IFPRI Discussion Paper 01872

October 2019

Determining Key Research Areas for Healthier Diets and Sustainable Food Systems in Viet Nam

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ABSTRACT

Vietnamese food systems are undergoing rapid transformation, with important implications for human and environmental health and economic development. Poverty has decreased, and diet quality and undernutrition have improved significantly since the end of the Doi Moi reform period (1986-1993) as a result of Viet Nam opening its economy and increasing its regional and global trade. Yet poor diet quality is still contributing the triple burden of malnutrition, with 25 percent stunting among children under age 5, 26 percent and 29 percent of women and children, respectively, anemic, and 21 percent of adults overweight. Agricultural production systems have shifted from predominantly diverse smallholder systems to larger more commercialized and specialized systems, especially for crops, while the 'meatification' of the Vietnamese diet is generating serious trade-offs between improved nutrition and sustainability of the Vietnamese food systems. The food processing industry has developed rapidly, together with food imports, resulting in new and processed food products penetrating the food retail outlets, trending towards an increase in the Westernized consumption patterns that are shifting nutrition-related problems towards overweight and obesity and, with it, an increase of non-communicable disease-related health risks. While regulatory policies exist across the food system, these are not systematically implemented, making food safety a major concern for consumers and policy makers alike. Where data exists, it is not easy to aggregate with data from across food system dimensions, making it difficult for Viet Nam to make an informed analysis of current and potential food system trade-offs. In our research, we reviewed existing literature and data, and applied a food systems framework to develop an initial food systems profile for Viet Nam and to identify a comprehensive set a of research questions to fill current data gaps identified through the review. Insights on these would provide the comprehensive evidence needed to inform policy makers on how to develop new food systems policies for Viet Nam, and further refine and improve existing policies to achieve better quality diets and more sustainable food systems in Viet Nam. Based on these, we then engaged with stakeholders to develop research priorities in the Viet Nam context and identified 25 priority research questions. This paper aims to stimulate such reflections by clearly outlining key areas for research, government policy, and development programs on priority investment to build the evidence base around inclusive food systems interventions that aim to result in healthier diets and more sustainable food systems for Viet Nam.

Keywords: Viet Nam, food systems, diet quality, nutrition, agriculture

ACKNOWLEDGMENTS

This work was funded by the CGIAR Research Program on Agriculture for Nutrition and Health. We thank Dr. Phung Duc Tung (Mekong Development Research Institute) and Dr. Peter Oosterveer (Wageningen University & Research) for their review of this paper and vital comments provided. We also thank the national stakeholders who took part in the consultation process to review this paper, and who identified key priority areas for research investments for Viet Nam's food system (see Annex 2 for full list of stakeholders).

ACRONYMS

AGP	Antimicrobial growth promoter
ASEAN	Association of Southeast Asian Nations
FAO	Food and Agriculture Organization of the United Nations
FBDG	Food-Based Dietary Guidelines
FLW	Food loss and waste
GAIN	Global Alliance for Improved Nutrition
GDP	Gross domestic product
HLPE	(FAO) High Level Panel of Experts on Food Security and Nutrition
ICT	Information and Communications Technology
LMICs	Low- and middle-income countries
LoFS	Law on Food Safety (Viet Nam)
MARD	Ministry of Agriculture and Rural Development (Viet Nam)
MoH	Ministry of Health (Viet Nam)
MoIT	Ministry of Industry and Trade (Viet Nam)
MoST	Ministry of Science and Technology (Viet Nam)
NCDs	Non-communicable diseases
NIN	National Institute of Nutrition (Viet Nam)
NNS	National Nutrition Strategy (Viet Nam)
PGS	Participatory Guarantee System
RA	Reproductive Age
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization of the United Nations
WTO	World Trade Organization

1. INTRODUCTION

1.1 Background

Achieving a world with no poverty, zero hunger, reduced inequalities, and responsible production and consumption are all key challenges of the Sustainable Development Goals (United Nations 2015). A food systems perspective provides a unique entry point to asses and potentially address all of these issues. Fueled by economic growth and rapid urbanization, low- and middle-income countries (LMICs) are undergoing the nutrition transition from mostly starchy, low-fat, high-fiber diets, to increased consumption of ultra-processed foods that are higher in fats, sugars, and salt. As a consequence, LMICs now face not only undernutrition and micronutrient deficiencies, but have also experienced the most rapid increases in the prevalence of overweight, obesity, and other diet-related non-communicable diseases (NCDs) (Global Panel on Agriculture and Food Systems for Nutrition, 2016; Kelly, 2016; Popkin, 2014), defined as the "triple burden" of malnutrition. Viet Nam's specific context demonstrates this example: during the country's rapid economic growth, following its liberating reforms in 1986 and the rapid rate in poverty reduction in the 1990s, the average caloric intake increased in almost all regions of the country, albeit with diverging intensity (Molini 2006). Despite the dominance of small-scale production and supply through traditional informal markets and small retail stores, the penetration of international food and standards, coupled with large-scale Vietnamese private sector investments, and the trend towards an increasingly meat-based diet, are transforming the agrifood sector from predominantly smallholder farming into large-scale enterprise oriented farming.

The transition to larger-scale, enterprise-oriented farming has been associated with a small decrease of the rural population engaged in agriculture-related income (8 percent decrease in 2016 from 2011), who moved into non-agricultural or remained unemployed (7 percent and 1 percent increase in 2016 from 2011). Still, agriculture, fisheries, and forestry continue to be a major contributor to the Vietnamese economy, comprising nearly 15 percent of Viet Nam's GDP in 2018 (General Statistics Office of Viet Nam 2018c). Just under half the population are involved in agriculture production, with 14.5 million farms comprising approximately 70 million land parcels. Of these, there are nearly 12 million hectares of arable land destined

for annual crops (7.7 rice, 1.1 maize, 0.93 vegetable, 0.27 other) and just over 3 million hectares under perennial crops (including 0.67 coffee, 0.30 cashew, and 0.93 fruits) (General Statistics Office of Viet Nam 2018d).

The continuing substantial decline in a diet of mainly starchy staples and increases in consumption of meat, fish, and dairy products has helped to lower the prevalence of undernutrition (Do T.P. Ha et al. 2011). However, this has also marked Viet Nam's transition from traditional diets towards unhealthy food consumption patterns such as high consumption of salt, ultra-processed foods (including instant noodles), and sweetened non-alcoholic beverages, as well as lower consumption of fresh fruit (in decline since 2000), vegetables, and seafood (T. T. Nguyen and Hoang 2018).

Understanding the food system factors behind these diet transformations is critical, as they have been linked to the country's increased prevalence of overweight and obesity (Do T.P. Ha et al. 2011) and an increased burden of disease and prevalence of NCDs (Bach Xuan Tran et al. 2018), all of which increase pressure on the national health care system (T. T. Nguyen and Hoang 2018). Viet Nam's rapid urbanization rate is expected to remain above 3 percent annually, and the country's now-globally integrated economy, whose trade volume accounts for 17.8 percent of its GDP (World Bank, 2017), will continue to be catalysts for the nutrition transition currently underway. This overall picture makes Viet Nam an excellent case study for understanding food systems frameworks with their dynamic drivers.

Acknowledging the national context, the Vietnamese government has demonstrated its commitment to addressing these emerging challenges by issuing strategic policies. Three key food and nutrition strategies have been rolled out through the National Nutrition Strategies (NNSs) for 1996-2000, 2001-2010 and, currently, 2011-2020. The NNS aim to improve meals "in quantity and balance in quality, ensuring safety and hygiene. Childhood malnutrition will be significantly reduced, enhancing the stature and habitus of the Vietnamese people." The nutrition policies have been typically guided by national development and socioeconomic targets. Resolution 100/2015/QH13, issued by the Prime Minister, emphasizes two main national target programs for the period between 2016-2020: (i) Building new countryside, and (ii) Sustainable poverty reduction. Both of these cover various aspects of food, nutrition,

and rural development. The current nutrition policy also aims to limit obesity and chronic non-communicable diseases related to nutrition.

Food safety policies are also a high national priority, and consumer concerns regarding food safety are high (Nguyen-Viet, Chotinun, et al. 2017; World Bank 2017). The Food Safety Law provides policies to accelerate the application of good agricultural practices in crop production and good animal husbandry regulations on quality management of agricultural products. Besides policies related to nutrition and food safety, the country leaders also govern the Vietnamese food systems with policies affecting the availability and affordability of food (Tran Cong Thang and Nguyen Le Hoa 2016). The wide range of policies suffer from a lack of coordination and implementation, often driven by a weak evidence base and limited cross-sectoral coordination (World Bank, 2016, 2017). Capacity building and research will be critical to help implement and adapt a systems approach to the Vietnamese contexts.

This review seeks to describe and contextualize the current food systems in Viet Nam, by reviewing the current literature and using updated frameworks for food systems characterization. It also aims to identify research and action priorities for food systems for healthier diets in Viet Nam. We undertook the following steps to prepare this review: First, we carried out a rapid identification of the main themes related to Viet Nam's food systems to facilitate a stakeholder co-planning workshop in Hanoi. Second, we used the entry points provided by the planning workshop (e.g. key words, research gaps identified by participating stakeholder's concerns) as the primary inputs for further analysis of the literature and existing data sources. Third, combining global food systems frameworks with further literature review and secondary data analysis, we characterized the food systems in Viet Nam, and created a food systems profile for Viet Nam. Upon completion, we formulated and prioritized research questions that might address the gaps and drive research priorities. Finally, we validated our findings and gathered feedback to finalize the paper through a consultation with key national stakeholders and experts in a workshop held in Hanoi on June 20, 2019.

In identifying research priorities, we adhered to two key criteria. First, Viet Nam's prioritized research questions should align with existing international and global agendas on food systems research. In

particular, those which could directly contribute to building the evidence base to strengthen policies that state the importance of focusing on a 'high quality diet', building more data and metrics for diet quality and food systems, better evaluation of policies and policy actions, climate accounting, and incentive structures (e.g. Global Panel on Agriculture and Food Systems for Nutrition, 2016; IFPRI, 2016)). Second, we acknowledged and considered national priorities as outlined in key policy documents. The objective of the review is to facilitate both national and international learning, as well as describe the transition of the Vietnamese food systems as they strive to become healthier, safer, more nutritious, and sustainable.

1.2 Nutrition Status, Health and Environmental Outcomes of Current Diets and Agricultural Production in Viet Nam

Poverty, food insecurity, and undernutrition have been rapidly decreasing in Viet Nam. Improvements are largely credited to new economic policies introduced in the late 1980s (IFPRI 2016), which opened the country's market to the world. As a result, the average Vietnamese diet has undergone significant changes, although two percent of the population still remains severely food insecure (FAO et al. 2018).

1.2.1 Nutrition Status

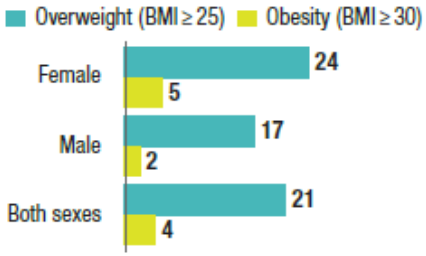
Over the past ten years, the prevalence of undernourishment has decreased from 18 to 11 percent (FAO et al. 2018). Undernutrition of children under the age of five improved significantly, with chronic malnutrition of children (stunting) falling from 32 to 19 percent between 2007 and 2013. However, the latest figure from 2015 sits at 24.6 percent, suggesting a slight regression from the improvements seen in 2013 (UNICEF-WHO-World Bank Group 2019). Disparities in wealth, region, and ethnicity prevail. Underweight and stunting remain a problem within specific pockets of poverty. In 2011, roughly one third of children in the northern midland mountainous areas and the central highlands were stunted, and 41 percent of ethnic minority children under five were stunted (Chaparro, Oot, and Sethuraman 2014; Viet Nam National Institute of Nutrition 2013; Viet Nam National Institute of Nutrition, UNICEF, and Alive & Thrive 2014).

During the same period, national data gave rise to increasing concerns of overweight and obesity, especially in urban populations (Nguyen Thanh Tuan, Pham Duy Tuong, and Popkin 2008; Viet Nam

National Institute of Nutrition, UNICEF, and Alive & Thrive 2014; Viet Nam Ministry of Health 2016). Latest figures place overweight children and adolescents at 9.7 percent (WHO 2016). Two percent of adolescents, 25 percent of women, and 20 percent of men are overweight (Figure 1.1)(WHO 2018).

Obesity in children under age five in Ho Chi Minh City increased threefold from 3.7 percent in 2000 to 11.5 percent in 2013. In urban areas, these figures have been attributed to a more sedentary lifestyle, as well as changes in eating habits marked by eating out of the home more frequently; the introduction of Westernized and fast foods containing more fat, salt and sugar; and poor coordination among schools and families in managing children's food intake. Meanwhile, for children in rural areas, frequent consumption of foods high in fat and increasing prevalence of advertisements for processed foods have been significantly associated with the increasing prevalence of overweight and obesity (Minh Do et al. 2015; Nguyen Thanh Tuan, Pham Duy Tuong, and Popkin 2008). Low levels of physical activity are also contributing to the rise in overweight and obesity, with more than a quarter of the adult population engaging in little or no activity (T. T. Nguyen and Hoang 2018; Viet Nam Ministry of Health and General Department of Preventive Medicine 2016).

Figure 1.1: Prevalence of adult overweight and obesity, 2014 (%)



Source: WHO 2015.
Note: BMI = body mass index.

Source: WHO (2018).

Micronutrient deficiencies are still a concern, especially relating to women and children (Table 1.1). Close to one third of women of reproductive age and children are anemic, with half of these anemia cases due to iron deficiency (Viet Nam National Institute of Nutrition 2015). Vitamin A deficiency affects

roughly 14 percent of preschool-aged children, indicating a problem of moderate public health importance according to WHO classifications (Viet Nam National Institute of Nutrition and UNICEF 2011). Zinc deficiency is also prevalent and estimated to affect 64 percent of women, increasing to more than 80 percent of pregnant women and nearly 70 percent of children (Viet Nam National Institute of Nutrition 2015). Viet Nam is now among the top 20 countries with the highest levels of iodine insufficiency (Iodine Global Network 2017) worldwide, especially after the end of government-subsidized iodized salt supplementation (Codling *et al.* 2015).

Table 1.1: Key Health and Nutrition indicators related to nutrition [1]

Micronutrient Deficiencies	Status of population deficient (%)	Reference Year
Iodine	84(ug/L) - Insufficient	2014
Goiter prevalence in children aged 8-10 years	9.8	2014
Iron		
Women of reproductive age (RA)	Anemia 25.5 IDA 37.7	2015
Women pregnant	Anemia 32.8 IDA 54.3	2015
Children under 5	Anemia 27.8 IDA 63.6	2015
Vitamin A: Subclinical VAD		
Children under 5	13	2015
Zinc		
Women RA	63.6	2015
Women pregnant	80.3	2015
Calcium		
Mild hypocalcemia - women (Serum Ca 1.1-0.9mmol/L)	83	2009
Moderate hypocalcemia - women (Serum Ca 0.8-0.9mmol/L)	14	2009
Mild hypocalcemia - children (Serum Ca 1.1-0.9mmol/L)	97	2009

[1] Data extracted from the following sources: Iodine Global Network 2017, Vietnam Central Endocrinology Hospital 2014, Vietnam National Institute of Nutrition 2015

Table 1.2: Key Non-Communicable Disease Risk Factors indicators related to nutrition[i2]

Non-Communicable Disease Risk Factors	Status of adult population affected (%)	Reference year
High blood pressure	18.9%	2015
High cholesterol	30.2%	2015
Elevated blood sugar	4.1%	2015
Salt intake	9.4g	2015
Insufficient physical activity	28.1%	2015

1.2.2 Health

Non-communicable diseases (NCDs) are currently the primary cause of death in Viet Nam, with the top seven out of ten mortality causes related to cardiovascular disease, chronic obstructive pulmonary disease, lung cancer, Alzheimer's, diabetes, and cirrhosis of the liver (GBD 2017 Risk Factor Collaborators 2018). Poor diet quality is attributed to have significantly determined/influenced the burden of disease of many NCDs in Viet Nam in 2017 and, in particular, was a primary risk factor for those with ischemic heart disease (69 percent); stroke (50 percent); diabetes (29 percent); colorectal, stomach, esophageal and lung cancers; and chronic kidney disease (39, 28, 19, 10 and 11 percent respectively).

In terms of links to diet, Vietnamese salt consumption is high, estimated between 9g and 22g/day (Jensen et al. 2018; T. T. Nguyen and Hoang 2018; Viet Nam Ministry of Health and General Department of Preventive Medicine 2016), more than double the WHO recommended intake (Table 1.2). While higher than regional and global national averages, fruit and vegetable intakes are insufficient to meet WHO recommendations, with 57 percent of the population not consuming five portions a day (Development Initiatives 2018a; T. T. Nguyen and Hoang 2018). These are all worrying consumption habits, given that in 2015, one in five Vietnamese adults aged 25-64 years suffered from hypertension (Ha T.P. Do et al. 2015), almost one-third of adults aged 25-64 had elevated blood cholesterol, and there is an increasing prevalence

[2] Data from Vietnam Ministry of Health and General Department of Preventive Medicine 2016

of diabetes mellitus (4 percent of adults in 2018) (T. T. Nguyen and Hoang 2018). The trend we are seeing is that risk factors for non-communicable diseases are increasing in prevalence over time (Viet Nam Ministry of Health and General Department of Preventive Medicine 2016).

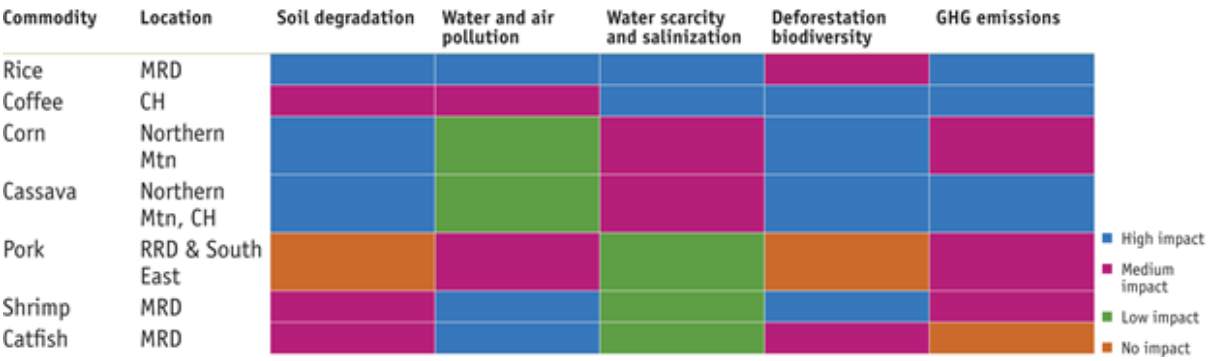
There has been marked public concern over food safety in Viet Nam. Issues associated with food safety include: (1) high density of human and animal populations living in close proximity; (2) a predominance of smallholder production systems with mixed species and little/no biosecurity; (3) abattoirs and wet markets operating with rudimentary hygiene, limited cold chain for distribution; and low levels of meat inspection; (4) widespread consumption of animal and fish blood, raw/undercooked meat, fish, organ tissues, raw leaf vegetables, and wild animal products; and (5) use of untreated wastewater and sewage for agriculture (Carrique-Mas and Bryant 2013). Although human health data and linkages with foodborne illnesses are scarce, it has been estimated that foodborne diseases may be responsible for around 7 percent of the infectious disease burden, ranking 29th in Viet Nam, making it more prevalent than measles (World Bank, 2017). During 2014 and 2015, there were almost 370 outbreaks of food poisoning in Viet Nam involving more than 10,000 cases and resulting in 66 deaths – although it is worth noting that the estimated number of food poisoning cases in Viet Nam is highly under-reported (World Bank, 2017). For consumers, between 2002 and 2010, the majority of food poisoning cases resulted from people consuming food at home (61 percent), in canteens (13 percent), and at parties/social gatherings (9 percent). During the same period, the contaminants related to reported food poisoning outbreaks included microorganisms (33 percent), toxins (25 percent), agrochemicals (11 percent), and unknown (31 percent) (Nguyen Thi Duong Nga et al. 2014).

1.2.3 Environmental considerations

Sustainability concerns are high on the agenda for food systems research in the context of climate change, biodiversity loss, and unsustainable practices within the entire food system (Haddad et al. 2016). As Viet Nam's agriculture has expanded and intensified over recent decades, its environmental footprint has grown, especially among the most dynamic areas of Vietnamese agriculture, creating agro-environmental hotspots (Table 1.3). For example, the marked increase in staple food production (T. T. Nguyen and Hoang 2018) is

associated with the increased use of pesticides (Pham V. Hoi et al. 2016). The expansion of shrimp aquaculture in the Mekong Delta has involved the conversion of large areas, including mangroves, to farms and ponds, leading to changes in ecosystems and land use, generating an array of pollutant emissions, most of them carried in wastewater and solid waste. Measurements taken by the Mekong River Commission at Mekong Delta water monitoring stations often exceed thresholds indicative of a threat to aquatic life (Nguyen Van Cong 2017; World Bank 2016). In the production of livestock, Viet Nam generates an estimated 80 million tons of animal waste per year. Only around 60 percent of this is treated, with the remainder often discharged directly into the environment (dumped on land, in fishponds, canals, rivers, etc.) (Tung Xuan Dinh 2017). The livestock sector's contributions to water pollution and global greenhouse gas emissions is worrying for the national government. For instance, Ammonia (NH_3) and Hydrogen sulfide (H_2S) gas concentrations in air emissions from pig farms in the northern region were reported to be 7 to 18 times and 5 to 50 times, respectively, higher than the nationally permitted levels (Vu Chi Cuong 2014). The agricultural sector's increasing effect on the environment has been attributed to three groups of issues: (1) policy and administrative failures; (2) market failures; and (3) knowledge and information gaps (World Bank 2016). Environmental costs associated with the intensification and extensification of Vietnamese agriculture have mostly not been quantified.

Table 1.3: Viet Nam's agro-environmental hotspots



Source: Khoi Dang *et al*. (2015) cited in World Bank (2016). MRD=Mekong River Delta; CH=Central Highlands; RRD=Red River Delta.

