Sanusi, R., & Harris, E. (2004). *Nigeria Food Consumption and Nutrition Survey 2001-2003: Summary*. International Institute of Tropical Agriculture.
- MB&NP. (2016). *National Policy on Food and Nutrition in Nigeria*. Abuja: Ministry of Budget and National Planning (MB&NP).
- Mekonnen, D. A., Talsma, E. F., Trijsburg, L., Linderhof, V., Achterbosch, T., & Brouwer, I. D. (2019). Food consumption patterns, nutrient adequacy and the food systems in Nigeria. *African Association of Agricultural Economists (AAAE) 2019 Sixth International Conference, September 23-26*. Abuja, Nigeria. doi:10.22004/ag.econ.295844
- Mezue, K. (2014). The increasing burden of hypertension in Nigeria - can a dietary salt reduction strategy change the trend? *Perspect Public Health, 134*(6), 346-352. doi:10.1177/1757913913499658
- Michael, E. J. & Masias, I. (2016). *Assessing the state of the rice milling sector in Nigeria: The role of policy for growth and modernization*. IFPRI.
- Ministry of Budget & National Planning. (2017). *Economic Recovery & Growth Plan*. Abuja, Nigeria: Ministry of Budget & National Planning. Retrieved from https://nigeriaembassygermany.org/mosaic/_M_userfiles/Economic-Recovery-Growth-Plan-2017-2020.pdf
- Ministry of Budget and National Planning. (2016). *National Policy on National Policy on Food and Nutrition food in Nigeria*. Retrieved from https://nesgroup.org/storage/app/public/policies/National-Policy-on-Food-Nutrition-in-Nig_2016_1562697177.pdf
- Moss, B. (2008). Water pollution by agriculture. *Philos Trans R Soc Lond B Biol Sci, 363*(1491), 659–666.
- NAERLS and FDAE. (2015). *Agricultural Performance Survey Report of 2015 Wet Season in Nigeria*. Zaria: NAERLS Press, Ahmadu Bello University.
- NAERLS and FDAE. (2017). *Agricultural Performance Survey Report of 2015 Wet Season in Nigeria*. Zaria: NAERLS Press, Ahmadu Bello University.
- National Population Commission (NPC) and ICF. (2019). *Nigeria Demographic and Health Survey 2018*. Abuja, Nigeria and Rockville, Maryland, USA: NPC and ICF. Retrieved from <https://dhsprogram.com/pubs/pdf/FR359/FR359.pdf>
- NBS (National Bureau of Statistics). (2020). *2019 Poverty and Inequality in Nigeria*. Abuja, Nigeria: National Bureau of Statistics. Retrieved from <http://nigerianstat.gov.ng/download/1092>
- NBS. (2012). *Consumption pattern in Nigeria 2009/10: preliminary report (2012)*. Retrieved from <http://www.nigerianstat.gov.ng/>
- Njoku, K. L., Ezeh, C. V., Obidi, F. O., & Akinola, M. O. (2017). Assessment of Pesticide Residue Levels in Vegetables sold in some Markets in Lagos State, Nigeria. *Nig. J. Biotech, 32*, 53-60.
- NMMB (Nigerian Market Monitoring Bulletin). (2017). FEWS NET. Retrieved from https://reliefweb.int/sites/reliefweb.int/files/resources/NMMB_12042017_final_4.pdf