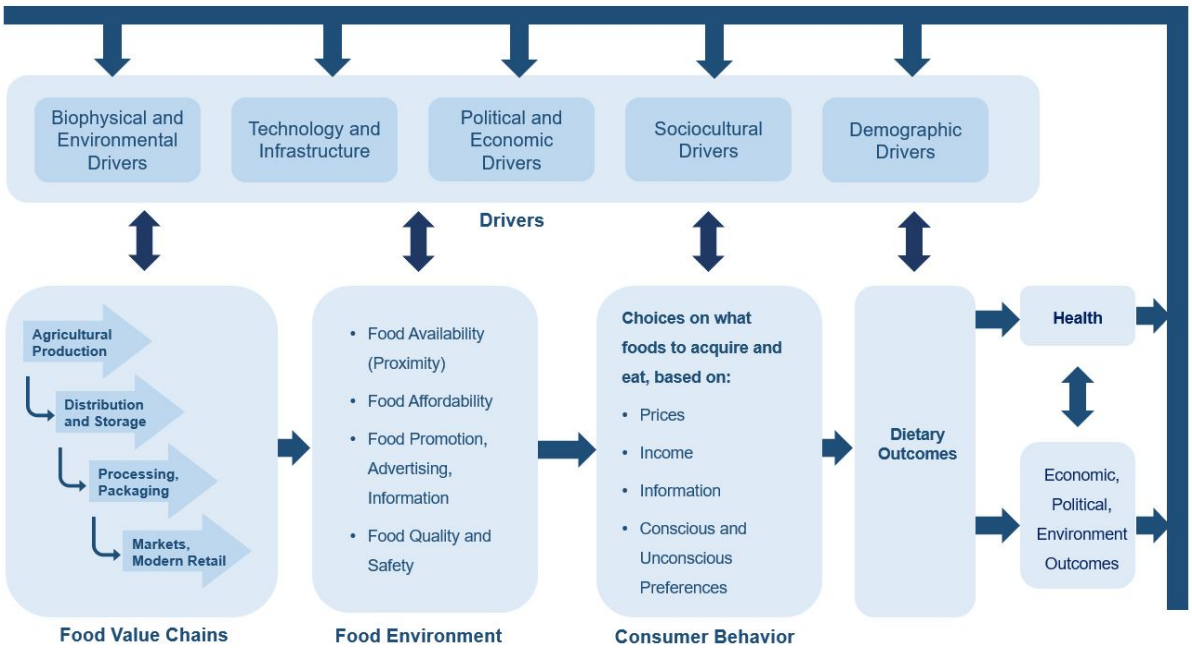
From the consumption side, food has been found to be the most promising category through which to engage people in adopting more sustainable lifestyles. However, the decision to consume food sustainably is mostly based on health motivations and less driven by an intention to protect nature (De Koning *et al.* 2015).

Various programs oriented around national or international standards have been initiated in Viet Nam to promote more sustainable agricultural production. Adoption rates of some appear to lag compared to other countries in the region. For example, in 2013, less than 3 percent of Viet Nam's tea production was Rain Forest Alliance-certified, much lower than India (34 percent), Sri Lanka (10 percent) and Indonesia (34 percent) (World Bank 2016). Although Viet Nam has the largest number of sustainability-certified aquaculture farms in the world, thanks to its export-oriented sector, a large majority of the shrimp growing area is not yet monitored (or certified) for environmental management practices (World Bank 2016).

2. CONCEPTUAL FRAMEWORK

The rapidly growing body of literature on food systems has produced a number of conceptual frameworks to illustrate and analyze the complexity of such food systems and their drivers. Earlier conceptualization is owed to Ericksen (2008b, 2008a) who contrasted biophysical and socioeconomic factors driving global environmental change with their linkages to food system activities and outcomes. More recently, the focus of food system frameworks has been broadened by allowing for the various stages of agrifood value chains, from production, storage, and transport, via processing and packaging, to wholesale, retail, and consumption. Such frameworks also provide a more detailed breakdown of food system drivers and account for food losses and waste along the different nodes of the chains (CIAT 2017; Global Panel on Agriculture and Food Systems for Nutrition 2017; HLPE 2017). This paper is structured around an adapted version of the Food and Agriculture Organization of the United Nations' (FAO) High Level Panel of Experts on Food Security and Nutrition (HLPE) framework (Figure 2.1).

Figure 2.1: Conceptual framework for food systems used to guide this paper



Source: Adapted from FAO's HLPE (2017).

This particular conceptual framework was selected to help focus our analysis on factors contributing to healthy diets, as a meter of comparison with the Vietnamese dietary trajectory, and to inform corrective/supportive policy options. The sections of this paper move from right to left of the modified HLPE framework, beginning with an overview of the current nutrition status and health and environment setting in Viet Nam, working backwards from these outcomes to analyze factors influencing diet and driving consumer behavior and dietary choices, the food environment, the food supply system, and finally ending with five food system drivers. Our focus on food systems and the food environment highlights the importance of availability, accessibility, affordability, and acceptability of healthy foods as key determinants of food choice, in line with frameworks proposed by the Global Panel on Agriculture and Food Systems for Nutrition (2016) and Haddad et al. (2016). In this context, availability refers to producing such raw materials and fresh food in sufficient quantities and delivering them to where they are processed or consumed. Accessibility stands for physical access to food in nearby retail (e.g. wet markets, small stores, and supermarkets) and food outlets (e.g. restaurants, kiosks, and food stalls). Affordability, in turn, relates to economic access to certain foods in dependence on purchasing power. Finally, acceptability reflects ultimate food choice and consumer preferences. Our framework points at the interrelations between these key determinants along the nodes of agrifood value chains. Food produced for direct household consumption set aside, a challenge of food system transformation is to ensure healthy, diverse and affordable food options among low-income consumers, who constitute the bulk of malnourished people, while offering attractive farm-gate prices to producers who supply these in a sustainable fashion.

3. DIETS, CONSUMER BEHAVIOR AND THEIR LINKAGE WITH FOOD SYSTEMS IN VIET NAM

Rice is the staple food of preference in Viet Nam. However, with improvements in diet, between 1985 and 2010, daily intake of rice declined (from 458 to 373 gram/person/day), while intakes of most other food groups substantially increased (Table 3.1). Meat intake increased nearly eight-fold (from 11 to 84 grams/person/day), fish intake increased by 25 grams (from 35 to 60 grams/person/day), and milk and egg increased more than 30-fold (from 1 to 30 grams/person/day). While consumption of fruits increased substantially (from 2 to 61 grams/person/day), daily per capita consumption of vegetables decreased from 214 to 190 grams. Oil and fat consumption increased significantly during the same period, from 1.6 grams/person/day in 1985 to 8 grams/person/day in 2010.

Total energy intake remained unchanged from 1985 to 2010 (~1925 kcal), but diet was more balanced, with the proportion of total dietary energy from carbohydrates decreasing (83 to 66 percent) and the proportion of energy from protein (11 to 16 percent) and fat (6 to 18 percent) increasing. These ranges are within the ranges of population nutrient intake goals set by WHO (2003) of 15 to 30 percent dietary energy from fat, with Viet Nam at 18 percent and 55 to 75 percent from carbohydrates.

Despite these overall dietary improvements, diet quality in Viet Nam is constrained by several challenges, which are presented together with the key outcomes in sections 3.1 to 3.4.

3.1 Diet Quality in Viet Nam

3.1.1 *Dietary Patterns: Changes Over Time*

Using data from four Viet Nam General Nutrition Surveys (see footnote in Table 3.1), which were conducted in 1985, 1989, 2000, and 2010, we are able to capture the trend in dietary patterns between 1985 and 2010. These are the nationwide food consumption surveys, led by the Viet Nam National Institute of Nutrition (NIN), using a detailed quantitative 24-hour recall, and representative of all 63 provinces in Viet Nam.

Table 3.1: Daily per capita food consumption (grams)

	1985	1990	2000	2010	change (%) 1985 to 2010	change (%) 2000 to 2010
Rice	458	452	397	373.2	-18.5	-6
Pulse/nuts	3	3.8	4.3	4.5	50	4.7
Fruit	2.2	4.1	62.4	60.9	2668	-2.4
Vegetables	214.0	171.3	178.6	190.4	-21	6.6
Animal oils, fat	1.6	3	6.8	8	400	17.6
Vegetable fat	5.6	10	14	14.5	159	3.6
Meat	11.1	24.4	51	84	657	65
Fish	35	42.1	45.5	59.8	71	31
Milk and eggs	0.8	2.9	10.3	29.5	3587	186
Animal protein	13.6	18	20.8	30.6	125	47
Total protein	52	57	62	74.3	42.9	20
Total fat	12	18	24.9	37.7	214	51
Sugar	0.9	0.8	7.8	3.8	322	-51

Note: Data extracted from General Nutrition Survey 2009-2010 (Viet Nam National Institute of Nutrition, Ministry of Health, and UNICEF 2010).

It is clear that dietary patterns have changed significantly over time. Viet Nam has evolved from a predominantly rice-based diet to a more balanced one. The proportion of animal protein/total protein in the diet increased from 26 percent (1981-1985) to 41 percent (2010) and animal lipid/total lipid intakes from 53 percent (1981-1985) to 62 percent (2010). Proportions are higher in urban than in rural areas and tend to be higher than the recommended proportion (40 percent for protein and 60 percent for lipid) (Viet Nam National Institute of Nutrition 2003; Viet Nam National Institute of Nutrition, Ministry of Health, and UNICEF 2010). Even though fat intakes are increasing, they are still lower than recommended, especially for children (Viet Nam National Institute of Nutrition, Ministry of Health, and UNICEF 2010).

The average consumption of fruit and vegetables has increased steadily over time, particularly since 1990, with a 11 percent increase in vegetable and nearly 1400 percent increase in fruit consumption (Viet Nam National Institute of Nutrition 2007; Viet Nam Ministry of Health 2010, 2016). However, these consumption patterns still fall below the WHO recommended target of 400g/day for these two food groups.

The average salt consumption was 9.4g/person/day (2015), more than double the WHO recommendation (Viet Nam Ministry of Health 2016). Sources of dietary salt are mainly from condiments added during the course of primary processing, marinating, and cooking (about 70 to 80 percent), followed by processed foods. Sugar intake soared from under 1g/day in 1985 to nearly 8g/day in 2000. The most recent national dietary surveys seem to indicate that sugar intake halved in 2010 with average daily intakes dropping to 4g/day. However, NIN indicated that the 2010 national survey did not adequately capture the sugar content of processed foods due to a lack of availability of nutrient composition tables for these products and, as such, underrepresented actual sugar intake. More recent sugar intakes estimated by NIN through the monitoring of the sale of sugary processed foods indicated that sugar intake is actually increasing, although exact figures are not yet available[3].

3.1.2 Dietary Diversity and the Consumption of Nutritious Foods

Just over 75 percent of children are currently consuming diets with the minimum dietary diversity (foods from at least four food groups), with a higher prevalence in urban than rural areas and in majority ethnic (Kinh) compared to ethnic minority groups, and in higher compared to lower economic quintiles (General Statistics Office of Viet Nam and UNICEF 2015). A very similar trend was found in the proportion of children receiving a minimal acceptable diet – meaning that both minimal dietary diversity and minimal meal frequency were met. Also here, large disparities are found across ethnic minority subgroups compared to the majority Kinh ethnic group (T. T. Nguyen et al. 2016). In addition, Vietnamese infants and young children share similar disparity across wealth quintiles and between urban and rural areas (Development Initiatives 2018a).

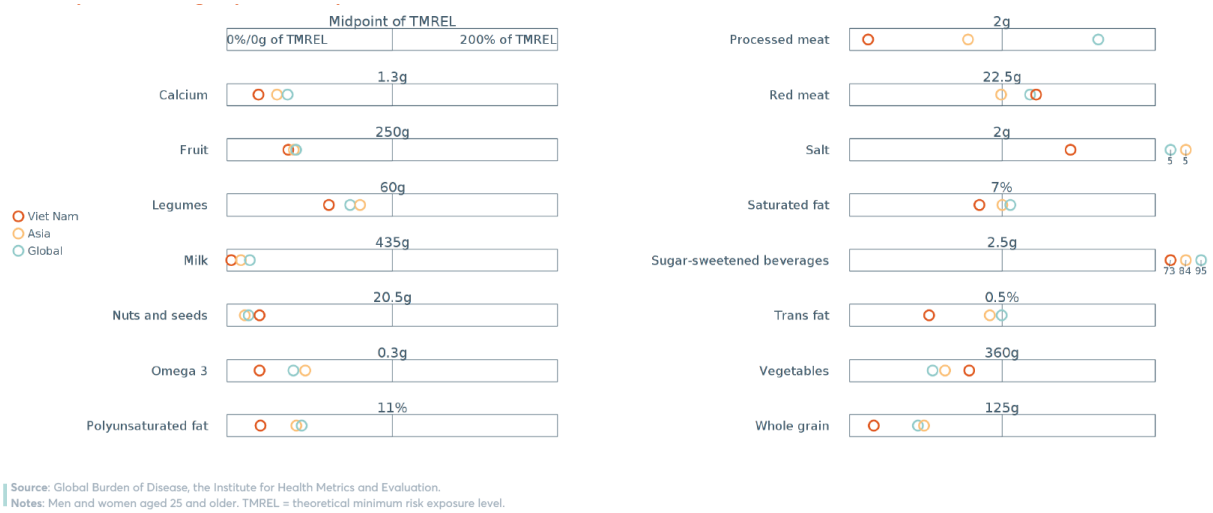
There are currently no national representative data available on women's dietary diversity, however, the 2017 Global Nutrition Report (Development Initiatives 2017) provides some insights into food group consumption trends relative to global and regional values. Generally speaking, diet diversity is

[3] This explanation was presented by representatives from NIN who participated in the consultative stakeholder workshop.

improving across Viet Nam, driven by a decrease in rice consumption in favor of more nutritious foods. Viet Nam consumes higher average quantities of nuts and seeds than both global and regional averages. Whole grain consumption is well below global and regional averages, which is reflected in a strong dietary preference to refined white rice (and products such as noodles) and white bread.

Meat intake has increased dramatically, particularly since the initiation of market reforms in 1986. The average yearly consumption in 1986 was 14 kilograms per capita, increasing to 55 kilograms in 2013, with pork representing the bulk of the meat consumed (Hansen 2018). In 2016, consumption of processed meat among men and women aged 25 and over was on average less than 2g/day, significantly lower than global and regional averages, however, red meat intake was above regional averages, and just above global consumption trends of nearly 30g/day (Figure 3.1). Despite this, saturated fat intake was lower than both regional and global averages, which may be a reflection towards a preference for leaner breeds or cuts of meat. The consumption of animal foods may even have been higher, as these figures often neglected to include dog and wild game as sources of meat.

Figure 3.1: Consumption of food groups and components in Viet Nam in 2016



Source: Global Burden of Disease, the Institute for Health Metrics and Evaluation cited in Development Initiatives (2018b).

Regarding the consumption of nutritious food groups, despite the rapid increase in milk consumption in recent years, milk consumption among Vietnamese people generally remains low due to

limited production, storage, and processing in Viet Nam, and irregular availability of imported milk sources (Viet Nam National Institute of Nutrition, Ministry of Health, and UNICEF 2010). The same national survey showed that the dairy consumption of an average Vietnamese child aged 2 to 5 was 138 grams/day – only one third of the national recommendation, and calcium intake of adult Vietnamese was 500-540mg/per/day, meeting only 50 to 60 percent of the WHO dietary recommendation.

Daily fruit and vegetable consumption is, according to the last NIN national survey data (2010), low at approximately 60g (0.75 servings) of fruit and 190g (2.38 servings) of vegetables (Viet Nam National Institute of Nutrition, Ministry of Health, and UNICEF 2010). Another study using data from a population-based survey of risk factors for non-communicable diseases also reported that Vietnamese people consume on average 0.87 servings of fruit and 2.29 servings of vegetables per day. With this amount, it is estimated that between 57 and 80 percent of Vietnamese people aged 25 to 64 years did not meet WHO recommendations for daily consumption of at least five servings of fruit and vegetables (Bui Tan Van et al. 2016; Nguyen Tuan T. and Hoang Minh V., 2018). Despite this, Viet Nam is still consuming more vegetables compared to both regional and global averages (Development Initiatives 2018a), however, consumption of fruit is particularly low.

Despite tofu being a traditional and important food in the Vietnamese diet, legume consumption overall is quiet low compared to regional and global trends. This may be due to a trade-off in the diet with shifting preferences to increased consumption of red meat and other animal source proteins, which are above global averages (Development Initiatives 2018a).

3.1.3 Micronutrient Intakes

The last nationally-representative nutrition survey conducted in 2010 showed that micronutrient intakes for vitamin A, iron, zinc, and iodine are sub-optimal for children age 24-60 months (Table 3.2).

Table 3.2: Percentage of dietary reference intakes met (DRI) per nutrient

Dietary Reference Intakes (DRI) per nutrient consumed (%)	
	Children 24-60 months
Energy	96
Protein	115
Vitamin A	65
Vitamin B1	137
Vitamin B2	153
Vitamin B3	123
Vitamin C	129
Calcium	101
Iron	70
Zinc	69
Iodine	69

Source: data extracted from General Nutrition Survey 2009-2010 (Viet Nam National Institute of Nutrition, Ministry of Health, and UNICEF 2010).

A study on a subset of the population showed insufficient micronutrient intakes, with the proportion of women of reproductive age having intakes at 25 percent for iron, 16 percent for zinc, 54 percent for folate, 64 percent for vitamin B12, and 27 percent for vitamin A, below the estimated average requirement (P. H. Nguyen et al. 2014). Staple foods provided most iron and zinc in the Vietnamese diet but have lower bioavailability due to phytates. Only a small portion of iron and zinc sources are derived from foods with higher bioavailability such as animal products, which only account for 10 percent of iron and 18 percent of zinc intake.

Micronutrient deficiencies can be attributed to multiple factors including insufficient absorption within the gastrointestinal tract, insufficient consumption of micronutrient-rich foods and diets based on the consumption of foods that limit or inhibit the bioavailability of micronutrients. For Viet Nam, it is estimated that there is a relatively low bioavailability of iron, zinc, and calcium (Viet Nam National Institute of Nutrition and Ministry of Health 2015) because of the phytate-rich rice-based diet. Another factor as to why iron and zinc intakes are still low, despite increasing intakes of animal foods, with some of the highest average intakes within the region and compared to countries with similar GDP, may be due to the main

sources of animal products in the diet coming from pork, fish, and chicken, which are lower in zinc and iron than beef (Hansen 2018).

There has been inequity regarding micronutrient intake, particularly for the rural, poor, and minority populations. These vulnerable groups consumed lower amounts of animal source foods and had less total dietary energy from fat, with higher consumption of cereals and other starches (Nguyen Minh Thang and Popkin 2004). Compared to women in the highest quintile of intake, women in the lowest quintile consumed 26 percent less iron, 19 percent less zinc, 36 percent less folate, 82 percent less vitamin B12, and 47 percent less vitamin A, mainly due to consumption of foods with low iron and zinc bioavailability (P. H. Nguyen et al. 2014).

Current strategies for preventing micronutrient deficiencies are the simultaneous integration of multi-sector solutions. Micronutrient supplementation is an important and necessary solution to promptly resolving micronutrient deficiency status. Micronutrient fortification in food is a medium-term solution. Dietary diversification is a long-term and more sustainable measure to reduce micronutrient deficiencies, but might not be sufficient for certain population groups like young children and pregnant women. International organizations (including UNICEF, WHO, GAIN, CGIAR etc.) are actively supporting Viet Nam in terms of technology, policy, and funding to implement malnutrition prevention programs that improve the quality of diets. One such initiative has been the Joint Program 'Integrated Nutrition and Food Security Strategies for Children and Vulnerable Groups in Viet Nam,' implemented from early 2010 by three UN agencies (FAO, UNICEF, and WHO) and the government of Viet Nam. The Joint Program's goal has been to address the continuing high prevalence of malnutrition among the most vulnerable, with a focus on reducing stunting and preventing future malnutrition in six representative provinces: Cao Bang, Dien Bien, Ninh Thuan, An Giang, Kon Tum, and Dak Lak (MDG Achievement Fund, 2013). Through its broad stakeholder involvement, from international to national to grassroots level, the initiative has confirmed the importance of understanding the need for synergies between the health and agriculture sectors to improve maternal and child nutrition. The initiative also contributed to shaping national legislation on maternity and breastfeeding protection as per UNICEF/WHO recommendations, including the extension of paid maternity

leave from 4 to 6 months in the 2012 Labor Code Amendment, and a ban on marketing of breast milk substitutes and related products for children under 24 months in the 2012 Advertisement Law (MDG Achievement Fund, 2013).

3.1.4 Ultra-Processed Foods

The Vietnamese diet is emerging with increasingly unhealthy consumption patterns associated with non-communicable diseases, including high intakes of salt, sugar, and fat (Nguyen Tuan T. and Hoang Minh V., 2018; World Instant Noodles Association, 2018) from ever-increasing consumption of instant noodles (5.1 billion packs/year) and sweetened beverages high in sugar and energy (925 million lt/year) (Viet Nam Ministry of Health 2016).

Processed meat consumption is on average less than 2 grams/day, significantly lower than global and regional averages. However, with increasing shopping in supermarkets and convenience stores where these foods are more widely available, this consumption pattern is likely to increase (Development Initiatives 2018a).

Fast-food has traditionally been an integral part of the Vietnamese diet, with street vendors and mobile peddlers providing quick, cheap, and relatively nutritious food options. Western and modern fast-food options were not available 20 years ago, but their presence has steadily increased in cities, on sale mostly in supermarkets, convenience stores and small family-owned stores, which has increased the availability of and access to ultra-processed, ready-to-eat foods that are high in fat, sugar, and salt. This trend has yet to be readily observed in rural and remote areas, while there are higher rates of consumption of processed foods in the major cities, especially Ho Chi Minh and Hanoi, as well as in the Mekong River Delta region. Sugar-sweetened beverage consumption by children aged 24 to 60 months is highest in the southeast, where daily intake is more than double the national average at 18ml/day. The north-central and central coastal areas and Mekong River Delta regions consume between 4 and 10ml/day, and the lowest intakes are in the Red River Delta, northern midlands, and mountainous regions.

3.2 Consumer Behavior

Consumer behavior has changed, especially over the past 30 years, as the country has undergone significant changes in its economy, which have led to increases in income, education, household demographics and dynamics, food aspirations, and food environment. The opening of the Vietnamese economy to foreign investment and markets has seen the introduction of, and an increase in, Western and international foods and modern retail outlets that has markedly changed how people are acquiring and consuming foods. Similarly, cinema, music, and the internet have increased Vietnamese consumer demand for modern and Western types of food.

Consumer behavior varies considerably between urban and rural populations, largely because of the nature of their immediate food environment and differences in primary sources of food (urban is purchased while rural is from own-production agriculture). However, there is a growing trend that has seen a slow convergence: driven by food safety concerns related to food products from long value chains that are perceived to be the most 'risky' foods, urban consumers are turning to products produced through urban agricultural schemes, and are directly sourcing from rural areas, which they perceive as a way to improve their ability to control the quality (especially freshness) and safety of the foods they are purchasing. Conversely, rural consumers are gradually increasing their use of retail outlets, particularly convenience stores and processed packaged foods, to complement their diets. Intergenerational food preferences are also changing consumer behavior with shifting taste preferences and food aspirations.

Concerns around food safety also greatly influence consumer behavior in Viet Nam. The lack of standard food safety enforcement mechanisms has resulted in asymmetric information and distrust between producers and consumers (Mergenthaler, Weinberger, and Qaim 2009a). Limited studies on some fruit, vegetables, and commodities (Mergenthaler, Weinberger, and Qaim 2009b; Nguyen Van Phuong, Tran Huu Cuong, and Mergenthaler 2014) provide insights from the consumer demand side regarding the importance of trust, quality, and safety standards. Integrated sociological and nutritional perspectives are productive in rapidly generating evidence to comprehend the complex trade-offs between food safety and nutrition in everyday food consumption practices (S. C. O. Wertheim-Heck and Raneri 2019). Civil society and

consumer groups are playing an increasingly important role and have a bigger voice in advocating for consumer rights with regard to food safety management and sustainability practices (see section 3.2.4 for in-depth insights into food safety). Nutrition education is another driver of consumer behavior, and this is explored in detail in sections 3.3.3 and 3.3.4.

The following sections explore the major drivers of consumer behavior with regard to food acquisition and consumption practices.