- Nnadi, F. N., Chikaire, J., Atoma, C. N., Egwuonwu, H. A., & Echetama, J. A. (2012). Ict for Agriculture Knowledge Management in Nigeria: Lessons and Strategies for Improvement. *Science Journal of Agricultural Research & Management*, 8.
- NPC(National Population Commission) and ICF International. (2014). *Nigeria Demographic and Health Survey (NDHS) 2013*. Abuja, Nigeria & Rockville, Maryland, USA: National Population Commission and ICF International.
- Nunes, B. N., Cruz, A. G., Faria, J. A., Ana, A. S., Silva, R., & Moura, M. R. (2010). A Survey on the Sanitary Condition of Commercial Foods of Plant Origin Sold in Brazil. *Food Control*, 21, 50-54.
- Nurudeen, A. A., Lawal, A. O., & Ajayi, S. A. (2014). A Survey of Hygiene and Sanitary Practices of Street Food Vendors in the Central State of Northern Nigeria. *Journal of Public Health and Epidemiology*, 6(5), 174-181.
- Nwuneli, N., Robinson, E., Humphrey, J., & Henson, S. (2014). The role of businesses in providing nutrient-rich foods for the poor: two case studies in Nigeria. *Institute of Development Studies/ Sahe Capital Partners and Advisory Ltd*.
- Nzeka, U. M. (2011). *Steady growth of Nigeria's retail food sector*. GAIN report United States.
- Nzeka, U. M. (2013). *Nigeria food processing ingredients market*. United States: Global Agricultural Information Network (GAIN) Report, USDA Foreign Agricultural Service. Retrieved from https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Food%20Processing%20Ingredients_Lagos_Nigeria_11-20-2013.pdf
- Nzeka, U;. (2013). *Grain and feed annual report*. USDA Foreign Agricultural Service. Retrieved from http://grain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Annual_Lagos_Nigeria_5-23-2013.pdf
- Obi, K. O., Oniore, J. O., & Nnadi, K. U. (2016). The Impact of Exchange Rate Regimes on Economic Growth in Nigeria. *Journal of Economics and Sustainable Development*, 7(12), 115-127.
- Obi-Egbedi, O., Okoruwa, V. O., Aminu, A., & Yusuf, S. (2012). Effect of rice trade policy on household welfare in Nigeria. *European Journal of Business and Management*, 4(8), 160-170.
- Odozi, J. C. & Omonona, B. T. (2012). Governance options for price instability: A review of the food grain commodity in Nigeria. *Journal of Development and Agricultural Economics*, 4(4), 93-100.
- Ogbeide, O. (1974). Nutritional hazards of food taboos and preferences in Mid-West Nigeria. *American Journal of Clinical Nutrition*, 27, 213-216.
- Ogunmoyela, O. A., Adekoyeni, O., Aminu, F., & Umunna, L. O. (2013). A Critical Evaluation of Survey Results of Vitamin A and Iron Levels in the Mandatory Fortified Food Vehicles and Some Selected Processed Foods in Nigeria. *Nigerian Food Journal*, 31(2), 52-62.
- Oguntona, C. & Kanye, O. (1995). Contribution of Street Foods to Nutrient Intakes by Nigerian Adolescents. *Nutr Health*, 10(2), 165-171. doi:10.1177/026010609501000206
- Oguntona, C. & Tella, T. (1999). Street foods and dietary intakes of Nigerian urban market women. *Int J Food Sci Nutr*, 50, 383-390. Retrieved October 17, 2017, from <http://www.tandfonline.com/doi/pdf/10.1080/096374899100941?needAccess=true>
- Ogwude, I. C. (2011). Transport Infrastructure and Mobility in Nigeria. *JORIND*, 9(1), 456-467.

- Okeke, E. C., Eneobong, H. N., Uzuegbunam, A. O., Ozioko, A. O., & Kuhnlein, H. (2008). Igbo Traditional Food System: Documentation, Uses and Research Needs. *Pakistan Journal of Nutrition*, 7, 365-376.
- Okojie, P. W. & Isah, E. C. (2014). Sanitary conditions of food vending sites and food handling practices of street food vendors in Benin City, Nigeria: Implication for food hygiene and safety. *Journal of Environmental and Public Health*, 14. Retrieved from <http://dx.doi.org/10.1155/2014/701316>
- Olander, F. & ThOgersen, J. (1995). Understanding of consumer behaviour as a prerequisite for environmental protection. *Journal of consumer policy*, 18(4), 345-385. doi:10.1007/BF01024160
- Olise, M. C., Okoli, M. I., & Ekeke, J. N. (2015). Factors Influencing Customers Patronage of Fast Food Restaurants: A Study Of Selected Customers Of Fast Food In Anambra State, Nigeria. *International Journal of Economics, Commerce and Management*, III(11), 686-701.
- Olootu, A. O. & Awoseila, F. (2011).) Reinventing Business Growth through Franchising in Developing Economies: A Study of the Nigerian Fast Food Sector. *International Journal of Marketing Studies*, 3(1), 162-170.
- Olotewo, J. (2016). Social media marketing in emerging markets. *International Journal of Marketing Research*, 2(2), 10-19.
- Olotewo, J. (2016). Social media marketing in emerging markets. *International Journal of Marketing Research (IJOMR)*, 2(2), 10-19.
- Olukunle, O. T. (2013). Challenges and Prospects of Agriculture in Nigeria: The Way Forward. *Journal of Economics and Sustainable Development*, 4(16).
- Oluleke, M. O., Ogunwale, A. O., Arulogun, O. S., & Adelekan, A. L. (2016). Dietary intake knowledge and reasons for food restriction during pregnancy among pregnant women attending primary health care centers in Ile-Ife, Nigeria. *International Journal of Population Studies* .
- Olutayo, A. O. & Akanle, O. (2009). Fast Food in Ibadan: An Emerging Consumption Pattern. *Journal of International African Institute*, 7(2), 207-227.
- Oluwafemi, F. & Ibeh, I. (2011). Microbial contamination of seven major weaning foods in Nigeria. *J Health Popul Nutr*, 415-419. Retrieved October 19, 2017, from <http://www.ncbi.nlm.nih.gov/pubmed/21957681>
- Omemu, A. M. & Aderoju, S. T. (2008). Food Safety Knowledge and Practices of Street Food Vendors in the city of Abeokuta, Nigeria. *Food Control*, 19(4), 396-402.
- Omojokun, J. (2013). Regulation and Enforcement of Legislation on Food Safety in Nigeria, in: Mycotoxin and Food Safety in Developing Countries. doi:<http://dx.doi.org/10.5772/54423>
- Omotayo, R. K. & Denloye, S. A. (2009). The Nigeria Experience of Food Safety Regulations. *A Paper Presented at FAO/WHO Forum of Food Safety Regulations, Morocco*.
- Onuorah, C. E. & Ayo, J. A. (2003). Food taboos and their nutritional implications on developing nations like Nigeria – a review. *Nutrition & Food Science*, 33(5), 235-240. doi:10.1108/00346650310499767
- Onyeneho, S. N. & Hedberg, C. W. (2013). An Assessment of Food Safety Needs of Restaurants in Owerri, Imo State, Nigeria. *Int. J. Environ. Res. Public Health*, 10(8), 3296-3309. doi:[doi:doi.org/10.3390/ijerph10083296](http://dx.doi.org/10.3390/ijerph10083296)

- Onyibe, J. E. (2019). Rethinking Ag-sector development strategies towards zero hunger by 2030 in Nigeria. *Journal of Emerging Trends in Economics and Management Sciences*, 10(1), 12-23.
- Onyibe, J. E., Daudu, C. K., & Akpoko, J. G. (2005). Spatial distribution of farm plots and enterprise combination as tools for determination of extent of maize adoption in the Sudan Savannah. *WECAMAN 5th regional maize workshop*. IITA Calavi Station, Cotonou, Benin.
- Osaghae, V. (2015). Causes of Nigeria unrest and conflict situation. *Proceedings of the IRES 3rd International Conference*. Dubai, UAE. Retrieved from http://www.worldresearchlibrary.org/up_proc/pdf/50-143995964828-30.pdf
- Otugo, N. E., Uzegbunam, C. E., & Obikezie, C. O. (2015). Social media advertising/marketing: A study of awareness, attitude and responsiveness by Nigerian youths. *International Conference on Communication, Media, Technology and Design*. Dubai, UAE.
- Otugo, N. E., Uzegbunam, C. E., & Obikezie, C. O. (2015). Social media advertising/marketing: A study of awareness, attitude and responsiveness by Nigerian youths. *International Conference on Communication, Media, Technology and Design*. Dubai.
- Pittore, K. & Reed, P. (2016). Business and its role in improving nutrition: opportunities, challenges and solutions for Nigeria. Case studies and key messages from the workshop. *Institute of Development Studies/ Sahel Capital Partners and Advisory Ltd*.
- Posthumus, H., Just, D., Mona, D., Christine, P., & Gerard, B. (2018). *Enhancing food systems in Nigeria : Scope and perspective for Dutch policy interventions*. Amsterdam & The Hague: KIT and WUR.
- Poti, J. M., Mendez, M. A., Ng, S. W., & Popkin, B. M. (2015). Is the degree of food processing and convenience linked with the nutritional quality of foods purchased by US households? *Am J Clin Nutr.*, 101(6), 1251-62.
- Poulton, C., Dorward, A., & Kydd, J. (2005). The Future of Small Farms: New Directions for Services, Institutions and Intermediation. *Proceedings of Research Workshop on the future of small farms*. International Food Policy Research Institute (IFPRI) and Overseas Development Institute (ODI) Imperial College, London.
- Prasad, A. & Prasad, P. (2007). Mix, Flux and Flows: The Globalization of Culture and its Implications for Management and Organizations. *Journal of Global Business Issues*, 11-20.
- Prestwich, A., Kellar, I., Parker, R., MacRae, S., Learmonth, M., Sykes, B., & Castle, H. (2014). How can self-efficacy be increased? Meta-analysis of dietary interventions. *Health Psychology Review*, 8(3), 270-285.
- Pretty, J., William, J. S., Jacqueline, A., Jill, A., David, B., Michael, B., . . . Sarah, P. (2010). The top 100 questions of importance to the future of global agriculture. *International Journal of Agricultural Sustainability*, 8(4), 220-236.
- Proietti, I., Frazzoli, C., & Mantovanni, A. (2014). Identification and Management of Toxicological Hazards of Street Foods in Developing Countries. *Food and Chemical Toxicology*, 63, 143-152.
- PwC. (2017). Transforming Nigeria's Agricultural Value Chain: A case study of the Cocoa and Dairy industries.