3.2.1 Consumer Food Preferences (Taste and Patterns)

Viet Nam is a diverse country, culturally, ethnically, and agroecologically. The result is a country rich in differences in regional food preferences, tastes, and patterns, based on ethnic group and climate (e.g. noodle soup in the north, rice in the south) and seasonal availability preferences. Although the majority (~85 percent) of the population are practicing Buddhists, very few Vietnamese observe a vegetarian diet. Most only abstain from consuming meat one or two days per month and, on these days, many will eat a variety of faux meat, such as soya-based meat substitutes.

Rice is the main and preferred staple food consumed by almost the entire population every day. Vietnamese dietary patterns are shifting from predominantly starch-based diets to those containing more meat and fish. Findings from the Viet Nam Urban Food Consumption and Expenditure Study showed that meat accounts for the largest share of the monthly food expenditures (37 to 44 percent) (The University of Adelaide 2017). Among different types of meat, pork is the most widely consumed, with strong preferences for fresh pork, lean pork, and particularly pork from black indigenous pigs, which is often perceived to be of better taste and quality (Lapar and Nguyen Ngoc Toan 2010). With the growing trend in pork consumption, pork consumers are increasingly concerned about pig diseases, chemical residues, and unhygienic conditions at the point of sale.

Vegetables, particularly green leafy vegetables, are an integral and preferred part of the Vietnamese diet. Indigenous varieties of green leafy vegetables are increasingly becoming popular across the country. Improved road infrastructure and investment into minority ethnic food systems and livelihoods has seen the

rise in value chains that are supplying urban markets with indigenous species and varieties such as Thai mustard. The perceived freshness and safety of vegetables is often a driver for consumer choice of which product to purchase (Wertheim-Heck, Raneri, and Oosterveer 2019).

Milk and dairy products are not a traditional part of the Vietnamese diet and are often are not preferred food choices due to cost and food safety concerns. Low dairy consumption is often regarded as a cause of insufficient calcium in the diet (Tu 2001). Furthermore, many Vietnamese adults are lactose intolerant. Despite this, there is a public awareness campaign designed to increase the consumption of dairy as part of the public health and nutrition strategy to increase the average height of the population, given the nutrient density of dairy foods.

In fact, there is growing tension between choices around foods that are viewed as nutritious (which tend to be traditional foods) and more 'tasty' foods (which tend more to be Western foods high in fat, sugar, and salt). Aspirations for food are changing, especially between generations, with youth preferring more modern Western foods, and older generations still preferring a more traditional diet and foods. This preference towards these 'tastier' foods among the younger generations may impact diet quality.

Eating out of the home has become more common, particularly in urban areas and for adolescents (Lachat et al. 2009), who see it as a more convenient and enjoyable experience, saving time on food preparation, and often cheaper than purchasing the ingredients to self-prepare. Moreover, there is a greater variety of foods on offer than what is typically offered at home, and out of home eating options are often located within close proximity (Lachat et al. 2011). Adolescent behavior associated with increased patterns of eating out found that their diets were different: there was a higher presence of desirable foods and nutrients, but also a higher percent of energy intakes from products abundant in fat and sugar (Lachat et al. 2009). However, there were also nutrition and food safety consumer concerns with regard to hygiene, fat, and salt content of the food prepared out of the home.

Consumers are increasingly aware of the health concerns regarding the risk of NCDs related to high consumption of meat, salt, processed, and unhealthy foods. This is causing some shifts in food preferences,

particularly in wealthier urban populations who began prioritizing meat consumption as the 'preferred food' as incomes increased, back towards a high plant-based diet. However, there are economic and perception barriers to the accessibility of vegetarian and vegan restaurants. As they are still a niche market, they are often expensive, offering plant-based menus within the same price range as meat-based menus; they can therefore be seen as poor value for money and also only attract wealthier clientele.

3.2.2 Retail Food Outlets

Results from the Viet Nam Urban Food Consumption and Expenditure Study (The University of Adelaide 2017) showed that the key factors influencing where consumers shop for foods are: price, freshness, quality, and food safety. Traditionally, Vietnamese consumers mainly relied on wet markets to purchase fresh meat, fish and seafood, fruit, and vegetables. Consumers of all socioeconomic strata acquire food at traditional markets because these offer several advantages. These include accessibility (including by scooter), freshness of produce (particularly vegetables, meat, and fish), exclusive availability of specific foods, and, importantly, also social interactions associated with trust and food origins (Wertheim-Heck, Raneri, and Oosterveer 2019). However, the number of consumers in urban areas using modern markets such as supermarkets, mini-marts, or convenience food outlets is on the rise, due to higher incomes, Western lifestyles, and perceptions that these outlets sell higher quality and safer food. According to Euromonitor data, over the period from 2011 to 2015, while sales by traditional grocery retailers grew by 184 percent, sales by modern grocery retailers grew by 224 percent (Vo and Smith 2017).

Over the past decade, Vietnamese shoppers have been offered a much broader choice in where to shop (Nielsen 2013). Shopping nowadays can roughly be subdivided into a daily household chore, on the one hand, and leisure time on the other. The latter particularly applies to hyper- and supermarket shopping, especially within the recently constructed mega-malls where grocery shopping is combined with window shopping and eating out. Regarding everyday food shopping as a household chore, practices are driven by a combination of: (i) taste and daily meal diversity, (ii) food safety, and (iii) health (Le Chi Cong, Olsen, and Ho Huy Tuu 2013; Wertheim-Heck, Vellema, and Spaargaren 2015; Mergenthaler, Weinberger, and

Qaim 2009a). Although Vietnamese consumers are becoming more aware of health and nutrition, food safety is the primary concern in providing tasty and diverse meals. Food safety is a well-recognized dilemma by consumers, and influences what they purchase and where (Raneri and Wertheim-Heck 2019).

Vietnamese consumers draw from a broad portfolio of food acquisition practices, ranging from self-provisioning – the practice of growing one's own food, which includes rural rice farming, as well as inner-city rooftop gardening – to convenience store and hypermarket shopping (Wertheim-Heck and Spaargaren 2015). With differences across the country and between urban and rural areas, seven prevalent practices can be distinguished (Table 3.3) in which variations of more local 'space of place'-bound direct personalized trust mechanisms coincide with variations of more indirect abstract food safety systems. There is therefore a clear differentiation as to where Vietnamese consumers acquire different food items. Commonly, rural households grow part of their food for home preparation, and even in the peri-urban districts of Viet Nam's major cities it is common for households to grow crops or raise small numbers of livestock (Pulliat 2015; NguyenThi Tinh et al. 2007).

Table 3.3: Overview of food acquisition sources by category based on consumer practices and preferences

Shopping behavior	Description	Motivation
Self-provisioning	Growing one's own produce in small areas, (vacant lots, balconies, rooftops, parks and side roads) for self-consumption and neighborhood bartering	This practice is motivated by the need to re-establish a direct link with production and keep cultivation under their own control.
Kinship shopping	Obtaining foods from relatives living in the rural hometown	This practice is motivated by concerns about the safety of the food provision in the city. In the practice of kinship shopping the control on food safety builds upon the ease with which family members are trusted in their good intentions ('they care for me') and the conviction that people in the countryside know how to produce safe foods.
Farmer shopping	This is the practice of buying directly from the grower	The reconnection with farmers is sought as an alternative to anonymous food shopping, and is based on blind trust that local farmer products are safer.
Market shopping	Purchasing fresh produce daily at formal wet markets or more informal street markets	Personal (long-term) relations with market vendors provide a sense of food safety.
Safe or organic food outlet shopping	Purchasing foods at dedicated outlets explicitly claiming to sell 'safe' or high-quality foods, either at brick and mortar shops or through online ordering services	Shopping at these specialized outlets is driven by concerns about food safety and a search for acclaimed quality, but is accessible only to shoppers from higher-middle and upper income classes.
Hyper-/supermarket shopping	The practice of shopping in a clean and orderly indoor air-conditioned environment and purchasing larger quantities of both fresh and processed foods, to be stored at home	Food safety is 'guaranteed' through 'company reputation' in combination with explicit food safety assurance through certification, labels and brands at product level.
Convenience outlets	Small-sized family-owned grocery shops (Mom & Pop stores) and more recently chain convenience stores (VinMart, Circle K)	Convenient close-to-home location mainly for purchasing cooking oils, spices and condiments, beverages and dried goods.

The dominant food purchasing practice is shopping daily for fresh foods at markets (Nhung Tran Thi Tuyet and Hara 2017; Wertheim-Heck, Vellema, and Spaargaren 2014; Wertheim-Heck and Raneri 2019). Shopping at markets, whether at formal wet markets or more informal street vending structures (see 3.3.1), is estimated to account for about 90 percent of total vegetable sales. Supermarkets are mainly a weekend destination where food shopping is combined with spending leisure time and eating out. Although supermarket sales have been growing over the past two decades, it is mainly in non-food and ultra-processed food categories. Although supermarket shopping is becoming more normal in daily life and losing its

novelty edge, the majority of consumers in Viet Nam still prefer to purchase food by the meal, or at least by the day, at fresh markets.

There is certainly a relationship between income, shopping frequency, and choice of shopping outlet (Table 3.4). Lower-income groups with irregular income sources, who are thus subject to daily food budgeting, are practically excluded from supermarkets (Wertheim-Heck et al. 2014; Wertheim-Heck and Raneri 2019) (Wertheim-Heck et al. 2014). Regular shopping for fresh foods at supermarkets is clearly limited to a select group, characterized by higher income and higher education levels. Research in Hanoi showed that habitual supermarket shoppers shop less frequently than shoppers purchasing from markets and that for them food safety prevails above everyday freshness (Wertheim-Heck, Vellema, and Spaargaren 2014).

Table 3.4: Profile of supermarket and convenience store shoppers compared to the general Hanoi population

	Supermarket shoppers (%)	Convenience store shoppers (%)	Hanoi population (%)
Income			
Upper and medium income classes	87	74	39
Education			
Completed university or higher education	70	55	42
Shopping frequency			
Shopping everyday	40	73	87

Source: (S. Wertheim-Heck, Vellema, and Spaargaren 2015).

In conclusion, the overall pattern of Vietnamese consumers is to purchase fresh foods from markets, and beverages, dry goods, and processed foods from convenience stores (mostly family-run stores) or hyper- and supermarkets. With regard to fresh foods, most recently a shift is being observed towards online purchasing via the ordering services of specialized food stores and through more informal networks (see above). The rise in online food ordering is mainly driven by food safety concerns. The advance in online food ordering indicates a remarkable shift from tangible food quality checks to trusting abstract quality

guarantees without being able to visually inspect the actual produce personally at the purchase site (Wertheim-Heck and Spaargaren, 2015). It is expected that online shopping will expand and broaden to the larger retail chains, motivated by convenience.

3.2.3 Daily Life and the Importance of Convenience

Since fresh foods are preferably purchased on a daily basis, convenience is an important factor in Vietnamese food shopping practices. Vietnamese consumers also demonstrate an ability to skillfully balance convenience with their high concerns over food safety in their everyday food shopping.

In the practice of purchasing daily foods, consumers appear to make constrained choices and two dominant types of shopping patterns are distinguished (Wertheim-Heck, Vellema, and Spaargaren 2014). People are either taking their time when purchasing fresh foods, 'walking and talking,' or they quickly walk through or drive along and do their 'shopping without stopping.' Food purchasing is not only regarded as a household necessity but is also, importantly, enjoyed as a much-valued social interaction within the local neighborhood community. Time is not, as yet, scarce. Two aspects importantly define this practice. The first aspect regards the consumers' radius of action. Most urban shoppers rarely travel outside their local community and their lives are commonly organized around the house. Everything outside their action radius is considered inconvenient, which is explained by limited transportation means (whether unavailable, unable to drive, or constrained by small children). The local neighborhood market is the preferred place for daily fresh food purchases. The second aspect regards the concept of kinship. Within local communities, the social cohesion is strong and builds on inter-dependence. Livelihoods still largely rely on the traditional insurance system of mutual indebtedness. Personal contact during daily shopping is vital to prevent isolation and fosters community spirit. Price negotiations are an important act of interaction; although the idea of bargaining is to reduce the price, it is also enjoyed as an interactive, habitual and social game.

Food shopping, for the time-constrained, is regarded as a time-consuming activity that conflicts with other activities in everyday life, particularly for populations leading more modern, urban lifestyles. These consumers opt for time-saving strategies and regard food purchasing more as an economic transaction than as social interaction. For this segment of the community, the priority is to reduce shopping

time through for drive-through purchasing – shopping without stopping – from vendors along the roadside. Other time-reduction strategies include a reduction in shopping frequency and shortening food preparation time.

3.2.4 Taboos, beliefs and misconceptions affecting consumer choice

In Viet Nam, food consumption is traditionally influenced by beliefs around the health properties of food and with food 'taboos' tending to be temporary and context specific (Avieli 2019). Many Vietnamese follow the Chinese yin-yang (âm-dương in Vietnamese) theory of diet categorizing food as dương (hot) or âm (cold) (Chen and Swartzman 2001). Hot foods include red meat, alcohol, and ginger; cold foods include noodles and bananas. Some foods are neutral (e.g. rice, pork or sweets). Moreover, people believe that certain animal organs such as pig heart, kidney, and brain are suitable for infants and elderly people, whereas other foods should not be given because they are likely to be unsafe or not nutritious (personal perception). Raw pork is rarely eaten except for fermented pork (nem chua), and sometimes raw blood pudding (tiết canh). Gender also influences consumption. For example, some risky foods like tiết canh, mainly from pigs and poultry, are mainly eaten by men.

Post-partum, women are reported to avoid 'cold' foods in order to restore their vitality, and encouraged to consume animal source foods that are 'hot' and promote blood generation and flow (Köhler et al. 2018). Fresh fruits (those that are fresh, 'itchy,' and with white sap) and vegetables (that are bitter, fermented, fresh, green leafy, hairy, strong smelling, yellow flowering) are regarded as 'cold' and as such are avoided during pregnancy and post-partum (Köhler et al. 2018). A common post-partum dish that is encouraged to be consumed for two months after birth to promote breast milk production is a combined dish of pork trotters with either papaya or red beans and potato (Lundberg and Trieu Thi Ngoc Thu 2011).

Wild foods are becoming more of a taboo as forest conservation efforts are reducing or limiting access to forest lands, which, in some cases, make it illegal to hunt or collect wild foods. While these foods are not traditionally a taboo part of the diet, they are becoming so given their legal ambiguity.

As Viet Nam has a rich diversity in ethnic groups, there are a wide range of food taboos and practices that are specific to individual groups, particularly minority ethnic groups. For example, the Cham Balamon practice a taboo on eating beef and the Bani on pork (Hardy, Cucarzi, and Zolese 2009).

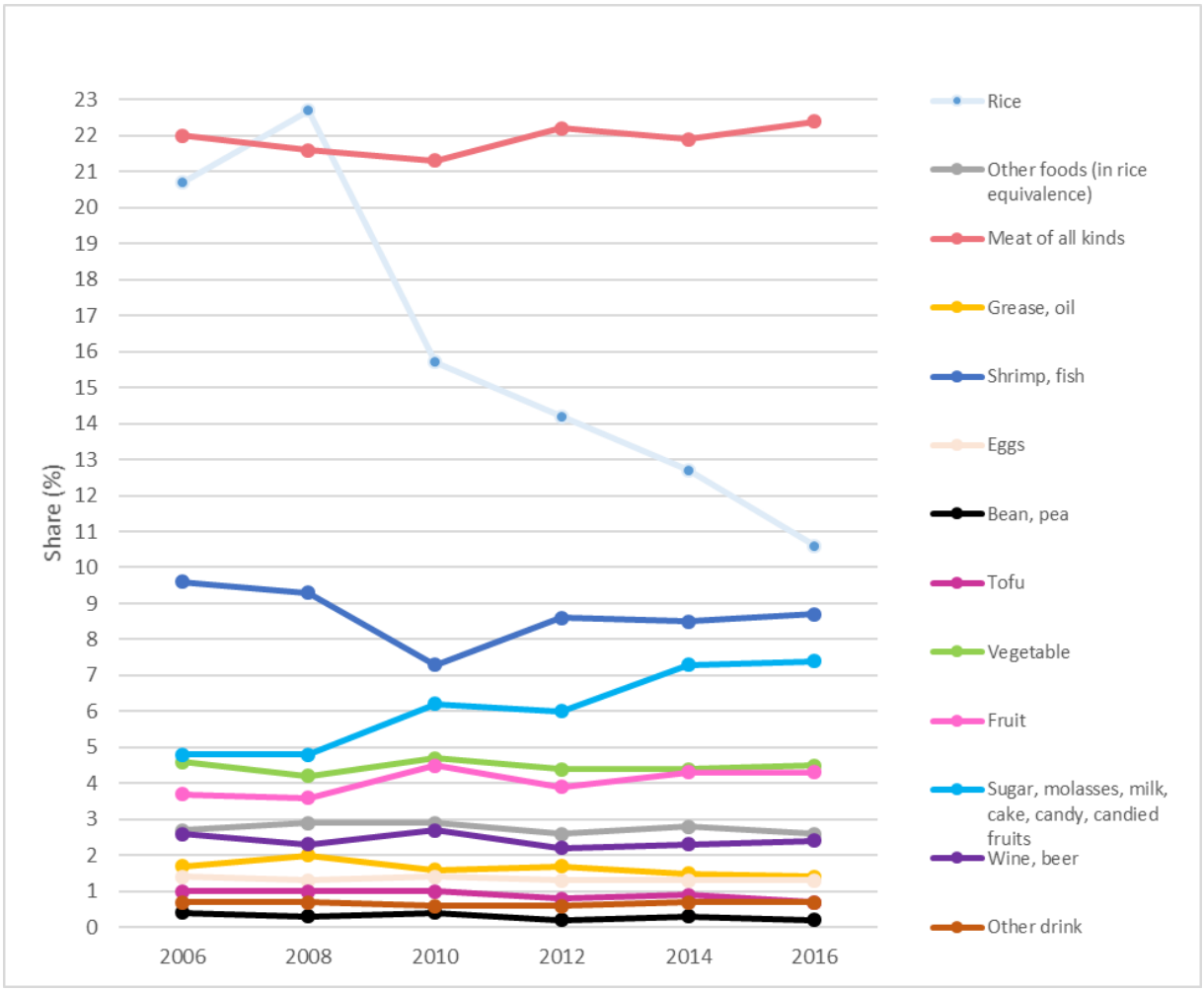
3.2.5 Socio-Economic Variables Influencing Consumer Choice

Over the last 30 years, food demand patterns have changed significantly in Viet Nam. The rapid economic growth that followed the Doi Moi reforms of 1986 determined significant improvements in living standards and in the quality of diets (Le Ngoc Dien, Nguyen Minh Thang, and Bentley 2004; Glewwe, Agrawal, and Dollar 2004; Mishra and Ray 2009; Nguyen Minh Thang and Popkin 2004; Molini 2006). From 1992 to 2004, the share of expenditures on meat, fish, and dairy increased, while expenditures on rice declined significantly (Mishra and Ray 2009). However, expenditure shares and dietary patterns differ across regions and between poor and non-poor households (Nguyen Minh Thang and Popkin 2004; Molini 2006; V. Mishra and Ray 2009).

Based on the results of the Viet Nam Household Living Standard Survey (General Statistics Office of Viet Nam 2016), in the period from 2006 to 2016, the share of living expenditures allocated to food and drink (eating, drinking, and smoking) declined from 53 percent to 51 percent. Within this budget, shares on food and foodstuffs declined from 40 percent to 35 percent, yet the share of food expenditures increased on meat, sugary products[4], and fruits, while budget shares on rice declined significantly (except for 2008), indicating that purchasing power slightly increased over time (Figure 3.2). From 2006 to 2016, rural residents increased their expenditure mainly on meat (from 21.5 percent to 24.6 percent) and sugary products (from 3.8 percent to 6.9 percent), while budget shares declined on pulses (from 0.4 percent to 0.2 percent) and fats (from 2.3 percent to 1.7 percent). Budget shares for urban residents declined on fish (from 9.8 percent to 8.3 percent) and slightly declined for most of the food items, except for sugary products (from 6.3 percent to 8.1 percent) and fruit (from 4.5 percent to 5.1 percent).

[4] Sugar, molasses, milk, cake, candy, and candied fruits.

Figure 3.2: Share of expenditure on key food items (2006-2016).



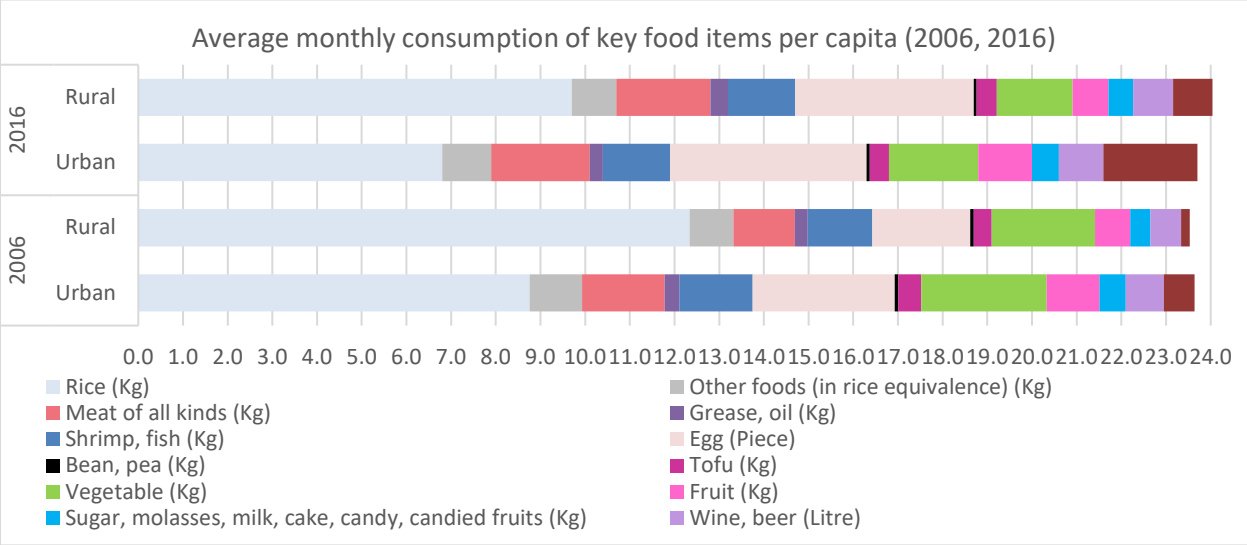
Source: General Statistics Office of Viet Nam (2016).

Individual consumption (per month) increased for most of the food groups, in particular for protein- and lipid-rich foods, such as meat, fats[5], eggs, and tofu, but also for sugary products, alcohol[6], and other drinks, while consumption of rice declined significantly (Figure 3.3). Quantity of pulses and vegetables consumed declined from 2006, while fruit consumption remained stable over time despite the increase in share of expenditures for this item. However, consumption patterns vary across income quintiles. In 2016, the top income quintile (Q5) consumed more meat, fats, fish, eggs, pulses, tofu, fruits, vegetables, sugary products, alcohol, and other drinks, and consumed less rice compared to the bottom income quintile (Q1)

[5] Grease, oil.
[6] Wine, beer.

(Figure 3.3). This trend is in line with the study by Hoa Hoang and Meyers (2015), who found that expenditure elasticities on rice are negative to income growth and its demand is expected to decrease in the next 15 years. Both urban and rural residents increased the consumption of meat, eggs, and other drinks (e.g sugary drinks and alcohol), while consumption declined for vegetables and declined slightly for pulses. Consumption of fats and tofu increased for rural consumers, while it declined for urban residents. The quantity of fish and fruits consumed remained stable for both rural and urban residents (Figure 3.4) (General Statistics Office of Viet Nam 2016).