- PwC. (2017a). *Transforming Nigeria's Agricultural Value Chain*. Lagos, Nigeria: Pricewaterhousecoopers Limited. Retrieved from <https://www.pwc.com/ng/en/assets/pdf/transforming-nigeria-s-agric-value-chain.pdf>.
- PwC. (2017b). *Federal Government of Nigeria's 2018 budget of consolidation*. Lagos, Nigeria: PricewaterhouseCoopers Limited. Retrieved from <https://www.pwc.com/ng/en/assets/pdf/pwc-2018-nigerias-budget-highlight.pdf>
- Qin, K., Li, J., & Yang, X. (2015). Trade-Off and Synergy among Ecosystem Services in the Guanzhong-Tianshui Economic Region of China. *Int J Environ Res Public Health*(12), 14094–14113.
- Raaijmakers, I., Snoek, H., Maziya-Dixon, B., & Achterbosch, T. (2018). Drivers of Vegetable Consumption in Urban Nigeria: Food Choice Motives, Knowledge, and Self-Efficacy. *Sustainability*, 10(4771), 1-14.
- Radwan, I. & Pellegrini, G. (2010). *Knowledge, productivity, and innovation in Nigeria : creating a new economy*. Washington D.C.: World Bank.
- Rane, S. (2011). Street Vended Food in Developing World: Hazard Analysis. *India Journal of Medical Microbiology*, 51(1), 100-106.
- Ranis, G. (2011). Technology and Human Development. *CENTER DISCUSSION PAPER NO. 1004*. Retrieved from <https://www.econstor.eu/bitstream/10419/59131/1/67164680X.pdf>
- Reardon, T. & Timmer, C. P. (2012). The economics of the food system revolution. *Annual Review of Resource Economics*, 4, 225-264. doi:10.1146/annurev.resource.050708.144147
- Reardon, T., Echeverria, R., Berdegue, J., Minten, B., Liverpool-Tasie, S., Tschirley, D., & Zilberman, D. (2019). Rapid transformation of food systems in developing regions: Highlighting the role of agricultural research & innovations. *Agricultural Systems*, 172, 47-59.
- Reardon, T., Lu, L., & Zilberman, D. (2017). Links among innovation, food system transformation, and technology adoption, with implications for food policy: Overview of a special issue. *Food Policy*. doi:<http://dx.doi.org/10.1016/j.foodpol.2017.10.003>
- Robinson, E., Akinyele, I. O., Humphrey, J., & Henson, S. (2014). *Policy Options for Enhancing Markets for Nutrient-Dense Foods in Nigeria*. IDS Evidence Report.
- Rockefeller Foundation. (2013). *Unhealthy Developing World Food Markets*. Research Report. Retrieved September 19, 2019, from <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=16&cad=rja&uact=8&ved=2ahUKEwjI3IGzvdzkAhWcA2MBHS8HA0YQFjAPegQICBAC&url=https%3A%2F%2Fassets.rockefellerfoundation.org%2Fapp%2Fuploads%2F20130501214213%2FUnhealthy-Developing-World-Food-Markets>
- Rothschild, M. L. (1999). Carrots, sticks, and promises: A conceptual framework for the management of public health and social issue behaviors. *Journal of Marketing*, 63(4), 24-37. doi:10.2307/1251972
- Ruel, M. T., Quisumbing, A. R., & Balagamwala, M;. (2018). *Nutrition-sensitive agriculture: What have we learned so far?* Global Food Security 2018.

- Ruel, M. T., Alderman, H., & Maternal and Child Nutrition Study Group. (2013). Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? *The Lancet*, 382(9891), 536-51.
- Sahel Capital. (2015). *Rice in Nigeria: Industry Dynamics*. Sahel Newsletter (Vol. 12). Retrieved from <http://sahelcp.com/wp-content/uploads/2016/12/Sahel-Newsletter-Volume-12.pdf>
- Salami, C. G. & Ajobo, R. T. (2012). Consumer Perceptions about Fast Food Restaurants in Asaba. *Global Journal of Management and Business Research*, 12(1), 74-81.
- Sanusi, L. S. (2010). Growth Prospects for the Nigerian Economy. *Eight convocation lecture of Igbinedion University*. Okada, Edo State, Nigeria.
- Saweda, L., Liverpool-Tasie, O., Adjognon, S., & Reardon, T. (2016). Transformation of the food system in Nigeria and female participation in the Non-Farm Economy (NFE). *Agricultural & Applied Economics Association Annual Meeting*, (p. 24). Boston, Massachusetts. doi:10.22004/ag.econ.236284
- Selig, E. R., Hole, D. G., Allison, E. H., Arkema, K. K., McKinnon, M. C., Chu, J., . . . Zvoleff, A. (2018). Mapping global human dependence on marine ecosystems. *Conservation Letters*(12:e12617). Retrieved from <https://doi.org/10.1111/conl.12617>
- Senauer, B. & Venturini, L. (2005). The globalization of food systems: A conceptual framework and empirical patterns. 5(1).
- Sholeye, O. O., Badejo, C. A., & Jeminusi, O. A. (2014). Dietary habits of pregnant women in Ogun-East Senatorial Zone, Ogun State, Nigeria: A comparative study. *International Journal of Nutrition and Metabolism*, 6(4), 42-49.
- Sibhatu, K. T. & Qaim, M. (2017). Rural food security, subsistence agriculture, and seasonality. *PLoS ONE*, 12(10). doi:<https://doi.org/10.1371/journal.pone.0186406>
- Sibhatu, K. T., Krishna, V. V., & Qaim, M. (2015). Production diversity and dietary diversity in smallholder farm households. *PNAS*, 112(34), 10657-10662.
- Smeets-Kristkova, Z., Acterbosch, T., & Kuiper, M. (2019). Healthy Diets and Reduced Land Pressure: Towards a Double Gain for Future Food Systems in Nigeria. *Sustainability*, 11(835), 1 - 31.
- Spencer, D. (2002).). The future of Agriculture in Sub-Saharan Africa and South Asia. In *Sustainable . Proceedings of International Conference, September 4-4, 2001*. Bonn, Germany: International Food Policy Research Institute, Washington D.C.
- SPRING. (2014). *The Role of Increased Income and Women's Empowerment on Nutrition: A Review of Communities' Perception of Changes due to Two Feed the Future Activities in Rwanda*. Arlington, VA: USAID/Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) Project.
- Sraboni, E., Malapit, H. J., Quisumbing, A. R., & Ahmed, A. U. (2014). Women's empowerment in agriculture: What role for food security in Bangladesh? *World Development*, 61, 11-52.
- Sreejesh, S. (2015). Consumers' Perceived Brand Aspiration and Its Impact on Intention to Pay Price Premium: Moderating Role of Brand Jealousy. *Theoretical Economics Letters*, 5, 273-284.
- Staatz, J. & Hollinger, F. (2016). *West African Food Systems and Changing Consumer Demands*. Paris: OECD Publishing.