Figure 3.3: Average monthly consumption of key food items per capita (2006, 2016) and by income quintile (2016)

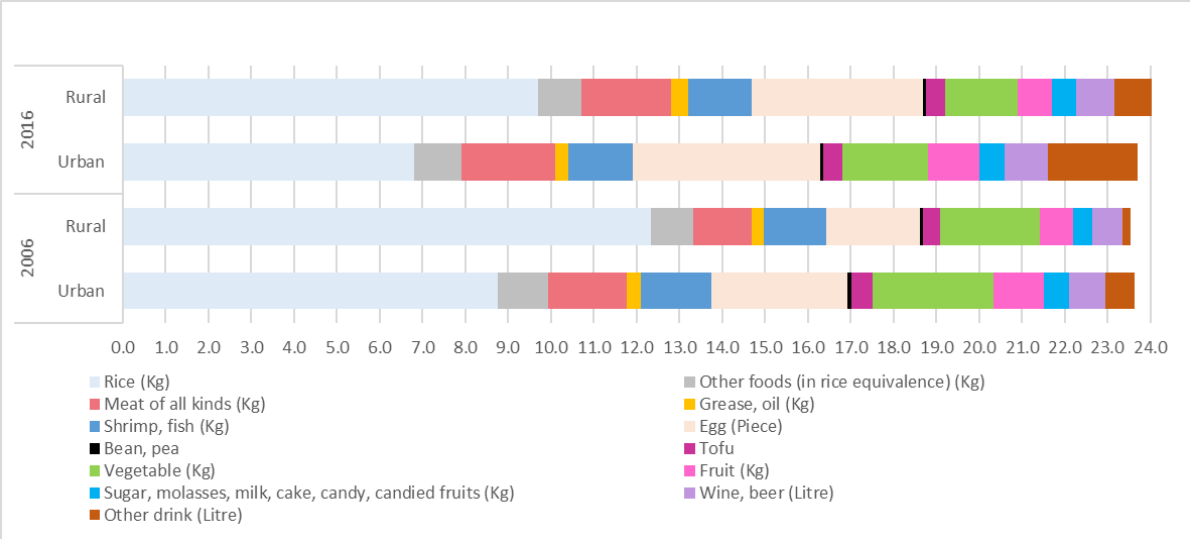


Source: (General Statistics Office of Viet Nam 2016).

Purchasing power and consumption patterns also differ by living area. In 2016, share of food and foodstuff expenditures were higher for rural (38 percent) compared to urban (30 percent) consumers. Urban residents spent a higher share of their food and drink budgets (eating, drinking, and smoking) on out-of-home meals (15 percent) compared to rural residents (10 percent). Share of expenditure on out-of-home meals increased significantly in both rural (from 5 percent to 10 percent) and urban areas (from 10 percent to 15 percent) and vary between the top (6 percent) and bottom (14 percent) income quintiles. Consumption of food out of the home is becoming increasingly popular, especially among young people, and can

potentially lead to consumption of more nutritionally-diverse foods, but also to an increased intake of fats and sugars (Helmisaari 2015; Le Ngoc Dien, Nguyen Minh Thang, and Bentley 2004; V. Mishra and Ray 2009; Lachat et al. 2009).

Figure 3.4: Average monthly consumption of key food items per capita (2006-2016)



Source: (General Statistics Office of Viet Nam 2016).

In conclusion, food demand patterns show similarities with those described for other LMICs, indicating they are influenced by income and urbanization (Popkin 1998; Pingali 2007). Demand for animal-based products has increased, while demand for staple foods, such as rice, is progressively declining and this trend is more evident for urban areas.

Although this ongoing trend has led to more diversified diets compared to the past decade or so, the poorest households are the most vulnerable to sudden price shocks, which impedes their ability to afford a diversified diet (Hoa K. Hoang 2017).

3.3 Food Environment

The food environment in Viet Nam has undergone a dramatic transition over the past decade (van Wijk et al. 2006; Maruyama and Le Viet Trung 2011; Dries, Tyng, and Truong Minh Dao 2013; Nguyen Hai Thi

Hong, Wood, and Wrigley 2013). The food system has seen major transitions from rural to urban focuses, and transitioning from traditional to modern retailing. Major shifts include the increasing penetration of transnational retail partnerships, which accelerated after Viet Nam's entry into the World Trade Organization (WTO) during the Doi Moi period (1986-1993), introducing new foods and implementing private food management and quality control systems. A more recent shift involves large-scale Vietnamese-owned businesses from outside the agrifood sector (importantly, originating from the real estate and finance sectors) into food retailing and agricultural production. The agrifood industry is a promising sector in the Vietnamese economy and is expected to grow to US$51 billion by 2020 (Dutch Embassy, 2017). The ambition of becoming a producer of high-quality foods in compliance with international standards requires improvements throughout the entire supply chains, and Vietnamese conglomerates are increasingly seizing the economic potential, with the potential promise of improving food safety and quality to consumers.

Although small-scale production and the flow through traditional or informal markets still dominates most of the country's agricultural value chains for domestic use, the penetration of international food standardization and management, combined with large-scale investments in the agrifood complex, is driving the development of closed and controlled value chains. This is pressing the agrifood sector to transform from predominantly smallholder farming into larger-scale farming. Another alternative trend is the development of participatory guarantee systems (PGS), a reliable and affordable quality assurance that enables farmers to increase their income while helping to build consumers' trust in their food (Moustier and Nguyen Thi Tan Loc 2015; Rikolto and Viet Nam National University of Agriculture 2018). With their low cost and great potential for education and dissemination, PGS constitute powerful instruments (Asian Development Bank 2018).

In this transforming food environment, consumers are being faced with an increasing number of food quality identifiers in which global standards compete with local standards and in which formal, state-regulated certification coexists with more grassroots-initiated qualification schemes. Moreover, consumers are facing an accelerating increase in food choice. This is tangible in the fresh food category, for instance the introduction of kiwi fruit since 2009, but most notable in the category of (ultra-)processed foods and

beverages like milk, soft, and alcoholic drinks. This development coincides with the advance of branding – both producers' branding and retail private labeling. All these developments in product choice, quality guarantee systems, and marketing communication are aiming to influence consumers in their everyday food choice within a changing food retail environment (see 3.3.1).

3.3.1 Markets

Food retail environment

Consumers in Viet Nam have access to food through a wide selection of food retail channels. The system of food retailing in Viet Nam consists of a formal provisioning structure planned and managed through business registration by the central government and the local People's Committees, and an informal structure characterized by unlicensed, unregistered business operations (Table 3.5). No formal rental fees apply in these markets, though more informal organizational arrangements do exist.

Table 3.5: Overview of vegetable retailing in Hanoi

	Formal Registered permanent business (business license)		**Informal** Non-registered flexible business (no business license)
Recently introduced retail concepts	Hypermarkets/Supermarkets (Chain) convenience stores		
Hybrid retail concept	(Safe) Vegetable shops Mom-and-pop convenience stores		
Long established retail concepts	Food stalls (outside wet market)		Flexible stalls (within wet market)
	Wet market: Kiosk (within wet market)		Street markets
	Stall (within wet market)		(Groups of) Mobile vendors

Source: Slightly adjusted from (S. Wertheim-Heck, Vellema, and Spaargaren 2015).

Global integration – reflected in food availability

The global integration and the advancement of international supermarket chains in Viet Nam has dramatically impacted the food availability in the country. Many elderly consumers still vividly remember the rationing system in the late 20th century, in which even the most basic foodstuffs were scarce. When Viet Nam entered the global economy in the late 1990s, this not only increased rice and other staple exports, but it also opened the country to an exponentially increasing influx of novel and counter-seasonal food products. This development accelerated through foreign direct investment of transnational food producers and retail corporations. In particular, the assortment in processed foods and beverages has expanded exponentially in the last decade. The widest selection of foods is nowadays being offered in hypermarkets and supermarkets (Nielsen 2013) in addition to fresh foods, including a broad range of packaged food products, including snacks and bottled beverages. However, traditional wet markets still offer a larger choice to consumers for fresh produce and animal source food varieties and breeds, especially traditional types such as pork.

Seasonality – consumption and affordability perspectives

Seasonality of fruit and vegetables is an issue at play mainly limited to rural areas and lower urban income groups. With the integration of Viet Nam in the Association of Southeast Asian Nations (ASEAN) and the wider global economy, food availability in urban areas has become less dependent on seasonality. The Vietnamese urban diet is incorporating an increasing amount of foods produced outside the country, including fresh foods, most importantly in the fruit category.

It is mainly vegetable consumption that has, to date, remained susceptible to seasonal fluctuations and variations, although cultivation in mountainous areas, like the central highlands of Viet Nam and Moc Chau in the north, allow for nearly year-round domestic availability of more temperate vegetables, especially the subtropical climate in the Northern Red River Delta, results in seasonal variations.

Seasonality is also reflected in the prices of products that are offered all year round. For instance, in the Red River Delta, summer season temperate vegetables offered from more distant mountainous areas

can be twice the price of similar products offered during the winter months sourced from within the Red River Delta (insights from Fresh Studio). Thus, seasonality is reflected in price levels, and particularly impacts lower income populations.

Affordability

Price is often assumed to play a major role in the preference for markets above supermarkets. However, the vegetables sold in supermarkets are generally rather similarly priced to vegetables sold in markets; even produce with an explicit food safety claim is generally not priced more than 10 percent higher than conventional produce at markets (Wertheim-Heck, Vellema, and Spaargaren, 2015). Ultra-processed foods are increasingly becoming more affordable to consumers, as is reflected in increasing rates of consumption, especially in urban areas. Fresh, quality, imported foods are less affordable than locally-produced foods, although this can fluctuate.

3.3.2 Food Labeling: Safety and Nutrition

Nutrition labeling

At present, regulations on the labeling of prepacked foods in Viet Nam is voluntary, based on regulations of the current Viet Nam food labeling laws, together with the provisions of the joint FAO/WHO Food Standards Programme's CODEX ALIMENTARIUS (Codex) international food standards, guidelines, and codes of practice. The 'Joint Circular No. 34/2014/TTLTBYT-BNNPTNT-BCT Guidelines for the labeling of pre-packaged foods, food additives and food processing aids' (Viet Nam Ministry of Health, Ministry of Agriculture and Rural Development, and Ministry of Industry and Trade 2014) encourages organizations and individuals to utilize nutrition labeling information as instructed by the Codex. There are some challenges in managing nutrition labeling, mainly that food companies find it difficult to declare nutritional content because they do not have the means to conduct food composition analyses themselves, nor is the information easily available to calculate the food's nutrient content. Consumers themselves seem to not clearly understand nutrition labeling, so they do not feel empowered to make informed food choices, yet

they are also not aware that this information could be available and useful to them. As such, Vietnamese food companies do not feel pressure from consumers to invest in food composition analysis or calculation for labeling.

3.3.3 Nutrition Knowledge and Education

Current Nutrition Knowledge

Currently, there is no nationally representative data available on levels of nutrition knowledge in Viet Nam, and no data on this has been included in the 2010 general nutrition survey. Individual studies of poorer populations in both urban and rural areas have shown that nutrition knowledge is limited; basic concepts on diet diversity, balanced meals, vitamins and minerals, food pyramid, and why these are important for nutrition, are often missing (Raneri et al. 2017).

Knowledge on infant and young child feeding is a critical determinant of child nutrition. Women in Viet Nam have knowledge gaps regarding exclusive breastfeeding up to 6 months and appropriate timing for the introduction of complementary foods, with mothers often introducing these foods too early or too late (Alive & Thrive 2012).

With transitioning diets, younger generations are losing knowledge about traditional and healthy foods, as they are often not cooking and prefer to eat out of the home and/or are choosing more Western non-traditional foods.

There has been little nutrition education mainstreamed through the Vietnamese higher education systems, with university lecturers' and school teachers' level of nutrition knowledge being limited (Quynh T. H. Pham et al. 2016). The lack of inclusion of nutrition education, and specifically public health nutrition, through any formal education or government channels may indicate a systemic problem with building nutrition throughout the education system from primary or even pre-school to university. It may offer a first entry point for improving national diet quality and nutrition.

National Strategies to improve nutrition knowledge and practice

The need for mainstreamed nutrition education has been gaining attention from the Government of Viet Nam, and is being addressed through the development and implementation of numerous policy documents and public education and communication solutions aiming to stimulate the nutrition status of the Vietnamese people (Government of Viet Nam 2015). Between 1980 and 2000, nutrition education media interventions have focused on malnutrition and micronutrient deficiencies. Since 2000, these efforts have also included messaging aimed at preventing overweight, obesity, and chronic diseases – outcomes of the nutrition transition that have started affecting the population. Nutrition education interventions have started to be implemented in select schools and hospitals, including for the first 1000 days of life, breastfeeding, and improving physical fitness, however, they are not widespread. Integrative and cross-cutting nutrition education on agricultural production, clean water, and sanitation has been recently promoted in an attempt to address the multi-sectoral aspects of malnutrition.

International food corporations have also joined forces with the government in the drive to support nutrition education. In 2012, based on findings from nationally-conducted research highlighting a status of nutrition experts in Viet Nam, Japan's Ajinomoto Group's Institute for Innovation, in collaboration with NIN, and other related Vietnamese government institutions, launched the Viet Nam Nutrition System Establishment Project (VINEP) to support the establishment of a nutrition education training system in Viet Nam, to improve the country's nutrition education framework by training dieticians and introducing higher education in nutrition science. In November 2012, the Ministry of Education and Training approved Viet Nam's first dietitian training program, and Hanoi Medical University opened a four-year nutrition bachelor course in September 2013. The course has attracted around 50 students each year since it was launched (Ajinomoto 2017).

The National Nutrition Strategy (NNS) for the period 2011 to 2020 and vision to 2030 (Government of Viet Nam 2012b) has six target groups, in which Objective 5 is to ″Improve awareness and increase proper nutritional practice.″ It is an important goal that is repeatedly mentioned and emphasized throughout the document. The specific objectives of nutrition education/communication that are disseminated by NIN in 63 provinces and cities are to improve nutrition knowledge and awareness and increase correct nutritional

practices. Currently, there are no comprehensive national assessments of indicators of Objective 5, but the insights into the effectiveness of the nutrition education strategies has been seen from the significant improvement regarding undernutrition indicators for mothers and children observed in 2015, demonstrating the effectiveness of including nutrition education in the public health nutrition campaign.

Communication and education on nutrition for preventing obesity, overweight, and non-communicable diseases have so far been limited. The use of social media networks (e.g. Facebook, Fanpage, Twitter, etc.) should be targeted to change lifestyle behavior, including a reasonable use of salt and sugar in food, and promote increased consumption of fruit and vegetables.

The link between agriculture and nutrition has been included in the nutrition education plans. Coordination with the Department of Agriculture and Rural Development, and social organizations will guide appropriate farming techniques; develop family Garden-Pond-Livestock systems (Vuon-Ao-Chuong Systems or VACs); and introduce new and more nutritious crop varieties, improved cultivation and husbandry techniques, and preservation and post-harvest food processing to ensure food and nutrition security. These efforts are specifically targeted to poor rural households in disadvantaged areas where natural calamities and floods occur frequently.

3.3.4 Nutrition Education Campaigns/ Outreach

Food-Based Dietary Guidelines (FBDG)

Viet Nam's first Food-Based Dietary Guidelines (FBDG) were developed and published in 1995, spearheaded by NIN with inputs from the Ministry of Health, Ministry of Education, and Ministry of Agriculture. The guidelines are endorsed by the Ministry of Health. They were developed considering the state of undernutrition at the time, with a high prevalence of underweight and stunting, micronutrient deficiencies, and food insecurity. The FBGD focused on promoting optimal body weight with detailed instruction on all the components of a healthy, balanced, and diversified diet. These messages were promoted together with information on breastfeeding, complementary feeding, and consumption of both animal and plant foods and limiting sugar and salt intakes.

Home gardening, fish ponds, and small-scale animal husbandry were promoted to encourage diversified and balanced family meals. The FBDG have since been revised three times (in 2001, 2006, and 2013) based on the national food consumption, nutrition, and health data. With each revision, the messages were progressively made simpler and shorter and rearranged upon the defined nutrition and health priorities of the time, and currently address newly-emerging problems such as the rising incidence of overweight and NCDs.

FBDG have been used as the main nutrition education material for the implementation of the NNS. FBDG have been introduced in nutrition education training courses, newspapers and other mass media, in nutrition education materials such as printed leaflets and posters, as well as audio tapes to be distributed and broadcasted at the community level in talk shows, clubs and cooking contests. FBDG messages are also promoted during the annual Micronutrient Days in June, and the Nutrition and Development Week in October.

Currently, there are ten food-based dietary guidelines and six food guide pyramids for different targeted groups, namely, children aged 3-5 years, 6-11 years, 13-15 years, 16-18 years, adults, and pregnant and lactating women, with the newest versions issued for the period of 2016-2020. These food guide pyramids provide the number of standard portion sizes for each food group and visualization of portion size, which allow people to easily diversify their diet at each daily meal, while ensuring a balanced and healthy diet.

Community Nutrition Programs

The development landscape in Viet Nam is dynamic and complex, since a multitude of government bodies have a stake in nutrition or programs that might impact nutrition, such as social safety nets and poverty reduction schemes (Ministry of Rural Development, Ministry of Investment and Planning, Women's Union, etc.). NIN, under the MoH, is the primary body responsible for nutrition policy and programs in Viet Nam and was responsible for drafting the NNS for 2011-2020, with a vision toward 2030. Within the NNS, many different ministries have a role in supporting nutrition in Viet Nam. The key community nutrition projects

and programs to implement the NNS include: (1) Nutrition education, communication, and capacity building; (2) Maternal and child malnutrition control, and improved stature; (3) Micronutrient deficiency control; (4) School nutrition; (5) Overweight/obesity and nutrition-related non-communicable chronic disease control; (6) Household food and nutrition security, and nutrition following emergencies; and (7) Nutrition surveillance.

In addition to NIN, a variety of national and international agencies support nutrition in Viet Nam, including WHO, UNICEF, Save the Children, Alive & Thrive, Health Bridge, HKI, Plan International, World Vision, World Bank, and the Asian Development Bank. The Joint Programme on Integrated Nutrition and Food Security Strategies for Children and Vulnerable Groups in Viet Nam aims to support the development and implementation of integrated nutrition and food security strategies to meet the equitable targets set in the NNS and National Food Security Strategy. The program has been implemented since early 2010 in six representative provinces of Cao Bang, Dien Bien, Ninh Thuan, An Giang, Kon Tum and Dak Lak (MDG Achievement Fund 2013).

Nutrition-specific interventions that have achieved high coverage include salt iodization, promoting breastfeeding, complementary feeding education and food supply for the at-risk, and vitamin A supplementation. Other nutrition-specific interventions that still have low coverage include micronutrient supplementation for pregnant women, micronutrient powders for children, and severe acute malnutrition management. Other recommended interventions yet to be implemented include calcium supplementation in pregnancy, energy-protein supplementation in pregnancy, and supplementary feeding for treatment of moderate acute malnutrition.

The protein-energy malnutrition control program, implemented by NIN since 1995, now continues through the national child nutrition improvement program. It is implemented in all 63 provinces nationwide through the system, from central to province, district, commune, and village nutrition collaborators. The main activities include nutrition education and communication at different levels from central to grassroots, and by different channels, including mass media, community gatherings, face-to-face counseling, at community health facilities, and in school settings. There are two important nutrition education campaigns

every year: Micronutrient Days in June and Nutrition and Development Week in October. Another main component of the program is child growth monitoring with regular nutrition status assessment of under-five children or under-three children, depending upon priority and resources, followed by nutrition counseling for mothers or caregivers on balanced and healthy diet, or nutrition rehabilitation for severely malnourished children. Demonstration of food preparation for children by commune or village health workers to children's caregivers is a regular activity. Micronutrient supplementation has also been implemented regularly, such as free vitamin A supplementation for young children and lactating mothers, promotion of iron-folic acid supplementation for women of reproductive age and pregnant and lactating women for controlling and preventing iron anemia, and food fortification. Multivitamin supplementation, sprinkle or home fortification for young children, has been implemented for disadvantaged areas. Diet diversification and balanced diets have always been promoted together with promotion of VAC ecosystems including home gardening, fish raising, and livestock raising for household food production.

More recently, there has been a drive to promote healthier diets for control and prevention of obesity and non-communicable chronic diseases due to the rapid increase of nutrition-related NCDs under the NCDs prevention and control programs and projects.

In Viet Nam, several nutrition-sensitive agriculture (NSA)[7] community interventions have been implemented on a small scale, targeting poultry, fishponds, home gardens, bean and inter-cropping, sloping land crop diversification, among others (Berti et al. 2016).

3.3.5 School Meal Programs

Most children spend six to eight hours at school, where they will eat lunch and snacks, from the time they begin preschool until they leave school for higher education. School meal programs, therefore, play an important role in children's dietary intake. Viet Nam's national School Meal Program, organized by the Department of Education, was first implemented at kindergarten level in 1977, and has been extended to

[7] Nutrition-sensitive agriculture (NSA) is an inter-sectoral, multi-level food system approach used to maximize agriculture's contribution to improved food security and nutrition, utilizing Complex Adaptive System Theory and Transition Management to analyze processes of embedding NSA interventions in food systems (NWO 2016).

elementary school since 1980. According to the Ho Chi Minh City Department of Education, 100 percent of kindergartens and 90 percent of elementary schools have applied the school meal program since 2002. In parallel with the evolution of society and economy, the purpose of the school meal program has changed, from only providing food to improving health by supporting appropriate diet and providing nutrition education under the current program. Parents are expected to contribute toward the cost of school meals; poor families may be supported by the government. In 2016, the School Milk Nutrition Program was approved, aimed at improving the nutrition status of children in kindergarten and primary school up to 2020. Private food processing businesses and corporations have also joined forces with the Vietnamese government to support the nutrition drive, to address both malnutrition and overweight and obesity. Awareness about the importance of school meals has risen significantly at Viet Nam's Ministry of Education and Training and Ministry of Health, with the introduction of menu-creating software developed by Ajinomoto Viet Nam Co., Ltd (AVN) since November 2017, where it has been introduced into 3,880 elementary schools with food preparation facilities across the country (Ajinomoto 2017).

3.3.6 Food Safety

Over the past 30 years, food safety has become one of the top concerns of Vietnamese consumers and the Vietnamese government. According to the global food source monitoring company Food Sentry (Lanier 2013), Viet Nam was among the top 10 countries with the most food safety violations in 2013. In the past four years, food safety and food poisoning have sparked widespread media coverage and triggered the first-ever public outcry, underscoring the gravity of Viet Nam's food safety crisis. A 10-year monitoring program at farm level showed that pesticide use is increasing in Viet Nam and that many toxic and illegal pesticides are still being used. Pesticide use increased from 35,000 tons a year in 2002 to about 105,000 tons in 2012. Besides pesticides, other hazards can be associated with fresh produce contamination, such as microbiological pathogens and heavy metals (Pham V. Hoi et al. 2016; Rubin 2018).

In 2016, the report 'Food safety risk management in Viet Nam: Challenges and opportunities' was produced by the World Bank and partners at the request of the Vietnamese government with the following conclusions:

- Food safety is a major concern for the public, with high levels of anxiety each time there is a high-profile food safety incident.
- The level of contamination found in Vietnamese food for domestic consumption justifies public concerns.
- Increasing urbanization puts pressure on traditional ways of providing food.
- The primary cause of food-borne illnesses comes from bacterial contamination, rather than from chemicals, which could be prevented by better levels of food hygiene throughout the value chain.
- High use of agricultural inputs such as antibiotics, pesticides, and chemical fertilizers; poorly regulated or illegal imports; lack of traceability; and cross-contamination are also important factors in assuring safe food, but the biggest challenge lies in changing the practices of vast numbers of small producers.
- Viet Nam has a modern food safety regulatory framework with foundations in place for further improving food safety performance and outcomes but much more could be done to make it results-focused.

Food safety is a controversial issue in Viet Nam. The cost of foodborne disease was estimated at up to US$450 million in 2003, with 128 million reported cases of food-related illnesses, of which 27 million patients needed medical care, including 3.5 million hospitalizations (World Bank 2006).

Food safety has attracted the attention of media reports, scientific literature, policy makers, and consumers, and is considered one of the largest food system problems in Viet Nam (World Bank, 2017). Vietnamese consumers have a lack of confidence in the safety of food they consume, which can influence consumers towards favoring more imported and packaged foods (Nguyen-Viet, Tuyet-Hanh, et al. 2017).

Farmers are reported to be struggling to producing 'safe' or safer foods (organic or low-agrichemical use) for their own consumption or marketing. A recent study conducted among 300 households producing vegetables in Hanoi showed that farmers are indifferent to adhering to production under safe vegetable requirements when they are controlled by the farmers' organization. They prefer to produce under safe vegetable requirements if it is controlled by an external organization. They are very much against organic production, whether it is controlled by the farmers' organization or by an external organization. They prefer pesticides to be provided in kind or in cash by the buyer, when they can sell more of their produce to one buyer, and when the agreement lasts longer (T. L. Nguyen 2019b).

There is little trust among stakeholders, but this is not the fault of individual farmers and traders. Rather, it is the predicament of a food system that has developed in a way that provides few rewards for those who implement good food safety and hygiene practices, but inadvertently high rewards for those who carry out unsafe practices (Viet Nam News 2016; Nguyen-Viet, Tuyet-Hanh, et al. 2017).

Vietnamese consumers are particularly concerned with the safety of fresh fruit and vegetables, especially with respect to residues of heavy metals or bacterial or pesticide contamination (Muriel Figuié 2004; Mergenthaler, Weinberger, and Qaim 2009b), and meat, especially pork, due to heavy metals, growth promoters, and veterinary drugs (Tran Thi Tuyet-Hanh et al. 2017). Due to the increasing use of agrochemical inputs, more than 90 percent of Vietnamese consumers in Hanoi even consider the consumption of vegetables problematic for health (Pham V. Hoi et al. 2016; Wertheim-Heck, Vellema, and Spaargaren 2014).

Another major issue is that many traditional traders do not want to sell safe vegetables, mainly due to the insufficient/poor supply of safe vegetables; customers' low demand for expensive and less varied safe vegetables; customers' preference for buying conventional vegetables in more convenient places; the strong competition between traditional and modern retailers; a lack of sufficient livelihood assets for traditional traders; and the weak and loose market governance (H. X. Nguyen 2019).

Public concern around food safety is so high that is was ranked first of the two highest concerns (above employment) – even higher than education or healthcare (Van Duan and Nguyen Huong 2016; Ha, Shakur, and Pham Do 2019; USAID 2015).

The ADB Survey (Asian Development Bank 2018) shows that contrasting perceptions on food safety prevail: 89 percent perceive food as unsafe compared to 5 percent who view it as safe; only 38 percent state they are well-informed about it, and 38 percent report an average level of information. By contrast, 96 percent consider managing to purchase safe food, and trust that they know some (69 percent) or the full (17 percent) origin of their food. Recent retail transformations influence food safety strategies: people indicate first relying on certified products (49 percent) for ensuring food safety, then on knowing the seller (43 percent), and going to a specialized shop (32 percent). The survey has demonstrated that 'origin' is often used as a proxy for food safety. The survey further indicates that 97 percent consider information on origin as important; it is stated as the second-most important attribute for purchasing both cabbage and pork, and is the third-most frequent answer for defining safe food (29 percent). Sources of information on origin are derived first from product labels (57 percent) and store displays (51 percent), ahead of the seller (39 percent), also indicating a shift from traditional forms of trust toward formal guarantees. If import is not necessarily seen as safer (36 percent say imported food compared to 35 percent who say home-produced), buying local produce is not considered a food safety strategy. Food safety is understood primarily as the absence of chemicals (51 percent). The main source of information about food safety remains traditional media, specifically television (90 percent). Seventy-four percent consider that the State should be responsible for controlling food safety.

Food safety is a concern for both urban and rural consumers. However, urban consumers feel that they are more at risk because they have limited or no access to self-produced food, which is often regarded as the only guaranteed source of safe food, given the mistrust in retail outlets (Ha, Shakur, and Pham Do 2019; Wertheim-Heck, Vellema, and Spaargaren 2014). These food safety concerns are largely a perceived risk, so there is a need for Viet Nam to create a culture of evidence-based decision making (World Bank

2017) regarding food safety standards, which is largely missing now. There is little data available to inform and guide policy makers regarding food contamination along the value chain, and nationally-representative cases of foodborne disease. For example, there are some efforts to measure pesticide residues in many commodities, but the link between contamination and public health risk or food safety outbreaks has not yet been verified by concrete evidence. A recent study showed that, while zoonotic diseases are strongly related to consumer food safety, there was little knowledge of zoonotic diseases amongst Vietnamese consumers (Hung Nguyen-Viet et al. 2019). While the trust in pork quality was high, microbial and physiochemical analyses suggest further studies were needed to address consumers' concerns about chemical contamination. Most market pork samples were not within Viet Nam's allowable range of standards for bacterial contamination: 90 percent did not meet standards for tuberculosis and 98 percent did not meet standards for coliforms. Salmonella contamination in pork and other animal source foods from slaughterhouse and markets is common with reports ranging from 20 to 75 percent. This broad range is thought to be due to the varying quality of regulation of the different market and value chain processes that coexist in Viet Nam.

The annual costs of pesticide-related consequences for domestic human health and costs of lost export opportunities has been estimated at US$700 million, a huge cost for Viet Nam. Foodborne diseases and food poisoning are a public concern in Viet Nam. It was recently reported that nine tons of salbutamol were legally imported for medical purposes in 2015, but only 10 kilograms were actually needed yearly for human use – the rest was likely used for livestock growth promotion (Nguyen-Viet, Tuyet-Hanh, et al. 2017). Outbreaks of food poisoning occur regularly (e.g. more than 4,000 in 2016), infecting hundreds of thousands of people.

The incidence of foodborne diseases appears to be increasing. Precise annual figures are not available, however, it is reported that during the period from 2009 to 2013, 261 outbreaks, with 10,263 cases and 50 deaths, were reported in southern Viet Nam (Thuan Huu Vo et al. 2017), while 1,007 outbreaks with 30,395 people and 164 deaths were recorded between 2011 and 2016, indicating an almost fourfold increase in outbreaks and a threefold increase in victims and deaths. In 2016, more than half of the food

poisoning outbreaks were from collective kitchens and schools (Government of Viet Nam 2017a). Biological risks are the most important cause of foodborne illness (Government of Viet Nam, 2017; World Bank, 2017). However, it is largely understood that this official reporting greatly underestimates cases in the community, as only a small proportion of foodborne disease is ever recorded as an outbreak. While data on food contamination is available, the evidence of its impact on health is limited (World Bank 2017).

The Viet Nam MoH outlines three main causes for food contamination. The first is due to the contamination from biological pathogens, which normally occurs in food processing and retailing of prepared foods. The second is due to contamination from chemical agents, specifically over-use of pesticides, antibiotics, and preservatives. The third cause is due to natural toxins, which are usually traceable to fisheries. According to the MoH, the prevalence of chemical contamination of food is growing out of control (Food Safety News 2012). Intensification of agriculture is directly related to chemical contaminants, with excessive amounts of pesticide being used to support increased vegetable cultivation (World Bank 2006). Vegetable production has strengthened since Viet Nam implemented a global trade strategy in 1986 and restructured its agriculture with de-collectivization in 1989. The state released regulations on agricultural inputs, which led to a growth in inappropriate demand for and use of agricultural inputs, mainly in the production of vegetables (Pham Van Hoi, Mol, and Oosterveer 2009). According to the Ministry of Agriculture and Rural Development (MARD), the number of agrochemicals imported increased from 20,000 to 50,000 tons between 2005 and 2014 (Viet Nam Net 2015).

Food safety communication remains a major challenge in Viet Nam. Risk communication is key to managing food scares and building trust in the food system, but little attention has been paid to this to date. It is important to build capacity in the techniques of risk communication, but also to develop over-arching strategies for dealing with food safety scares, as these are likely to continue (World Bank 2017). Many cases show that there was no consistency of risk communication from the media, scientists, and policy makers for a specific food safety incident. This often creates panic and alarmism, rather than helping consumers to make the right food choices. Consumers normally do not think about risk in the same terms that experts do. Therefore, for consumers, risk is highly subjective and in Viet Nam in recent years the

public has considered the risks associated with chemical hazards in foods to be extremely high. Risk assessment of chemical, biological, and physical hazards in foods is crucial to provide scientifically-based information on actual risks and to inform official risk communication activities (Tran Thi Tuyet-Hanh and Hung Nguyen-Viet 2013).

3.3.7 Food Safety Policies

The government regards safe and healthy food provisioning as important for social stability and applies strategies to mitigate food safety risks that importantly build on approaches to sourcing, retailing, and purchasing structures developed in Western settings (Henson and Caswell 1999). The government explicitly aims to reduce food safety incidents through a combination of legislation and retail modernization. Legislation in Viet Nam (Law on Food Safety (LoFS)s No.55/QH12/2010) (Government of Viet Nam 2010) aims to ensure that '*food shall not cause any harm to people's health and lives.'* The LoFS is the umbrella guideline on managing regular occurrences of food safety incidents, defined as *'any circumstances arising due to food poisoning, a food-borne disease or other circumstances arising in relation to food that cause harm to human health and lives.'*

The law assigns food safety responsibilities among the Ministries of Agriculture and Rural Development (MARD), Health (MoH), and Industry and Trade (MoIT) under the Viet Nam Food Safety Law (2010), while the Ministry of Science and Technology (MoST) is responsible for the development of standards, laboratory validation, and the methods for quality control of imported and exported goods. In Viet Nam, the quality of planning and action processes has an impact on national policies. The barriers to planning include the top-down approaches, minimizing human ability for planning at subnational levels and difficulty in integrating multiple disciplines, with lack of decentralization of decision-making powers limiting greater community participation (Lapping et al. 2014). An important aspect covered under the LoFS is the provisioning of foods through sales outlets *'to keep and maintain the hygiene of the business places.'* MoH formulates the food safety standards and regulations, while the actual structuring of trade and retail falls under MoIT. Important in this respect are the Prime Ministerial Decision No. 559/QD-TTg

(Government of Viet Nam 2004) on the development of market places 2004-2010, Decision 146/2006/QD-UB, on incentive mechanisms for supermarket construction in Hanoi (Hanoi People's Committee 2006), and Decision 99/2008/QD-BNN (Viet Nam Ministry of Agriculture and Rural Development 2008), requiring all foods entering modern retail outlets to possess a certificate issued by official government authorities verifying that the vegetables have been produced in accordance with national regulations on safe vegetable production. These policies address both the application of agrichemicals as well as hygiene practices. Retail modernization is regarded as an important instrument in both respects, as supermarket chains are known to implement private food safety management systems and maintain food hygiene standards (Reardon 2006).

This retail modernization policy marries well with the government's ambition to transform Viet Nam into a civilized modern society. It therein strives to reduce the provision of food via wet markets and informal street vending while stimulating the development of supermarkets and convenience stores. The expectation of policy makers is that reducing long-established modes of provision results in higher sales penetration of the more controlled, 'modern' and thus safer alternative of super- and hypermarkets.

Despite the best intentions, the application of food safety policies in Viet Nam remains problematic. First, the government's ability to control food safety is weak. The country does not have a strong legal basis to control all types of food along the value chain. As a result, contaminated food can enter the food market illegally or even legally, since the law technicality allows contaminated food to enter the market easily (H. V. Pham and Dao 2016) (Pham and Dao, 2016). The national surveillance system is inconsistent and inadequate to monitor the large population and the amount of food produced. For example, in 2012, the whole country had only 300 food safety inspectors for 90 million people, while in Japan, there are 12,000 inspectors for 127 million people (Pham and Dao 2016; Naziri et al. 2014). There is also a high level of corruption among food inspectors, which makes it more difficult to have a transparent and fair inspection among food practitioners (World Bank 2006; Naziri et al. 2014). Furthermore, Viet Nam's production system is still small and fragmented, and lacks investment in technology. Therefore, the government cannot control all the stakeholders in food provisioning because smallholders are often exempted from business

registration and legal administrative supervision (Pham and Dao, 2016). Lastly, even when a case of bad food practices is uncovered by the authorities, the system for implementing sanctions is not strong, and therefore there is no strong deterrent to prevent food producers and traders from continuing to perpetrate their profitable yet unsafe practices (Pham and Dao, 2016).

3.3.8 Food Loss and Waste

Food loss and waste (FLW) is a global problem that negatively impacts the bottom line of businesses and farmers, wastes limited resources, and damages the environment. More than 40 percent of fruits and vegetables in developing regions spoil before they can be consumed (Foundation for Food and Agriculture Research 2019). Viet Nam is included among with the worst performing countries in regards to food loss and waste globally (Gustavsson et al. 2011), with food waste contributing to more than half the total landfill weight in Viet Nam.

In Viet Nam, the issue is shocking. The survey conducted by CEL Consulting in 2018 revealed that, on average, a quarter of the food produced within the three studied sectors is lost before it actually reaches processing plants or distribution centers (five percent higher than FAO's Seed Security Assessment results). Adding retail and consumer waste could increase this to 60 percent for fruits and vegetables. Total losses are estimated at 8.8 million tons or US$3.9 billion (32 percent of Viet Nam's GDP and 12 percent of Viet Nam's GDP derived from agriculture). The CEL Consulting survey estimates that, continuing along this path, the total average loss and waste for Viet Nam would reach more than half of what is produced in the short term future (CEL Consulting 2018).

The fruit and vegetable food group accounts for the worst food loss percentage (32 percent of production). This represents approximately 7.3 million tons of fruit and vegetables lost per year. For the meat industry, losses reach 14 percent (roughly 694,000 tons per year (General Statistics Office of Viet Nam 2018a). In the fish and seafood group, losses represent 12 percent of production (about 804,000 tons per year).

Food loss and waste affects the vast market of fresh goods in Viet Nam and contributes to raising prices, thus further preventing poor consumers from accessing fresh food on a daily basis. Evidently, food waste and loss is an issue across the entire Vietnamese food system – from production and marketing to the end user and consumer. From the production end, pest and diseases are a major contributor to food waste, accounting for 37 percent of rice yield losses (Sivapragasam A et al. 2017). Changing climate conditions and extreme weather events are also increasingly causing yield losses, and contributing to food wastage (FAO 2011). Poor post-harvest storage facilities, and in particular a lack of utilization of cold-chain storage facilities lead to significant losses as well, especially for fruit and vegetables. In addition, Viet Nam has traditionally been composed of remote, smallholder farms that, combined with poor road infrastructure, lengthy value chains consisting of many middle men, inefficient packing materials, and poor cold storage technologies available nor utilized, made transporting fresh produce difficult before spoilage occurs difficult. From the consumer end, there is a lack of awareness about the impact of food waste beyond the obvious implication to household income use efficiency; the environmental and socioeconomic impacts are often unknown, or undervalued. However, the increasing awareness and concern around food safety is showing the power that consumers have to elicit changes within the food system in an attempt to decrease spoilage, improve safety and therefore decrease wasteage of food in Viet Nam.

The government issued a legal document (Prime Minister's Decision No. 68/2013 / QĐ-TTg) on supporting policies to reduce losses in agriculture; the implementation of this policy is still lacking, including the development of effective farmers' cooperatives, cold chain technology, and the participation of different stakeholders.

3.3.9 Trade

Figure 3.5: Food import and export trends from 1999 to 2018 Left: Food exports (% of merchandise exports) Right: food imports (% of merchandise imports)

Source: (World Bank 2019)

Vietnamese food and agriculture exports make up nearly 17 percent of the total national export value, with fish and seafood, pork, coffee, tea, pepper, rice, cashew, cassava starch, rubber, fruits and vegetables amounted to US$36 billion in 2017. China is by far the largest importer of Vietnamese fruit and vegetables, followed by the United States, Republic of Korea, Japan, Netherlands, Malaysia, Taiwan, Thailand and Singapore. Vegetable oils and fats are key export products, destined mainly to Cambodia, Republic of Korea, China, Singapore, the United States, Japan and Canada. Regarding rice, China is the main exporter, followed by Ghana, Philippines, Indonesia, Malaysia, and Cote d'Ivoire, while Hong Kong, Singapore, Australia, and the UAE are the top importers of fruit and vegetables. Cashew nuts, another important export crop, is imported primarily to the United States, followed by China, Netherlands, Australia, and the UK. Groundnuts are largely exported to China, followed by Taiwan, Republic of Korea, and Russia. Cassava and cassava products are almost entirely exported to China, followed by Indonesia, Korea, Japan, the Philippines, and Malaysia. Increasingly, dairy is growing in importance as an export product in the region, as Viet Nam focuses on improving domestic production with China, Philippines, and Cambodia. Despite domestic demand for meat products increasing, Viet Nam exports meat both regionally (Primarily

Hongkong, followed by China and Malaysia). Fishery products is a major export for Viet Nam with a wide global market. The major importers are the US and Japan, followed by China, Korea, Thailand, UK, The Netherlands, Australia, Germany, Hong Kong, and Italy (General Statistics Office of Viet Nam 2018b).

Imported foods play an important part of the Vietnamese food system, however making up a smaller percent of total merchandise imported than of foods exported. Wheat flour is a key import, mostly from Japan, followed by Philippines, Singapore, and Thailand. Wheat grain is imported mostly from Australia, followed by Argentina, Bulgaria, Romania, and Brazil. Viet Nam's increasing demand for dairy and dairy products, stimulated largely by the government's promotion of dairy and milk for good health and nutrition, as well as with local production. Despite increasingly successful local diary production, Viet Nam still imports dairy, mostly from New Zealand and Singapore, followed by Thailand, the United States, Australia, and the Netherlands. The nation's increasing demand for animal source foods and meat is reflected by the large imports of animal fodder and materials, half of which comes mostly from Argentina, followed by the United States, China, Brazil, and Australia (General Statistics Office of Viet Nam 2018b). In 2017, Viet Nam imported 262,321 live cattle and nearly 42,000 tons of meat, worth a total of US$410 million.

Table 3.6: Major Export and Import values by SITC three-digit group for Viet Nam

	Export Value*			Import value *		
Product	**2014**	**2015**	**2016**	**2014**	**2015**	**2016**
other meat and edible offal, fresh, chilled or frozen	59967	87809	108169			
meat and edible meat offal, prepared or preserved	6130	4598	3498			
milk and cream and milk products other than butter or cheese	92468	95001	68924	628856	464264	402941
fish, fresh, chilled or frozen	2691287	2570541	2757727			
fish, dried, salted, smoked	69873	73986	110086			
crustaceans, fresh, chilled frozen, dried, salted	3000647	2213579	2315050			
fish, crustaceans prepared or preserved	2001547	1707972	1851633			
feeding stuff for animals, excluding unmilled cereal				3259296	3397475	3451307
Rice	2936931	2807904	2159977			
maize, excluding sweet corn	30753	11720	12728			
cereal preparations and preparation of flour, starch, fruits or veg	188009	193349	261119	327331	322099	360433
wheat including spelt, and meslin unmilled				648765	600883	1004993
meal and flour of wheat and flour of meslin				9652	9024	7491
vegetables, fresh, chilled, frozen, roots, tubers, fresh, dried	976588	1006906	493190			
vegetables, roots and tubers prepared or preserved	148782	119838	116848			
fruit and nuts, excluding oil nuts, fresh or dried	148782	119838	116848			
fruit preserved preparations excluding fruit juice	178558	227496	321517			
sugar, molasses and honey	253883	164595	89380			
Coffee	3557412	2671030	3336618			
tea and mate	228120	217188	227993			
other edible products and preparations	410811	540052	597760	924745	952202	1029476
oil seeds	10797	13890	60945			
fixed vegetable fats and oils, crude, refined not soft				565720	464563	517514

* 1000 USD

Source: General Statistics Office of Viet Nam 2018b

Table 3.7: Major Export and Import values for Viet Nam

Product	Export Value**	Import Value **
fishery products	8315735	-
frozen shrimp	2447140	-
frozen fish	2882085	-
frozen cuttle fish	28751189	-
dried cuttle fish	235726*	-
animal fodder and materials	-	3208614
Dairy	69564*	865448
meat and meat preparation	118630*	-
Rice	2615949	-
wheat flour	-	11151
wheat	-	993642
cassava and its products	1029219	-
Malt	-	190924
preparations of cereals, flour, starch, milk or pastry products	595539	-
cashew nuts	3516805	-
ground nuts	39263*	-
fruits and vegetables	3501591	1547036
vegetable oils and fats	173998	761089 ^
Coffee	3244315	-
Sugar	8265*	-
Confectionary	-	302638

**Value in 1000 USD
*2016 value due to missing data for 2017
^ category is animal or vegetable oils and fats
- no values available

Source: General Statistics Office of Viet Nam 2018b

The Ministry of Industry and Trade is responsible for the trade aspects of exported products. However, in terms of import and export controls, the respective ministries are responsible for their groups of products. Similar to the case of food safety management, each ministry handles its surveillance and control role differently, and coordination needs to be strengthened to ensure a comprehensive food control system (World Bank 2017).

While legal documents have been issued to prevent low quality products from entering the country, the import control process is not well implemented, e.g. limited checks at borders and no evidence of a common import control procedure based on FAO norms and guidance, causing concern to both domestic producers, who feel that they are treated unfairly, and consumers, who do not have confidence in imported products (World Bank 2017). Export products, on the other hand, follow the standards of importing countries, and the government, especially MARD, who is responsible for the main export products of the country, has placed a high priority on supporting the export sector to enhance its competitiveness and expand international trade markets. This includes the maintenance of an effective export control system, with different types of inspection (document check and on-site), level of oversight, and inspection frequency based on the high/low risk products (World Bank 2017).

Although international trade increasingly plays a vital role in its economy, Viet Nam has yet to provide regulations to limit the trade impacts on the development of food environment policies, where there might be a conflict of interest with the national nutrition improvement. The implications of international trade for Viet Nam's food systems will be discussed in more detail in the section on 'Drivers.'

3.4 Food Supply Systems

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

3.4.1 Agricultural Production Subsystem

Overview

Viet Nam has multiple agroecosystems and rural socioeconomic realities. Typically, eight regions are recognized, each with multiple production subsystems: (1) northwestern highlands, (2) northeastern highlands, (3) Red River Delta, (4) north central coast, (5) south central coast, (6) central highlands, (7) southeastern lowlands, and (8) Mekong River Delta. Since the Doi Moi reforms, huge leaps in agricultural

production for self-sufficiency and export have been made. At present, Viet Nam has a surplus production of rice, pork, and numerous vegetable varieties. While being export-oriented, ingenious and diversified production systems for national food production are found in each region. Viet Nam is a major center of crop and livestock genetic diversity, including rice, taro, citrus fruit, vegetables, pigs, chickens, and buffalo (Ha Dinh Tuan et al. 2003; Berthouly 2008; Siemonsa and Piluek 1993; N. T.D. Thuy et al. 2006). The diversity of 54 different ethnic groups is clearly reflected in distinct production systems ranging from terrace rice culture, buffalo ranging, home gardening, to integrated fishpond systems (Nguyen Van Huong et al. 2018; Dang K. Nhan et al. 2007; Timsuksai and Rambo 2016). Family farming is commonly dual-purpose with differential production for home consumption and markets.