- Swinburn, B. A., Sacks, G., Hall, K. D., McPherson, K., Finegood, D. T., Moodie, M. L., & Gortmaker, S. L. (2011). The global obesity pandemic: shaped by global drivers and local environments. *The Lancet*, 804-814. doi:10.1016/S0140-6736(11)60813-1
- Tari, V. A., Kibikiwa, M. G., & Umar, K. (2016). The effects of Boko Haram insurgency on food security status of some selected local government areas in Adamawa State, Nigeria. *KY Journal of Food Science*, 5(3), 012-018.
- TechnoServe. (2019, December 20). *TecnoServe Business Solutions to Poverty*. Retrieved June 08, 2020, from <https://www.technoserve.org/blog/a-business-solution-to-malnutrition-in-nigeria/>
- The Nation Nigeria Newspaper. (2016). Nigerian communities where delicacies are taboos. Retrieved from www.thenationonlineng.net
- Tilman, D. (1999). Global environmental impacts of agricultural expansion: The need for sustainable and efficient practices. *PNAS*, 96(11), 5995-6000.
- Tomori, M. A. (2012). Transformation of Ibadan built environment through restoration of urban infrastructure and efficient service delivery. Retrieved from <http://macosconsultancy.com/Publication/Transformation%20of%20Ibadan%20Built%20Environment.pdf>
- Torres, C. & Seters, J. v. (2016). Overview of trade and barriers to trade in West Africa: Insights in political economy dynamics, with particular focus on agricultural and food trade. *Discussion Paper*(195). Retrieved from www.ecdpm.org/dp195
- Truong. (2010). Personal aspirations and the consumption of luxury goods. *International Journal of Market Research*, 52(5), 653-671.
- Ukamaka, D. M., Danjuma, S. E., Mbolle, C. J., Achonam, E. I., & Mbadiwe, I. E. (2017). Livelihood issues in herdsman-farmers conflict among farming communities in Kogi State, Nigeria. *African Journal of Agricultural Research*, 12(24), 2105-2115.
- Ukegbu, O. P. & Ekebisi, C. (2016). Assessing Dietary Diversity Score and Nutritional Status of Rural Adult Women in Abia State, Nigeria. *Food Sci Nutr Technol Assess*, 1(1), pp. 1-11. Retrieved August 24, 2017, from <https://medwinpublishers.com/FSNT/FSNT16000106.pdf>
- Ukeje, E. (2007). *Modernizing small holder agriculture to ensure food security and gender empowerment: Issues and Policy*. International Food Policy Research Institute.
- UNDP. (2012). *The roles and opportunities for the private sector in Africa's agro-food industry*. Johannesburg, South Africa: United Nations Development Programme (UNDP).
- UNDP. (2013). *Roadmap: Nigerian Agribusiness Supply*. Retrieved February 21, 2020, from https://www.undp.org/content/dam/nigeria/docs/IclusiveGrwth/UNDP_NG_RoadmapNigerianAgribussmaer2013.pdf
- UNEP. (2016). *Food Systems and Natural Resources. A Report of the Working Group on Food Systems of the International Resource Panel*. United Nations Environment Programme.
- UNICEF. (2013). *Improving child nutrition: The achievable imperative for global progress*. New York. Retrieved from https://sites.unicef.org/nutrition/files/Nutrition_Report_final_lo_res_8_April.pdf
- United Nations. (2018). *2018 World Urbanization Prospects*. Retrieved from <https://esa.un.org/Unpd/Wup/>

- United Nations, Department of Economic and Social Affairs, Population Division. (2017). *World Population Prospects: The 2017 Revision, Key Findings and Advance Tables*. Working Paper No ESA/P/WP/248.
- USDA (U.S. Department of Agriculture), Economic Research Service. (2012). *Food Service Industry - Market Segments*. Retrieved from www.ers.usda.gov/topics/food-markets-prices/food-serviceindustry/
- USDA. (2011). *Steady Growth of Nigeria's Retail Food Sector*. Global Agricultural Information Network (GAIN).
- Uwem, U. A., Iniobong, N., & Inyene, P. N. (2015). Testimonials in television advertising and consumer patronage of selected antiseptic products in Uyo urban, Akwa Ibom State of Nigeria. *International Journal of Education and Research*, 217-236.
- Uzoejinwa, B. B., Ani, A. O., Abada, U. C., Ugwuishiwu, B. O., Ohagwu, C. J., & Nwakaire, J. N. (2016). Small-scale food processing enterprises: measures for national development and addressing food security challenges in Nigeria. *International Journal of scientific and technical research in engineering (IJSTRE)*, 1(5), 72-82.
- van Dijk, M. & Meijerink, G. W. (2014). A review of global food security scenario and assessment studies: Results, gaps and research priorities. *Global Food Security*, 3(3-4), 227-238.
- Vasantha, S., Vijaylakshmi, S., & Kiran, P. (2015). Review on impact of changing lifestyles on dietary pattern. *International Journal of Current Research and Academic Review*, 3(6), 135-147.
- Von Braun, J. & Diaz-Bonilla, E. (2008). Globalization of agriculture and food: Causes, consequences and policy implications. In J. Von Braun, & E. Diaz-Bonilla, *Globalization of food and agriculture and the poor* (pp. 1-46). New Delhi, India: Oxford University Press.
- Von Grebmer, K., Bernstein, J., Hossain, N., Brown, T., Prasai, N., Yohannes, Y., . . . Foley, C. (2017). *2017 Global Hunger Index: The inequalities of hunger*. Washington DC; Bonn; and Dublin: International Food Policy Research Institute, Welthungerhilfe, and Concern Worldwide. doi:<https://doi.org/10.2499/9780896292710>
- Wahlqvist, M. L. & Lee, M. (2007). Regional food culture and development. *Asia-Pacific Journal of Clinical Nutrition*, 16(1).
- WENR (World Education News & Reviews). (2017). *Education in Nigeria*. WES Staff. Retrieved from <https://wenr.wes.org/2017/03/education-in-nigeria>
- WHO. (2003). *Fruit and Vegetable Promotion Initiative: A Meeting Report*. Geneva: World Health Organization. Retrieved October 12, 2017, from http://apps.who.int/iris/bitstream/handle/10665/68395/WHO_NMH_NPH_NNP_0308.pdf?sequence=1&isAllowed=y
- WHO. (2015). *Global burden of foodborne diseases*. Retrieved from www.who.int/foodsafety/areas_work/foodbornediseases/ferg
- World Bank. (2014). *Nigeria: Economic Report No 2*. Washington DC: World Bank.
- World Bank. (2016). *Poverty Reduction in Nigeria in the Last Decade*. The World Bank Group. Retrieved from documents.worldbank.org/curated/en/103491483646246005/pdf/ACS19141-REVISED-PUBLIC-Pov-assessment-final.pdf

- World Bank. (2019). Retrieved from <https://www.worldbank.org/en/country/nigeria/overview#1>
- World Bank. (2019). *Nigeria Rural Access and Agricultural Marketing Project (P163353)*. The World Bank. Retrieved from <http://documents.worldbank.org/curated/en/975781572164080494/pdf/Project-Information-Documents-Integrated-Safeguards-Data-Sheet-Nigeria-Rural-Access-and-Agricultural-Marketing-Project-P163353.pdf>
- Zippora, M. M. & Mberia, H. K. (2014). The effects of celebrity endorsement in advertisements. *International Journal of Academic Research in Economics and Management Sciences*, 3(5), 178-188.
- Zurek, M., Ingram, J., Zimmermann, A., Garrone, M., Rutten, M., Tetens, I., . . . Deppermann, A. (2016). A Framework for Assessing and Devising Policy for Sustainable Food and Nutrition Security in EU: The SUSFANS conceptual framework. Retrieved from <http://www.susfans.org/portfolio/framework-assessing-and-devising-policy-sustainable-food-and-nutrition-security-eu-susfans>

ALL IFPRI DISCUSSION PAPERS

All discussion papers are available [here](#)

They can be downloaded free of charge

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

www.ifpri.org

IFPRI HEADQUARTERS

1201 Eye Street, NW
Washington, DC 20005 USA
Tel.: +1-202-862-5600
Fax: +1-202-862-5606
Email: ifpri@cgiar.org