The country has 11.7 million hectares of arable land destined for annual crops (39.3 percent with irrigation), 3.4 million hectares under perennial crops, and 14.9 million hectares under forestry. Following the Doi Moi, the government has recognized the household as the basic unit of production and allocated land use rights to families. Viet Nam's roughly 14.5 million farms comprise approximately 70 million land parcels (Pham Van Hung, MacAulay, and Marsh 2007). Currently, about 41.6 percent of the population in Viet Nam is involved in smallholder agricultural production. However, the share of young farmers is rapidly decreasing and part-time farming, combined with off-farm employment, including migration, is the new rural reality (Nguyen Trung Hung 2016; Brünjes and Revilla Diez 2016).

Crop production

Most of Viet Nam's 11.7 million hectares for annual crops is destined for rice. The 2017 rice production occupied 7.7 million hectares, providing an estimated 42.8 million tons of rice at average yields of 5,550 kilograms per hectare (General Statistics Office of Viet Nam 2018a). Other important annual crops grown include maize (1.1 million hectares), vegetables (931,000 hectares; Table 3.8), cassava (535,000 hectares), sugarcane (281,000 hectares), peanuts (195,000 hectares), sweet potato (121,000 hectares), soya (69,000 hectares), and sesame (37,000 hectares). While some upland crops, such as cassava and maize, typically

follow the rainy season with peak harvests at the end of the rainy season (October and November), most of the important annual food crops, such as rice and vegetables, have multiple seasons (Pham Thi Thu Huong *et al.* 2013; Laborte *et al.* 2017).

Table 3.8: Viet Nam's expanding vegetable production area (1000 hectares) and production (million tons)

Region	2010		2015		2017	
	Area	Prod.	Area	Prod.	Area	Prod.
National	780.1	12.9	887.5	15.7	931.3	16.5
Red River Delta	166.2	3.4	187.6	3.9	191.4	4.1
Midlands and Northern Mountainous Areas	103.6	1.3	130.2	1.7	137.2	1.8
North Central Coast	84.0	0.9	90.8	1.1	99.5	1.2
South Central Coast	65.1	0.9	64.6	1.0	70.0	1.1
Central Highland	78.3	1.7	101.2	2.5	107.5	2.7
Eastern Mekong Delta	129.5	0.9	59.9	1.1	61.0	1.1
Mekong Delta	221.8	3.8	253.2	4.5	264.7	4.6

Source: Viet Nam Ministry of Agriculture and Rural Development (2017).

Out of 3.4 million hectares under perennial crops, 2.4 million hectares were destined for export in 2017, including rubber (972,000 hectares), coffee (665,000 hectares), cashew (298,000 hectares), pepper (152,000 hectares) and tea (129,000 hectares). These products will likely not end up on a Vietnamese table, but will add to rural income generation and buying power. National fruit production, on the other hand, does reach Vietnamese consumers. In 2017, fruit crops covered 925,000 hectares of land. This is a 21 percent area increase compared to 2014 when national fruit production occupied 765,900 hectares. The most important fruit crops in terms of area are bananas, orange, tangerines, mandarin, lemons, pomelo, kumquat, pineapple, litchi, rambutan, longan, mango, and dragon fruit. Viet Nam is a hotspot of diversity and origin of many of these fruit species (Wu *et al.* 2018). The 14.9 million hectares under forestry also provide food such as wild catch, insects, mushrooms, bamboo shoots, wild vegetables, and other edible non-timber forest products (Ogle et al. 2003; Shairp et al. 2016).

Imports – Widening Assortments and Mitigating Seasonality

The import value of fruit and vegetables has shown a twofold increase from 2008 to 2014. More than 30 percent of Viet Nam's annual import value of fruit and vegetables comes from China. In general, Chinese imported fruits and vegetables have low prices, regularly below the level of domestic produce. In recent years, Vietnamese consumers are starting to favor commodities from ASEAN countries, like Thailand and Malaysia. Economic prosperity is driving value consciousness in which prices are being weighed against food quality and safety concerns. This is reflected in the fact that China is top of the list with regard to fruit and vegetable volume imports, but that Thailand is leading in terms of high-value product imports.

Increasingly, Viet Nam is importing fresh foods from outside the ASEAN region, including EU countries, Australia, New Zealand, the United States, and Latin American countries. Although products originating from these countries are premium priced, the volume of imports has shown a steady increase over the past decade. Products from those countries are considered safer, especially compared to those from China.

Imported fresh foods include products that are being produced in Viet Nam – mitigating seasonality – as well as products that are complementary to the domestic food production – widening the assortment.

Even though Viet Nam is a rice exporter and produces sufficient rice to feed the population, quality rice is imported from Cambodia and Thailand, while small volumes of sticky rice are imported from Laos. A total of 6.7 million tons of rice were exported, making Viet Nam the third largest rice exporter globally following India and Thailand with 10.2 and 12. 5 million tons, respectively (Quan Tran 2018; FAOSTAT 2018). Most of the export rice is distributed within Asia, with China being by far the main importer (43.6 percent), followed by Africa and the Americas. The total export turnover of fish and seafood, pig meat, coffee, tea, pepper, rice, cashew, cassava starch, rubber, fruits and vegetables amounted to US$36 billion in 2017, representing 16.8 percent of the total national export value. On the other hand, Viet Nam imports agricultural products like animal feed (soya, maize), beef, and wheat.

As demand for beef has risen, so have beef imports. In 2017, Viet Nam imported 262,321 head of live cattle and nearly 42,000 tons of meat worth a total of US$410 million. The demand for milk and dairy

products is also soaring, and represented an import value of US$865.4 million in 2017. In 2015, the country's imported meat value is estimated to have reached US$234.7 million, an increase of 143 percent and 14 percent compared to 2010 and 2014, respectively. Although the import value of poultry increased by US$34.8 million between 2010 and 2014, its contribution to Viet Nam's meat imports decreased from 72 percent to 51 percent, whereas the share of bovine meat rose sharply during the same period. Bovine meat's import value saw a fourfold increase, from US$25 million to US$92.5 million, accounting for 45 percent of the total meat imported to Viet Nam in 2014. Viet Nam was able to generate a total pork export value of US$46.6 million in 2014. The reasons behind this significant increase are considered to be falling oil prices, a decrease in local cattle head between 2017 and 2012, and growing demand for beef. Trade agreements with Australia and New Zealand also facilitated the wave of imported beef in Viet Nam.

Livestock

Viet Nam's livestock production systems range from low-input backyard rearing, to intensified small family businesses with 50 to a few hundred head of animals, to high-input mega-stables with thousands of animals (FAO, 2008; Udo *et al.* 2011). The country's meat consumption has risen significantly over the last five years, from 3.5 million tons in 2013 to 4.2 million tons in 2018 (Table 3.9). In 2017, Viet Nam had 27.4 million head of pig, making it the sixth largest producer after China, the European Union, the United States, Brazil, and Russia. National pork production increased from 3.0 to 3.7 million tons between 2010 and 2017 (General Statistics Office of Viet Nam, 2018). The bulk comes from exotic pigs, including Yorkshire, Duroc, and Pietrain breeds. However, Viet Nam is also a genetic reserve of on-farm pig diversity, with significant variability of I pig, Mong Cai, Muong Khuong, Meo, Ba Xuyen, and Thuoc Nhieu breeds (Ministry of Agriculture and Rural Development 2009; Lemke et al. 2008). Vietnamese indigenous pig breeds offer quality meat and commonly fetch high market prices in both domestic and foreign markets.

Poultry production has expanded from 300.5 to 385.5 million head between 2010 and 2017 (70 percent chicken / 30 percent duck). The production of meat from poultry increased from 0.6 to 1.0 million tons for this same period, and egg production from 6,421.9 to 10,637.1 units (General Statistics Office of

Viet Nam 2018a). Even after the first avian influenza crisis of 2003, consumption and small-scale production remained widespread with 92 percent of Viet Nam's rural population raising backyard poultry (M. Figuié and Fournier 2008).

There are about 2.5 million buffaloes in Viet Nam used for animal traction, transport, meat, and milk. The highest density of buffaloes (1.4 million) is found in the northern midlands and mountain areas where the animal is still highly valued as a capital asset. Buffalo meat production has remained reasonably stable at 83.6 versus 88 thousand tons in 2010 and 2017, respectively (General Statistics Office of Viet Nam 2018a). There are about 5.7 million head of cattle in Viet Nam used for milk, meat, or dual purpose production. These include several local breeds and at least 15 imported breeds (Ministry of Agriculture and Rural Development 2009). Beef production increased from 278.9 to 321.7 thousand tons from 2010 to 2017 (General Statistics Office of Viet Nam 2018a). National milk production increased very rapidly from 306.7 million liters in 2010 to 881.3 million liters in 2017, in line with a growing national demand (General Statistics Office of Viet Nam 2018a).

Table 3.9: Changes in livestock populations from 1990 to 2017 (millions of head)

	Pigs	Poultry	Cattle	Buffaloes	Sheep & goats
1990	12.3	107.4	3.1	2.9	0.4
2000	20.2	196.1	4.1	2.9	0.5
2010	27.4	300.5	5.8	2.9	1.3
2017	27.4	385.5	5.7	2.5	1.9

Source: General Statistics Office of Viet Nam (2018).

Fisheries and Aquaculture Sector

Fishing from sea and inland catch, as well as aquaculture, are important activities in Viet Nam, providing valuable dietary nutrients, as well as export revenue (Table 3.10). The 2017 national production stands at 7.2 million tons (General Statistics Office of Viet Nam 2018a). Fish and shrimp production from aquaculture production increased from 2.4 and 0.5 million tons in 2012 to 2.7 and 0.7 million tons in 2017, respectively. The total 2017 aquaculture production was 3.8 million tons and also includes species such as eel. Caught fish amounted to 3.4 million tons in 2017 with 94.1 and 5.9 percent sea and inland catch,

respectively. Fishing and aquaculture are important throughout the country, but particularly in the Mekong River Delta and north-central to central coastal areas where 4 and 1.6 million tons, respectively, of fish were produced in 2017 (General Statistics Office of Viet Nam 2018a). In the Mekong Delta, aquaculture is dominant with 2.7 million tons coming from production rather than wild catch (66.2 percent). The situation in the north-central to central coastal areas is different, with 1.4 million tons, or 85.7 percent, derived from wild catch.

Table 3.10: Production from fisheries and aquaculture (2012-2017; in millions of tons)

	Sea catch	Inland catch	Aquaculture	Total
2012	2.5	0.2	3.1	5.8
2013	2.6	0.2	3.2	6.0
2014	2.7	0.2	3.4	6.3
2015	2.9	0.2	3.5	6.8
2016	3.0	0.2	3.6	7.0
2017	3.2	0.2	3.8	7.1

Source: General Statistics Office of Viet Nam (2018).

Challenges and government strategy

Viet Nam's agricultural production is at the foundation of the national food supply and rural economy. The accelerated growth of the agricultural sector for both national food supply and export revenue has led to a series of challenges. Smallholder inclusion and sustainable intensification are particularly important challenges as Viet Nam transitions from a logic of production maximization to optimization with an eye for eco-efficiency and quality. Small-scale family farming poses a challenge for standardized quality standards, traceability, and market system logistics overall. Conflicting strategies have been pursued by both the government and the private sector. On the one hand, land consolidation and vertical integration of production at scale are widely seen as essential for raising productivity and sustaining growth of agricultural exports. In parallel, approaches that seek to organize family farmers in cooperatives or producer groups towards inclusive market integrations are also widely promoted.

The overuse of agricultural inputs such as inorganic fertilizers and pesticides is negatively affecting the health of producers, consumers, and the environment (Dasgupta et al. 2005; Nguyen Huu Dung et al.

1999). Limited use of native genetic resources and sizeable imports of high value seed, particularly in the vegetable seed sector, have led to increased genetic uniformity. While there is an ongoing effort to promote better practices and traceability schemes for the national food supply, the widespread over- and misuse of agrochemical inputs remains a key challenge (Mergenthaler, Weinberger, and Qaim 2009b; Muriel Figuié et al. 2004). Attention to product quality and environmental sustainability are relatively new national priority areas. Good agricultural practices involving integrated crop management and semi-organic production involving trust-based participatory guarantee and direct marketing systems have been steadily growing, yet are generally inaccessible for poorer consumers. It will remain difficult to reduce the use of agrochemical inputs without profound changes to the production system, with attention to soil health, crop rotation, and better use of agrobiodiversity. Climate change and extreme weather events have also affected the regions differently during the last decade, with floods in the north-central coast, saltwater intrusion in the Mekong River Delta, and droughts in the central highlands (Nguyen Tam Ninh et al. 2017).

3.4.2 Antimicrobial Use in Livestock and Aquaculture

Rapid expansion of animal production and the sharp rise in meat consumption have led to intensification in both small- and large-scale farming, which increases the use of antimicrobial growth promoters (AGP), prophylactics, and therapeutic treatments of diseases. Extensive use of antimicrobials in agriculture can result in the development of antimicrobial-resistant bacteria in animals, soil, and aquatic environments. As a result, the first-generation antibiotics are already ineffective in many cases, and newer, more expensive antibiotics are also losing their effectiveness. In Viet Nam, antibiotic resistance is rising sharply – the prevalence of penicillin-resistant pneumococcus has increased from 8 percent to 56 percent in Ho Chi Minh City between 1990 and 2000. Viet Nam also has the highest prevalence of several resistant strains of *Streptococus pneumonia* compared to 10 other countries in the Asian Network for Surveillance of Resistant Pathogens (The GARP- Viet Nam National Working Group and Nguyen 2010). In addition, limited evidence has also suggested the negative impact of antibiotic residues in marine aquaculture on coral reef

systems through affecting photosynthesis and nitrogen fixation of aquatic microorganisms such as cyanobacteria and green algae (Hedberg et al. 2018).

Data on agricultural use of antibiotics in Viet Nam is limited. In livestock, antimicrobials are often added to animal feed as AGP. According to a study conducted in 2016, 42.2 tons and 981.3 tons of antimicrobials were added to feeds for Vietnamese poultry and pig production, respectively (Van Cuong et al. 2016). The larger amount of AGP in feeds for pig production reflects the higher antimicrobial content in pig, higher feed conversion factor in pig, and larger pig production compared to chicken production in Viet Nam. It may therefore not be surprising that the second report of colistin-resistant *Escherichia coli* isolated from food came from Viet Nam (Malhotra-Kumar et al. 2016).

In aquaculture, antibiotics are often used haphazardly with little control and enforcement of regulations. In shrimp production, which has increased by 17-fold in volume and 40-fold in monetary value since Doi Moi, antibiotic residuals often exceed the acceptable limits by international standards. It explains why Viet Nam has experienced a large number of rejections of shrimp at the port of importing countries (Lee, Suzuki, and Vu 2019). In fish and lobster production, many antibiotics used are listed as important for human use by WHO, such as tetracycline, rifampicin and enterocaps, and each costs around US$2 for a cartridge of 100 doses (Hedberg et al. 2018). These antibiotics were generally bought at the local pharmacy in the form of pills manufactured to treat infections in humans. Farmers often crush the pills and mix them, with bare hands, with the trash fish used as feed. Antibiotics are either applied prophylactically at fixed intervals of one to seven times per month, or used therapeutically treat the stocks immediately or several days after the disease was observed until the stocks look healthy. The drivers of antibiotic use in small-scale aquaculture are often the low cost of antibiotics, poor knowledge of alternative disease management, and lack of a stringent regulatory environment (Lim et al. n.d.). Thus, responsible use of antibiotics in aquaculture is contingent on the regulation of antibiotics sales for the animal sector and knowledge exchanges with farmers on disease management.

Viet Nam has adopted a One Health approach to incorporate human and animal health sectors, but the surveillance of the animal health sector remains weak, and inter-sectoral activities are limited. The One

Health approach was reflected in the 2013 Global Action Plan, which planned for surveillance to be conducted at the hospital, community level, and of food-producing animals. However, it was not until 2017 that the specific description of the animal sector surveillance was detailed. In addition, while pharmaceutical companies are required to report sales of antibiotics, feed mills are not mentioned in the official documents despite their role as main providers of antibiotics for animal production (Bordier et al. 2018). The One Health cross-sector collaboration was stipulated and initiated at the policy level through the National Steering Committee established in 2016, but its activities remain highly silo-oriented. Surveillance activities are monitored by separate departments with limited cross-departmental collaboration and communication. The full operationalization of the One Health approach would require not only stronger adhesion of the key stakeholders to the Action Plan, but also regional collaboration to exchange lessons learned and identify successful programs that can be adapted in Viet Nam (Nguyen-Viet, Chotinun, et al. 2017).

3.4.3 Food Storage, Transport and Distribution Subsystem

In terms of storage and distribution, Viet Nam presents a case of traditional and mixed food supply chains as categorized by HLPE (2017). Like other growing Asian economies, transformations have been most evident in the post-farm gate segments of the food supply chains, including logistics and cold chain (Reardon and Timmer 2014). Logistics improvement is considered a key competitive factor for Viet Nam, including its food production systems.

In Viet Nam, post-harvest loss in the agricultural value chain is significant: the loss of fruit and vegetables (see section 3.3.3) can be up to 45 percent, and up to 35 percent for seafood products (Viet Nam Ministry of Industry and Trade 2017). Besides low mechanization of agriculture, low capacity in storage and transport has been cited as one key reason for this inefficiency (Viet Nam Ministry of Industry and Trade 2017). The increased consumption of meat and export requirements have been driving up the demand for frozen food storage (Viet Nam Ministry of Industry and Trade 2017). Besides, the low penetration of fresh food into Vietnamese modern distribution is attributable to the difficulty and preference expenses of

sourcing and distributing perishable products, while the consumers still hold a marked preference for fresh fruit and vegetables (World Bank, 2017). Although cold storage capacity has increased four times over the past ten years, it has been mostly focused in southern regions, serving the export markets, while being very limited in domestic restaurants and supermarkets. Most of the logistics providers in the agricultural sector are small-sized purchasers, transporters, and processors who often lack the equipment and infrastructure to effectively operate a cold supply chain. Additionally, agrobusinesses and logistics providers have yet to develop close connections and long-term commitment (Viet Nam Ministry of Industry and Trade 2017). The rise in the demand for cold chain services has mostly been associated with seafood and pork exports. Cold chain development for national food supply chains is developing fast, especially for the dairy sector.

3.4.4 Food Processing and Packaging

The food processing capacity in Viet Nam is large and predominantly export-focused, with coffee, pepper, rice, cassava, and seafood being primary commodities for value addition. Growth of sugar-sweetened carbonated beverage sales in Viet Nam, led by foreign-owned companies, has significantly accelerated after trade and investment liberalization (Schram et al. 2015). As the Vietnamese processed food market has been experiencing steady growth rates (Viet Nam Net 2016) and expenditure on processed food has seen an upward trend, research and policy responses to navigate the relationship between trade liberalization and nutritional implications are very needed[8].

Viet Nam's agricultural products processing industry has achieved substantial growth: Over a period of five years (2007 – 2012), its increases in added value were 5 to 7 percent, contributing to the export sector. Estimated to be employing about 1.6 million people in 7,000 modern industrial processing companies as of 2018, the sector is still largely dominated by smallholders. For example, the fruit and vegetable sector has around 150 industrial scale (over 500 thousand tons in annual production volume) processing facilities, while there are thousands of small-scale processors of products like lychees, longans,

[8] Calculated from the Vietnam Household Living Standard Surveys 2014 and 2016 (General Statistics Office of Vietnam 2016, 2014)

gherkins, etc. (Department of Planning 2018). In the coffee sector, foreign direct investment and multinational companies like Nestlé, Olan, Neumaan, etc., still account for the largest share of processed coffee products. Fifty percent of coffee grinding facilities are small-scale household businesses (Department of Planning 2018). In the livestock meat processing sector, it is estimated that only about 3 percent of slaughterhouses are those of industrial scale. These large-scale slaughterhouses can only work up to 30 percent of their capacity due to the competition from small slaughterhouses as well as local consumers' preference for freshly prepared meat products.

Despite the growth of the sector, the processing industry is estimated to account for only 5 to 10 percent of the total volume of agricultural products. For example, only about 5 percent of the total fruit and vegetables are inputs for the processing industry. Even for the agricultural products with the most advanced processing capacity, like cashew nuts, seafood, coffee, etc., raw, unprocessed products still account for up to 70 to 80 percent. For of some agricultural products, the preference has not been given for higher value-added processed products, such as white pepper over black pepper (Department of Planning 2018).

The agricultural products processing industry in Viet Nam is still in its infancy and faces many barriers. Among them are the limited application of science and technology to increase productivity; the lack of connectivity among value chain stakeholders, which in turn leads to the unguaranteed quality and unsustainable inputs for the industry; and insufficient incentives for larger corporations to apply new technologies and expand the market for processed products. Post-harvest loss is still an issue, which creates uncertainties for the quality and quantity of agricultural inputs. Instead of using safe, modern, and natural techniques, several processed products in Viet Nam are susceptible to unsafe use of toxic chemicals in post-harvest storage, which can lead to disqualification from several important markets. Viet Nam has also not taken advantage of by-products of processing, such as bagasse and bran, to create extra added values.

Parallel to the growth in consumption of processed food and the domestic food processing industry, the domestic printing and packaging sector, according to Mr. Hoang Quang Huy of the Association of Research and Development for Innovation, has enjoyed growth of 15 to 20 percent in recent years (Duc 2019; Huynh 2018). Between 2012 and 2015, the food processing and packaging sector was the second

largest employer in Viet Nam. Inevitably, this saw the country become a prime target for processing, packaging, and labelling machinery makers (T. V. Pham 2016).

Currently, Viet Nam has more than 900 packaging facilities, mostly located in the southern provinces (Kanepackage Viet Nam 2018). The market has two main segments: smallholder packaging businesses serving small producers, and large companies serving big clients. Not surprisingly, the domestic companies are mostly small scale, while the foreign direct investment companies have more advantages in terms of technologies and financial capital.

Packaging costs are currently high, accounting for more than 50 percent of the cost of certain products, and food processors are looking for ways to cut packaging costs, including through the use of automation.

3.4.5 Food Retail and Provisioning Subsystem

Overall economic growth, including a sizable young population, rapid urbanization, and concerns about hygiene and food safety are driving notable changes in consumption patterns. The formal food retail system can be subdivided into more recent, and what are considered to be 'modern' types of food retailing, which include: hypermarkets, supermarkets, and chain convenience stores; and more 'traditional' forms of food retailing, such as family-owned stores (known as mom-and-pop stores in Viet Nam), as well as wet markets that are state-planned and governed by a management board, where vendors pay a fee to be allowed to sell their products.

While Viet Nam's food retail sector is still dominated by these small traditional outlets, they are increasingly under pressure from the nationwide retail modernization, in which modern retail channels are rapidly expanding in response to growing consumer demand (Table 3.11). The trend has been coined 'supermarketization' (Reardon, Berdegué, and Timmer 2005), and started in the late 1990s, initially with domestic state-owned enterprises, but later, and especially since 2009, took off with an acceleration in foreign ownership (Nguyen Hai Thi Hong, Wood, and Wrigley 2013). These modern channels are characterized by a high level of global food system integration.

End user or consumer retail of food for home preparation in Viet Nam is provisioned through several outlets, depending on scale of wealth and convenience, and are, in order of current frequency: (1) traditional wet markets, (2) street sales, (3) small- to medium-sized neighborhood and convenience stores, (4) supermarkets and hypermarkets, and (5) social and online networks.

Consuming food away from home is common in Viet Nam, for both occupational and recreational reasons (Lachat et al. 2011) and is provisioned through the following channels: (1) restaurants, (2) street food, (3) school meals, and (4) work canteens. Restaurants and street food are accessible in small towns and cities, and delivery services are readily available in cities. Companies in Viet Nam's industrial zones frequently provide canteen lunches in the workplace. There is also a country-wide program that provides milk to kindergartens and primary schools. In some provinces, these are sponsored by food companies (e.g., Ajinomoto, Rue Milk) and in some provinces and cities school lunches also are provided. These are meant to provide a balanced meal for children and serve as an education and communication tool to influence students' dietary habits (Duc Son Nguyen Trung Le 2011).

Table 3.11: Total number of large food retail outlets by region and city (2010-2016)

Geography	Traditional markets		Supermarkets		Shopping malls	
	2010	2016	2010	2016	2010	2016
Region						
Red River Delta	1.771	1.854	148	270	33	51
Midlands and northern mountainous areas	1.404	1.416	74	124	9	18
North Central Coast	2.462	2.431	11	23	18	26
Central highlands	356	374	60	87	1	3
Southeastern area	756	750	119	182	36	57
Mekong Delta	1.779	1.688	23	64	4	15
Cities						
Hanoi	411	454	74	124	18	22
Hai Phong	152	154	11	23	7	10
Da Nang	85	70	60	87	4	8
Ho Chi Minh city	255	240	119	182	24	40
Can Tho	102	106	23	64	..	6

Source: (General Statistics Office of Viet Nam 2019)

Traditional wet markets continue to play a key role in food retail in both urban and rural food provisioning in Viet Nam. Independent of household income category, they account for the largest share of urban household food expenditure (CGFAR 2018b). However, there have been numerous government

initiatives - also with World Bank support (LIFSAP 2018) - to redesign, upgrade and reorganize traditional market infrastructure. Within and among wet markets, there is considerable variability. Some are directly managed by the government marketing boards that report to the local People's Committee, while others are managed by private companies with a public history. Inside wet markets, there is commonly a section for fixed stalls (full-time traders) and for occasional mobile vendors (part-time traders and often producers).

Temporal street markets and mobile street vendors are common in villages and large cities alike. Street markets are typically mounted early morning until late afternoon. However, they have come under increased scrutiny from government authorities who are closing them down to supposedly improve security, orderliness, and urban development (Turner and Schoenberger 2012). They have also come under criticism by permanent market sellers who perceive them as unfair competition. Informal street vendors commonly roam around outside traditional markets and many mobile vendors patrol the streets with push carts, bicycles, scooters, or simply on foot using traditional shoulder poles. Informal mobile food selling is commonly linked to relative poverty and gendered livelihood strategies (Kawarazuka 2016). There is little quantitative data on this type of food provisioning. While not representing a dominant food retail subsystem at the same level as the permanent traditional markets, the temporal street markets and mobile street vendors represent a decentralized, wide-reaching and opportunistic form of food retail.

Small- to medium-sized neighborhood and convenience stores in Viet Nam come in many shapes and sizes. First, there are thousands of small, family-owned grocery stores, on almost every street in Viet Nam's villages, cities, and along major traffic routes. They offer anything from processed food and vegetables to meat, in what can range from an extended living room to a fully-fledged shop. A second type of outlet are small- to medium-sized convenience stores or mini-marts that are part of commercial retail chains such as Circle K, VinMart+, and B's Mart. These types of outlets are spreading rapidly, especially in the cities. Viet Nam is forecasted to be the fastest-growing convenience store market in Asia by 2021, with a growth rate of 37 percent according the International Grocery Research Organization. Scientific literature has not caught up with the phenomenon of Viet Nam's mini-mart boom. A third type of small retail outlet concerns safe food and organic stores. These include stores like such a Bac Tom, Naturally

Viet Nam, and Organik. While potentially in high demand, such stores currently hold an upscale niche market of higher-income consumers.

Supermarkets have expanded rapidly throughout Viet Nam (Table 3.11). There is a wide diversity of supermarket chains, ranging from nationally-owned supermarkets to foreign investments (Nguyen Hai Thi Hong, Wood, and Wrigley 2013), including VinMart, Big-C, AEON, Co.op Mart, Lotte Mart, MegaMarket, and others. Government policy frequently assumes that supermarkets with stricter food safety and hygiene standards are a logical progression to modernize food retail and will replace traditional markets. However, while the 'supermarketization' in Viet Nam is progressing at a steady pace (Coe and Bok 2018), these outlets are as yet not necessarily replacing the traditional outlets. Clearly, household food expenditure shares at modern retail outlets increase with income. The current supermarket model, while being attended for selected food purchase by the middle- and high-income groups, is not necessarily accessible for the poor (Wertheim-Heck, Vellema, and Spaargaren 2015). A recent study found that low-income households in Hanoi and Ho Chi Minh City spend about 2 percent and 19 percent of their food budget at supermarkets, respectively (CGFAR 2018b). The aspiration of modern shopping at supermarkets is closely tied to urban lifestyles and increasing labor emancipation of young Vietnamese families. This trend is likely to continue in the years to come (EVBN 2018).

Food purchase through social and online networks is a niche informal mechanism for urban food provisioning that has gained importance, yet remains largely invisible. It involves food remittances from the home town to the city. These clearly reflect the intergenerational shift of people from the countryside to the city (Tarp 2017). Additionally, in response to food safety concerns, informal social mobilization to acquire 'safe vegetables' is a common phenomenon (for example, at the workplace). Moreover, Facebook and social media groups have sprung up to provide direct access to 'safe' and organic produce. Formal e-commerce and online food purchases are growing in the Vietnamese food retail space and are predominantly associated with convenience and price (Anh Kim Dang *et al.* 2018). Yet the share of online food purchases in Viet Nam's major cities is still very minor (CGFAR 2018a).

4. DRIVERS OF FOOD SYSTEM TRANSFORMATIONS

Drivers of food systems are governed by food system actors' decisions and their behaviors, which affect the components of the food system's organization and ultimately shape food system outcomes. Here we discuss the most relevant food systems drivers in Viet Nam under the four groups of drivers described in the conceptual framework: (1) Environmental changes; (2) Science, technology, and infrastructure; (3) Policies, laws, and institutions; and (4) Socio-cultural drivers.

4.1 Environmental changes

4.1.1 Natural Resource Capital and Ecosystem Services

Viet Nam is ranked 16th among countries in terms of largest share of biodiversity. It is home to a wide array of species whose contributions to the economy are particularly significant in agriculture, fisheries, and tourism (Asian Development Bank 2013; Viet Nam Ministry of Natural Resources and Environment 2015). However, the introduction of new, high-productivity varieties and hybrids has caused a reduction in the planted area and in genetic diversity of indigenous varieties. For example, 80 percent of traditional rice varieties, 50 percent of local corn and bean cultivars, 90 percent of tea and fiber crop varieties, and 70 percent of local fruit species can no longer be found in the production system (Vu Dang Toan 2015). Forest flora resources, livestock, and aquatic genetic resources are also deteriorating in a similar manner. To combat biodiversity loss, an impressive number of national strategies, programs, and plans for biodiversity conservation have been issued, including measures to control activities that have negative impacts on biodiversity. Admittedly, there has been a conflict of interest between meeting the local economic growth targets and conservation and sustainable use of biodiversity (Vu Dang Toan 2015; Viet Nam Ministry of Natural Resources and Environment 2015). Over-exploitation and changes to fishing, harvesting, and products resulting from agricultural, forestry, and fisheries' breeding practices have been cited as a major cause of natural resource depletion. How Viet Nam will balance its economic needs, especially in feeding a large part of its highly resource-dependent poor populations, and resource preservation, deserves continual attention.

Agriculture, the bedrock of food systems, can only be sustainable if natural resources are well managed. The case of rice farming in Viet Nam demonstrates that the aforementioned dilemma can be a win-win situation for both natural resources and production. In the Mekong Delta region, more intensive farming methods and increased use of pesticides and fertilizers have increased yields and reduced poverty, however, this has also led to negative impacts on the environment and health. In a study that investigates and compares farming strategies among rice and rice-fish farmers, integrated rice-fish farming and integrated pest management strategies were found to provide sustainable options to intensive rice farming, because of a more balanced use of multiple ecosystem services (Berg et al. 2017), reducing the need for chemical inputs. It has also been indicated that alternative farming systems, such as rice combined with vegetables, fisheries, or other flood-based livelihoods, could offer greater benefits than intensive rice monocultures, without the environmental costs and impact currently endured across the delta with triple rice cultivation in high dikes (D. D. Tran et al. 2018).

Prospectively, about one-third of the current paddy land in Viet Nam is projected to shift to alternative agricultural land uses, e.g. aquaculture and vegetable ornamental plant production, or ecosystem services by 2030, which will help to accelerate agricultural growth (World Bank 2016).

4.1.2 Climate Change

There is a significant body of literature on how climate change impacts food availability, food access, food utilization, and the stability of the food system (Wheeler and Braun 2013). As one of the countries most affected by climate change, in the past 50 to 60 years, Viet Nam has experienced temperature rise, more volatility in rainfall patterns, increased evapotranspiration, rising sea levels, exacerbated coastal erosion, and salinity intrusion (World Bank 2016). These climatic changes have substantial implications for the country's food production. For example, rice production (Bingxin Yu et al. 2010), coffee production (Haggar and Schepp 2012), and the livestock system are all projected to suffer from disease-related impacts of climate change (World Bank 2016). On a positive note, aquaculture, in particular in the Mekong Delta, may benefit from increased inundation (JICA 2013), and livestock productivity decreases can mitigate the

human health and environmental costs associated with meat consumption and production (Haddad et al. 2016; World Bank, 2016). Managing climate change risks for agricultural production has therefore led development partners to embrace climate-smart agriculture, and driven the government's need to support adaptive management, learning and innovation, and no-regret adaptation strategies (World Bank 2016). A significant number of these adaption strategies have been initiated by the farmers themselves, rather than public-sector initiatives, such as delaying planting of winter--spring rice in the Red River Delta and switching to drought-resistant crops such as cassava, maize, and groundnut in the central region; while the public sector has been active in building its institutional architecture to deal with climate change (JICA 2013).

Although adaptive responses in agricultural production can help to effectively counter anticipated climate change impacts on the sector, with high social vulnerability, household food insecurity can persist despite national food self-sufficiency. The poorest households will face inequitable risks and decline in living standards under the combined impacts of lower yields, cost of autonomous response measures, and increased variability of food retail prices (JICA 2013). Additionally, climate change-induced calamities and the associated climate variability stresses also pose adverse effects on health conditions, which complicate the impacts on nutrition. In Viet Nam, seasonal variation has been observed in stunting, underweight, and wasting among children living in the mountains, and cold temperatures substantially increased mortality among the older population (Rocklöv et al. 2014). Policy responses to nutrition therefore need to expand to respond to climate-related volatilities. "The nutrition transition will unfold in parallel with climate change in coming decades, but very little research on the potentially reinforcing effects of these phenomena has been done" (Wheeler and Braun 2013). This statement is also true for Viet Nam, where in-depth research depicting how climate change is influencing the nutrition transition is not available.

4.2 Science, Technology and Infrastructure

Innovation and Technology

Like other Asian countries, Viet Nam has adapted several innovations and technologies transferred from developed countries into its food system. These technology innovations span various sectors, including agriculture (such as chemical fertilizer, hybrid maize, tractors, pesticides, genetic modification, and so on), processing and wholesale, and transport (motorized mills, trucks, refrigeration, and freeze drying are good examples), and market organization and communication (chain stores, self-service retail, supermarkets, private standards, ICT) (Reardon et al. 2018). The Global Innovation Index Report reveals some of the strengths (for example, credit, knowledge absorption and diffusion, mobile app creation, etc.), as well as the weaknesses such as research and development, investment, intensity of local competition, ICT services, etc., across the sub-indexes for Viet Nam (Cornell University, INSEAD, and WIPO 2018).

Viet Nam is very active in improving its innovation performance: in its Resolution 19-2017/NQ-CP (Government of Viet Nam 2017b), the Vietnamese government has assigned responsibilities to ministries, agencies, and local governments to undertake actions to improve Viet Nam's performance and national competitiveness, and the Ministry of Science and Technology (MOST) has been tasked with coordinating these efforts (Cornell University, INSEAD, and WIPO 2017). There is a general political consensus to embrace industry (Thanh Tung 2018) in food systems with the feeling that 'high-tech farming means better agriculture,' including the use of digitalization to transform the way smallholder farmers learn, communicate, and trade with agrobusinesses. According to national targets (Government of Viet Nam 2012a), by 2020 Viet Nam will be home to 200 hi-tech agricultural businesses and 10 hi-tech agricultural zones, but Viet Nam currently only reports 22 hi-tech agricultural businesses out of thousands of agricultural firms. That is because companies face numerous difficulties in capital and investment incentives, while this field is capital-intensive and requires a long time to recoup seed funds (Luu Tien Dung and Nguyen Thi Kim Hiep 2017). The state bank of Viet Nam has established regulations to disburse a US$4.4 billion line of credit for high-tech and climate-smart agriculture as of 2017 (Viet Nam News 2017).

Conversations on agricultural development in Viet Nam have also involved adopting both technical solutions and a systems lens to innovation, so that actors' innovative capacity can be harnessed. For example, the Vietnamese agricultural extension system, while trying to move away from a purely model-based technology transfer approach towards participatory forms of extension, still faces cultural and institutionalized stereotypes that prevents attributing a more active and knowledgeable role to disadvantaged farmers in the innovation process (Friederichsen et al. 2013). The dominance of public institutions in agricultural research, under which intellectual property rights are difficult to protect, the multiple steps necessary to initiate a research activity, and competitive or venture funding for research which is scarce if unavailable, have been cited as a crucial institutional barriers to innovation (World Bank 2016).

Infrastructure

Although infrastructure improvement has been integral to all policies guiding agricultural and rural development in Viet Nam, the limited scale and the low quality of the resulting infrastructure has acted as a brake on investment in the agricultural sector, including transport and distribution, especially when up to 70 percent of the goods are transported by road (Viet Nam Ministry of Industry and Trade 2017). A large number of rural infrastructure development projects have been implemented and assessed to be successful in lowering the cost of transporting agricultural goods, establishing markets to facilitate production and trading, and shortening the travel to key social infrastructure like schools and clinics, which in turn boost other social outcomes (Asian Development Bank 2010; D. Mishra 2011). Besides, in the most remote areas, where physical connectivity is a big concern and transportation costs make up a high share of the total costs, it has been argued that the construction of roads per se may not always be a priority if the supply of transport services is not adequate (Lançon, Sautier, and Dao The Anh 2014). In several areas across the country, local private collectors and traders have developed marketing systems that provide outlets to most of the local producers and overcome the physical linkage difficulties (Hoang Xuan Thanh et al. 2015; Lançon, Sautier,

and Dao The Anh 2014). The scope of the accessibility issue is not only limited to the cost-effectiveness of transport functions, but also provision of credit, logistics services, and institutional arrangements among the stakeholders (Lançon, Sautier, and Dao The Anh 2014). There is a lack of collective action, e.g. the dearth of well-functioning, commercially-oriented cooperatives and producers' organizations, that could aggregate commodities and provide a wide range of services, which raises the transaction costs, including post-harvest loss (World Bank 2016).

4.3 Policies, Laws and Institutions

4.3.1 Leadership

From the centrally-planned approach to the economy following Reunification (1976–1986), to economic reforms of the Doi Moi (1986–1993) that turned the country from a rice importer to the world's third-largest exporter in 1989, public investment and various forms of government support have played very important roles in Viet Nam's agricultural development (OECD 2015). Policy liberalization and privatization led to a minimization of successive governments' direct role in the food systems, increased private sector small and medium enterprises, entry of large-scale domestic and foreign firms such as processors and supermarket and fast food chains, as well as large input firms (Reardon et al. 2018). However, the effectiveness of different types of markets in the food systems is still constrained by the situation of 'too much state, too little governance:' the presence of state-owned enterprises with their privileges, which has tied up government resources in comparably unproductive activities, is arguably still an obstacle to the private sector and the development of high caliber systems for food safety and biosecurity management. The state's ownership of agricultural land and control of bulk water delivery has caused high transaction cost and low productivity. A focus on quantitative production targets that do not incorporate systems for food quality, food safety, and environmental management has caused concerns among consumers and heightened risks for farmers and firms (World Bank 2016).

Recognizing these challenges, the government has begun to shift from a supply-oriented focus on agricultural production, to a focus on market responsiveness and sustainability, as signaled in Viet Nam's

Agricultural Restructuring Plan 2014 (World Bank 2016). To achieve this change, the shifts in government roles are also desirable, as summarized by the World Bank (Table 4.1).

Table 4.1: World Bank summary of government actions deemed necessary to support better market responsiveness and sustainability in Viet Nam's agricultural sector.

Less of…	More of…
Long-range land-use planning	Facilitating innovation including, but not limited to, R&D, tech transfer and advisory services
Managing farms and plantations	Facilitating and regulating land markets
Being a leading source of agricultural research and advisory services	Providing a conducive enabling environment for agribusiness and logistical investment
Technology push	Facilitating farmer-agribusiness linkages
Investing directly in supply chains	Facilitating, monitoring, and regulating trade
Being the market for farmers	Providing information
Direct commercial role in agri-trade	facilitating production and commercial risk management
Bearing agricultural risks	Co-managing natural resources and co-regulating food safety

Source: World Bank (2016).

4.3.2 Globalization and (International) Trade

Since the country's economic reforms that culminated in its WTO accession in 2007, Viet Nam's international trade has experienced steady growth, fueling its economic growth and now accounting for 178 percent of its GDP (World Bank 2017). Trade agreements pursued (16 trade agreements were signed between 1995 and 2016) have removed several tariff barriers and opened doors to new markets. The expansion and deepening of its export portfolio demand the move from quantity-driven to quality-driven exports, for example, by strengthening its current weak quality and safety standards to meet the increasingly stringent standards set by the international market, including environmental and social standards. The invisibility of the country's export products to the users and consumers also raised the need for differentiated commodities or higher value-added products (World Bank 2016). These upgrading requirements, in turn, have important implications for the country's production system that still covers mostly smallholders with limited financial and human capital.

Viet Nam provides a good case study of local food systems coexisting with exporting food systems (Dao The Anh and Sautier 2011). In theory, foods that are traded could either harness both quality and

safety standards of produce for both export and domestic markets, or they could bifurcate, leading to a situation in which high-quality products are exported, and low-quality remain within the domestic market. The imbalance in surveillance and control practices for export versus domestic market has been noted (World Bank, 2017). These observations demonstrate the need for linked research between trade and food quality.

The increasingly open markets have also given rise to the influx of foreign products and investment, not only facilitating access to a higher variety of products, improved technologies and production models, but also creating more competition that demands quick restructuring efforts for the relevant sectors. For example, Viet Nam is increasing its imports of not only processed foods but also frozen meat. In the scenario of increased free trade agreements, Viet Nam's livestock sector at the current low level of competitiveness has been predicted to suffer from output and welfare decline (Nguyen Duc Thanh et al. 2015). The increased liberalization of trade also introduced new sources of vulnerabilities to the food systems, such as dumping and illegal imports, and legal import of agricultural inputs such as antibiotics and pesticides that jeopardize the safety of Vietnamese products (World Bank 2017). From the consumption side, while reductions in barriers to trade can increase consumer food choices, the large increases in imports and domestic production of processed foods may skew the food supply towards an over-supply of highly processed foods (Friel et al. 2013).

Modernization policies aim to improve food safety by promoting the closure of open-air markets in favor of supermarkets and convenience stores. Traditional open-air markets are the urban population's main source of food, but don't provide formal food safety guarantees, whereas modern retail outlets provide safety guarantees but are not utilized by the urban poor for multiple reasons, including shopping preferences, habits, and convenience (hours of operation, formality, cost, and perceived freshness (Wertheim-Heck, Raneri, and Oosterveer 2019). These modern outlets were designed to increase the consumption of safe foods in Hanoi, however they may also stimulate the consumption of unhealthy ultra-processed foods (Wertheim-Heck and Raneri 2019).

4.3.3 *Food Prices and Volatility*

As one of the world's largest exporters of agricultural products, Viet Nam's local food prices and policy responses are strongly linked to world food prices. Viet Nam's essential rice sector serves as a good illustration. In 2008, amid rising world prices for rice, the government imposed a temporary export ban due to concerns for food security and a desire to stabilize the domestic price of rice. This policy, while contributing to pushing the world price higher, kept the domestic peak price much lower than the international one. Meanwhile, in 2011, variations in the world markets were transmitted to the domestic market fully. The price volatility between 2008 and 2011 prompted the government to adopt a broad range of policies targeting various stakeholders involved at the different stages of rice production and trading, e.g. reduction of post-harvest losses in agricultural production, ensuring profit margins for farmers, and rice export management (Tran Cong Thang, Do Lien Huong, and Le Nguyet Minh 2013).

Since the average Vietnamese households spend half of their income on food, higher food prices may have significant effects, although the impacts are different for net buyers (most urban consumers) or net sellers (most rural households). Vu and Glewwe (2011) estimated the impact of the 2007-2008 food price hike on welfare in Viet Nam. The findings show that higher food prices made most households worse off: a uniform increase in the price of rice would reduce the welfare of about 54 percent of rural households and 92 percent of urban households. All of the within-group impacts are sensitive to differences between the changes in producer and consumer prices, and the southeast and central highlands would be impacted the hardest (Linh Vu Hoang and Glewwe 2011). In a more recent study, Hoa K. Hoang (2017) projected a 30 percent increase in rice prices (observed during the 2007-2008 food crisis) would cause households, especially low-income households, to shrink their calorie intake and demand for rice as well as for some, if not all, other food groups (Hoa K. Hoang 2017). Policies are therefore necessary to address the short-term and long-term impacts of food prices on food security and nutrition, covering social protection programs and price stabilization measurements (HLPE 2017).

4.3.4 Land Tenure

Agricultural land in Viet Nam was decollectivized in 1988 and the subsequent 1993 Land Law and its revisions gave households the power to exchange, transfer, lease, inherit, and mortgage their land-use rights. As one of the largest rural titling programs in the developing world, Viet Nam's tenure formalization has raised the incentive to use land more efficiently and led to significant increases in the share of total area devoted to long-term crops and in labor devoted to non-farm activities, thanks to the increased security of tenure (Quy-Toan Do and Iyer 2008).

In a country where agricultural land holding is dominated by very small farms, land consolidation is important to upgrading production systems and product quality (World Bank 2016). Agricultural land consolidation remains at an early phase in Viet Nam. Although the government has been implementing land consolidation in many communes, in most parts of the country the land rental market, an important pathway to land consolidation, remains underdeveloped due to limits or restrictions on land holding sizes and uses, high transaction costs in land transfers, and the administrative setting of land price values by provincial bodies (World Bank 2016).

Land use planning by the state at multiple levels designates a certain amount of land dedicated to rice cultivation. Long-standing restrictions on the use of paddy land helped to ensure food security in the past, yet comes at the cost of productive and allocative efficiencies: Quy-Toan Do and Iyer (2008) cite restrictions on crop choice as one reason why increased land titling has had limited impact on investment in perennial crops. Decree 35, released in February 2015, enhanced the flexibility of rice-land with a provision under which rice land can more easily be put to alternative agricultural uses, including the cultivation of other seasonal crops and aquaculture. Removing the land designation policy has been projected to benefit agriculture by facilitating more diversified land uses, shifts to higher return crops and/or aquaculture for which domestic demand is growing rapidly, without compromising food security in Viet Nam (Giesecke et al. 2013). However, land use decision can come at environmental costs: in upland areas, for example, the expansion of coffee, rubber, and cassava plantings has cut into natural forest, contributing to biodiversity loss and land degradation. The growth of shrimp aquaculture in the 1990s and early 2000s

was blamed for the destruction of nearly half of the Mekong Delta's mangrove forests (Nair (2015) as in (World Bank 2016)).

4.4 Socio-Cultural Drivers

4.4.1 Culture and Social Traditions

For a country whose food consumption is so deeply ingrained in its particular cultures and behavior that the word for 'eating' is part of many words for special occasions[9], culture and social traditions dictate a large role in Vietnamese food systems. Failure to account for cultural acceptability and indigenous knowledge (including agroecological norms) can damage the effectiveness of the government's agenda for agrarian transition: e.g. Hmong farmers in the northern uplands still preferred their local varieties over introduced hybrids, and subtly challenged the full adoption of hybrid maize as an 'agricultural technology' (Kyeyune and Turner 2016). As illustrated elsewhere in this paper, the retail modernization policy has failed to account for the traditional vending structures in a large population in Hanoi. Such policies are yielding undesirable effects, such as increasing the consumption of ultra-processed foods, as well as increasing inequitable access to retail outlets that further alienates the urban poor (who cannot access supermarkets) from safe and nutritious foods, as they turn to more informal street vending structures in the absence of formal wet markets (Eidse, Turner, and Oswin 2016; Wertheim-Heck, Vellema, and Spaargaren 2014).

The cultural perspective, including taboos and beliefs (see section 3.2.4), also explains the types of food people eat and the implications for their nutritional status. A good example of this is traditional Vietnamese postpartum practices that discourage women from eating certain foods defined as 'cold', such as certain fruits and vegetables, in favor of 'hot' foods that are believed to increase their 'vital energy' and aid production of breastmilk. However, such practices can lead to vitamin deprivation and constipation and also conflict with WHO's worldwide '5 a day' fruit and vegetable policy for better health and wellbeing (Lundberg and Trieu Thi Ngoc Thu 2011). Understanding the importance of culture and taking such

[9] E.g. weddings "ăn cưới", party "ăn tiệc", anniversary "ăn cỗ", New Year celebration "ăn Tết")

observations into account can help to adapt the nutrition interventions to be culturally appropriate and thus be more readily adopted and effective.

As culture is dynamic, capturing the changing culture is essential to understand trends in the food systems. As Viet Nam is increasingly integrated into the global economy, its culture is also being influenced from multiple directions. This can be most observed in big cities, where, for example, the rise of Korean influence has been cited as leading to the growth in consumption of dairy products, especially cheese, among the younger generation (Decision Lab 2016). While sharing a communal meal at home is typical of a traditional Vietnamese family, the rapidly 'modernized' life has led to the rising popularity of eating out, demonstrated by the increased share of food away from home in the total food consumption of an average Vietnamese (Linh Vu Hoang 2009).

4.4.2 Women and Youth Empowerment

Women play a vital role in agricultural production and the food systems, and gender equality leads to superior agricultural and development outcomes, including increases in farm productivity and improvements in family nutrition (Asian Development Bank and FAO 2013; UNDP 2016). In Viet Nam, 63 percent of working women were engaged in agriculture, compared to 58 percent of working men (UN Women and FAO 2014). In livestock value chains, for example, most animal source food products are produced by smallholders, many of them women, and sold in traditional open markets where women also predominate as retailers (Nguyen Thi Duong Nga et al. 2014). According to the Viet Nam Country Gender Assessment, despite its progress in narrowing gender equality, the country still exhibits significant gaps, for example, women typically have more limited access to and control over key productive resources such as land, and to services such as credit, less access to healthcare, lower wages, more involvement in own-account work, and unpaid family labor (World Bank 2011).

The Vietnamese government has recognized gender equality in its Law on Gender Equality and its National Strategy on Gender Equality. As a policy response to empower women, the Land Law 2003 stipulates that the land use right certificate carry both the wife's and husband's names, aiming to enable

women to participate more actively in household economic production, and to protect the rights of the woman in the event of civil disputes. Improved Vietnamese women's land rights has been found to positively impact household welfare, including access to credit for agricultural production (World Bank, 2008), increased women's self-employment in agriculture (Menon, Van der Meulen Rodgers, and Kennedy 2017), increased household food expenditure (Newman 2015), and reallocation of household expenditures toward food and away from alcohol (Menon, Van der Meulen Rodgers, and Huong Nguyen 2014). However, as of 2008, the majority of land use right certificates still did not include the wife's name, and access to larger funds often requires other kinds of collateral than the certificate (World Bank 2011).

A recent study (Viet Nam National University of Agriculture and Rikolto 2018) revealed that women often had more experience in agriculture than men and that they participated mainly in the production processes of value chain activities. Driving the increase of women in agriculture was also the increasing shift of men moving towards non-farm employment. Women were empowered to make decisions regarding agricultural production, however, they still lacked capacity and empowerment compared to men in regard to selling land, deciding land use purpose, and taking loans for agricultural production.

A barrier to the engagement of women in innovative approaches to agriculture is the difficulty associated with inciting their participation in trainings due to higher household demands and expectations, including farm labour, household chores, and caring for a family member and/or young children. In addition, trainings are often targeted towards cooperative members and realistically the voice and presentation of men in both formal and informal groups is higher than that of women.

In 2018, the number of young Vietnamese people aged from 16 to 30 was estimated at 23.3 million, accounting for 24.6 percent of the country's population. Despite the central role of agriculture in the rural social systems, little progress has so far been achieved towards raising the income and living standard of youths engaged in its practice. So while young people have the potential to feed growing urban populations and transform the food system, their potential is often overlooked. As yet, there are very few young people involved in agrobusiness or incentivized to be, due to (1) generational break in family and community

traditions of smallholder farming; (2) lack of voice and agency; (3) poor image of agribusiness; (4) lack of access to skills and knowledge; (5) poor access to finance; (6) poor access to ICT and connectivity; and (7) poor access to land (T. L. Nguyen 2019a), as well as challenges such as poor access to farm inputs, good market channels, and other services (Vietnam National University of Agriculture and Rikolto 2018).

4.5 Demographic Drivers

4.5.1 Population Growth and Urbanization

After increasing rapidly over the years, the Vietnamese population, ranked 15th globally at 92.7 million in 2016, had stabilized at a growth rate of around 1 percent in 2017. Its urbanization rate has been on a continual rise, becoming the key demographic driver of food systems transformation. Around 35 percent of the total population resided in urban areas in 2016, from 20 percent in the 1980s. The urban population growth rate is much higher than the rural rate, standing at around 3 percent in 2016 (United Nations 2018). Urbanization has demonstrated its driving force in the transformation of several components of the Vietnamese food system: diet change, for example towards more processed foods in urban total food expenditure (Reard*on* et al. 2014); modernization of the food distribution system (Wertheim-Heck et al. 2015); conversion of agricultural land into commercial use and diversification of agricultural products (Van Dijk et al. 2012; Hoang Xuan Thanh et al. 2013); more complex rural-urban linkages promoted by various market agents, entailing not only rural-urban supply but also urban-rural flows and the rise of urban and peri-urban agriculture (Hoang Xuan Thanh et al. 2013).

It has been argued that urbanization provides massive agrobusiness opportunities (for importers, local farmers, processors) but also challenges for city planners in terms of physical infrastructure, as well as new ownership and management models (Tschirley 2017). In Viet Nam, where urban areas have expanded spatially at almost 3 percent per year, among the fastest rates in the region (Tu Hoang 2015), considerations about food retail, food waste, and other food-related issues have not been integrated into urban planning. For example, in Hanoi, retail modernization policies, as an effort to cope with rising food safety concerns, have failed to account for the dominance of existing wet markets in consumers' everyday

shopping practices (Wertheim-Heck, Vellema, and Spaargaren 2014). By marginalizing the wet markets, the policies also run the risk of further excluding urban and rural poor female smallholder vendors and low-income consumers, which calls for flexible approaches to retail modernization (Kawarazuka, 2016; Wertheim-Heck et al. 2015). This example in the food distribution sector demonstrates that characterizing the winners and losers of urbanization in the food supply chains and proposing appropriate policy responses is crucial.

4.5.2 Internal Migration

Internal migration rates, especially rural-urban migration, have been rising in Viet Nam, due to better prospects of employment and income opportunities (General Statistics Office of Viet Nam and UNFPA 2016). There has been some evidence that migration, especially short-term as a mechanism by which households maintain food security, has a positive impact on overall per capita food consumption (Nguyen Minh Cong and Winters 2011), for example, thanks to more adequately supplied and accessible markets[10]. However, as Viet Nam's high proportion of migrants are characterized by a lack of permanent residential registration status, limiting their access to public services (Demombynes and Linh Hoang Vu 2016), internal migration can increase the pressure on urban poverty and aggravate nutrition deserts for the urban poor.

How out-rural migrants benefit their home agricultural production and food security is multifaceted and highly context-dependent, for example, on how remitted money is used, how new knowledge is transmitted, and how rural labor structure is affected (Hoang Xuan Thanh et al. 2013). On the one hand, agricultural production investment is an important expenditure for remitted money, and many migrants who return to their home areas with a 'brain gain' help improve agricultural production, as well as household and local incomes. On the other hand, migrants may have to depend on home-based relatives for food when prices rise in urban areas (ActionAid and Oxfam 2012).

[10] Using panel data from the 2004 and 2006 Vietnam Household Living Standards Surveys, the authors find that short-term migration has a positive impact on food consumption through increased per capita food expenditures and greater calories per capita consumed. Households with short-term migrants appear to increase food consumption and calorie intake from a number of food categories. However, for long-term migration, they find minimal evidence of increasing per capita calorie consumption and no evidence of a broader increase in per capita food expenditures or food diversity (General Statistics Office of Vietnam 2006, 2004).

4.5.3 Changing Age Distribution

Viet Nam has a young population, with the working-age (15 to 64) comprising around 84 percent of the total population. More than half of the Vietnamese population is under 34, born after the economic reforms, and play a significant role in food system transformation, especially through consumption practices. For example, urban young people are driving the growth of Western food and 'cheese mania' in out-of-home consumption (Decision Lab 2016), which can account for up to 20 percent of the total calories consumed (General Statistics Office of Viet Nam 2014). The young labor force also implies opportunities and challenges for food production. The agricultural sector has to transform and become a more youth-friendly and stimulating environment. Viet Nam now has a youth-led vibrant start-up environment conducive to agrobusiness growth, where agricultural technologies and innovations are encouraged (The Voice of Viet Nam 2017; Viet Nam Advisors 2019). The global call for engaging youth in food systems in developing countries means that Viet Nam should make use of the opportunities entailed for modernizing agricultural sectors by leveraging youth's potential.

At the same time, Viet Nam is among the countries with highest speed of population ageing in the world. As diet-related non-communicable diseases are the biggest health threat to the Vietnamese elderly (Viet Nam Net, 2017), food systems interventions increasingly have to take into account their needs, especially in the context of inadequate healthcare and public service systems (Hutt 2017). The absolute number of people of working age is expected to peak in the mid-2030s (World Bank 2016), which will also affect the domestic labor market for agriculture and other components of the food systems.

5. SYNTHESIS AND THE WAY FORWARD

5.1 Synergies and Trade-Offs Between Diets and Other Food Systems Outcomes in Viet Nam

Food systems outcomes reflect complex causal processes that can involve interactions among various drivers (Ericksen 2008b). In Viet Nam, for example, the combination of the upward trend of international trade volume, increased urbanization, and a young population enables stronger effects on diets and domestic markets (Vo and Smith, 2017; World Bank, 2017). In another instance, climate change impacts on food production are also subject to the future trends in domestic consumption and export opportunities (World Bank 2016). One therefore must always consider the pathways and extent to which a driver affects the food system components in a broader context covering relevant drivers.

Besides synergies, trade-offs are inevitable in harnessing the implications of various drivers. The conflict between meeting the local economic growth targets (economic drivers), which has accounted for the country's dietary improvements in the past period, and sustainable use of biodiversity (biophysical and environmental drivers) could translate into the trade-off between dietary outcomes and environmental outcomes. Although some examples demonstrate that win-win solutions are plausible, it requires a strategic lens to tackle specific problems. While Viet Nam has eagerly embraced world-class knowledge, modernization, digitalization of production processes, and high-tech farming (innovation, technology, and infrastructure drivers), its ambition can be set back by deeply-rooted cultural characteristics (social-cultural drivers). While making use of the opportunities brought about by international trade in terms of diversity and raised standards, Viet Nam's trade policies should also carefully consider the implications of the influx of ultra-processed products that cater to the large young populations and growing numbers of urbanites.

Everyday shopping practices are importantly shaped by constraints that drive the trade-offs people make around food safety. Food safety concerns are not the principal factor determining Vietnamese consumers' buying behaviors; the primary choice is about the selection of the preferred retail outlet and location and buying power, which is mainly convenience-driven. These factors hamper the active search

for alternative sales locations that might offer better food safety guarantees, like supermarkets, which are being promoted by public policy.

As Viet Nam has opened its economy and increased regional and global trade that has brought a decrease in poverty and overall undernutrition across the country, the trade-off has been an increase in the prevalence of consumption of Westernized processed foods and consumption patterns that are shifting nutrition-related problems towards overweight and obesity associated with increased consumption of salt, fat, sugar, energy, meats (including ultra-processed meat products), and insufficient quantities of fresh fruits, vegetables and legumes. The 'meatification' of the Vietnamese diet has serious trade-offs for the sustainability of the Vietnamese food system. Meat production is often less resource-efficient than for crops, however, the increase of meat in the diet is undoubtably a considerable factor in the improvement in nutrition observed over the past 20 years. However, the distribution of meat consumption is likely unequal – with poor populations who are still undernourished and not consuming sufficient quantities, and wealthier populations now facing the burden of overweight and obesity, often consuming in excess.

The traditional Vietnamese diet is seasonal, but this is now changing with the increased presence of supermarkets that aim for a consistent supply of food, and better value chain connections that can connect urban consumers with year-round produce that can be grown at different times of the year, utilizing the diverse agroecological landscapes available in Viet Nam. Improved value chain efficiency is increasing the availability of preferred foods, such as indigenous varieties of green leafy vegetables and breeds of black pig, for urban consumers. Foods are therefore available to consumers for longer periods throughout the year than could previously be supplied by the immediate peri-urban food system that previously acted as the primary food bowls for major cities like Hanoi. As such, there is a risk that dietary patterns will shift away from more traditional diets that reflect the seasonality of the immediate and local food system, in favor of a more unified seasonal availability across the country. This may eventually lead to a reduction in the diversity of foods consumed across the year, in favor of preferred (and now more available) foods that are consumed more frequently.

The Vietnamese MARD is looking to invest in larger-scale agricultural production systems that will rely more heavily on agrochemical inputs, and longer, more complex value chains. While these efforts are designed to make food cheaper and easier to access, the trade-offs might be at the cost of the variety and quality of foods consumed in terms of safety, healthiness, and nutrient content.

Food systems outcomes do not only entail nutrition and health outcomes, but also environmental and socio-economic outcomes (impacts). Evidence has been limited in how the drivers affect these non-dietary outcomes in relation to nutrition and health outcomes.

5.2 Defining Targeted Research Priorities

With a view to determining key areas for research and investment for government policy makers, researchers, and development programs, the coauthors of this paper developed a draft set of questions based on research and policy gaps arising from the food system thematic areas corresponding with each section of this paper. The paper and draft set of priority research questions were circulated to 57 stakeholders (listed in Annex 2) from national and international agencies with specific areas of expertise, including: food supply chains, food environment, consumer behavior, diets, food safety, nutrition and health, and drivers, for their review, prior to a participatory stakeholder consultation workshop, at which the key questions would be discussed and prioritized. Stakeholders who would not be able to participate in the workshop were invited to provide their full feedback prior to it. During the stakeholder consultation workshop on June 20, 2019, in Hanoi, participants contributed to refining the content of the paper and identifying areas that required extrapolation. From among the invited stakeholders, some volunteered to contribute to these sections, and were included as co-authors.

Following review of the paper's content, the draft set of research questions was reviewed. Participants then broke up into parallel working groups, to further refine and add to the set of proposed questions. Following the workshop, these questions then went through an online prioritization exercise using Google Forms, where stakeholders were asked to identify their top 15 priority research questions out of the full list of 56 that resulted from the workshop, across all thematic areas. The results of the 30 priority

research questions are presented in Table 5.1. Annex 3 shows the results of the full ranking, and Annex 4 synthesizes the prioritization of all questions within each thematic area.

Table 5.1: List of Prioritized research questions

Priority Ranking Order for Action	Research Question	Domain	Priority Order by Vote
1	What are the trade-offs and associations between agricultural production, health, environment (including agrobiodiversity and ecosystem services), and economic outcomes?	Synergies & trade-offs	1
2	How to work with the private sector to promote healthy diets? What policies are necessary to regulate the private sector to promote health?	Food environment	2
3	What is the potential of smallholder-oriented innovations in the food distribution systems?	Food supply	3 (tie)
4	How can we improve the management system/governance of food supply in Viet Nam?	Food supply	3
5	Can healthier food choices lead to a healthier food supply?	Food supply	3
6	What are the trade-offs between food safety, food waste, nutrition and environment?	Synergies & trade-offs	3
7	What is the role of street food in Vietnamese diets and its nutritional outcomes?	Nutrition and consumer behavior	7 (tie)
8	What should Viet Nam do to promote healthy and diverse diets within the context of trade (liberalization, imports, foreign investments)?	Synergies & trade-offs	7
9	How are the interactions/dynamics between family, school and communities ensuring healthy diets for children?	Food environment	8 (tie)
10	What are the costs and benefits for smallholders associated with the rise of different distribution and retail outlets?	Food supply	8
11	What are some options to make modernization of the supply system more inclusive?	Food supply	8
12	How do food policies interact with the determinants of obesity and NCDs?	Food environment	9 (tie)
13	What are the weak points along the supply chain regarding food loss management?	Food supply	9
14	What interventions targeted at smallholders can improve food supply systems in Viet Nam?	Food supply	9
15	Who are the winners and losers regarding environment, economic, health and nutrition outcomes of food-related opportunities brought about by urbanization?	Synergies & trade-offs	9
16	To what extent, and how, are food system-related matters considered in urban planning?	Drivers	16 (tie)
17	How does the governance system (and its new laws, policies, etc.) affect the food system?	Drivers	16
18	How does trust (e.g. food safety, traceability, etc.) affect consumption behavior?	Nutrition and consumer behavior	16
19	What are the synergies and opportunities between the drivers of food system change?	Synergies & trade-offs	16
20	How has climate change influenced the nutrition transition in Viet Nam?	Drivers	20 (tie)
21	How to harness the role of traditional beliefs and practices to improve diets (e.g. of ethnic community communities)?	Drivers	20
22	How do new consumption trends and norms (e.g. vegetarianism, clean eating, etc.) affect the food system?	Drivers	20

Priority Ranking Order for Action	Research Question	Domain	Priority Order by Vote
23	What are the effects of marketing campaign strategies from the private sector on diets and health?	Food environment	20
24	What are storage knowledge gaps of farmers and traders?	Food supply	20
25	What are the major nutrition-sensitive agriculture promotion strategies best suited for improving healthy diets, among general population, particularly 'vulnerable' groups including migrants and minority ethnic?	Nutrition and consumer behavior	20
26	What are child and adolescent initiated interventions that promote healthier diets at household, school and media levels?	Nutrition and consumer behavior	20
27	How can food labeling initiatives have positive effects on the food system? Specifically, how can they improve consumer knowledge and empower consumers to make healthier food choices while also creating demand for healthier and safer food options from food companies?	Nutrition and consumer behavior	20
28	How can emphasizing increasing consumer demand help shape or change production patterns to be more sustainable? What are the demand and supply incentives that are needed?	Synergies & trade-offs	20
29	Have dietary consumption patterns followed agricultural production patterns or vice versa? How could the demand and supply relationship between production and consumption be better understood to shape healthier food systems, through shaping both agriculture and nutrition policies?	Synergies & trade-offs	20
30	What is the evidence of health benefits/harm of modernized diets compared to traditional ones?	Nutrition and consumer behavior	30

5.3 Conclusion

Viet Nam is an excellent example of a country in which local food systems coexist with exporting food systems (Dao The Anh and Sautier 2011). Vietnamese food systems are undergoing rapid transformation, with important implications for human and environmental health and economic development. Notable transitions are being experienced, with population migration from rural to urban areas, and from traditional to modern retailing.

Yet Viet Nam is still at the intersection between the old and the new, traditions and modernization. While its economy is bolstered by participation in global markets through its rice exports, Viet Nam is still struggling to balance modernization with sustainable agricultural practices that will support sustainable growth and safe and improved nutrition, while dealing with climate change and its effects on agriculture and food production. With an appetite to become a modern economy participating competitively nationally and in the global arena, Viet Nam is held back by lagging innovation and technology with few high-tech

agrobusinesses, pockets of widespread poverty, the limited scale and the low quality of infrastructure, the presence of state-owned enterprises with their privileges that have tied up government resources in comparably unproductive activities, and the state's ownership of agricultural land and control of bulk water delivery that has caused high transaction costs and low productivity. Clearly, quantitative production targets that incorporate systems for food quality, food safety, and environmental management are needed, both to appease consumer and government concerns around food safety and to lower the risks for farmers and firms (World Bank 2016). Food systems interventions in Viet Nam need to be linked to enhancement in multiple sectors, including innovation and technology, infrastructure, trade and investments, policies related to food prices and volatility, and culture and social traditions, which need to be taken into account if Viet Nam's retail modernization and food systems policies are to flourish without undesirable effects, such as increased consumption of ultra-processed foods, as well providing equitable access to retail outlets and safe and nutritious foods for all strata of society, including the urban poor who currently source their foods from the informal street vending structures or formal wet markets (Eidse, Turner, and Oswin 2016; Wertheim-Heck, Vellema, and Spaargaren 2014).

The last general nutrition survey was conducted in Viet Nam nearly 20 years ago; as such, this nationally-representative data likely does not accurately represent the current state of diet quality or nutrition within the context of this rapid food system transition. Similarly, data gaps exist for the other key food system dimensions of agricultural production, food safety, and, in particular, food processing and value chains. Where data exists, it is often not easy to aggregate with data from other food system dimensions, making an informed analysis of current and potential food system trade-offs for Viet Nam difficult. This paper has clearly outlined key areas for priority investment of research, government, and development programs to build the evidence base around inclusive food system interventions that aim to result in healthier diets and more sustainable food systems for Viet Nam. It is recommended that these areas of priority be reviewed once the latest general nutrition survey has been completed.

REFERENCES

ActionAid, and Oxfam. 2012. "Participatory Monitoring of Urban Poverty in Viet Nam: Five-Year Synthesis Report (2008-2012)." Hanoi, Vietnam: ActionAid Vietnam and Oxfam.

Ajinomoto. 2017. "Sustainability Data Book 2017." Tokyo. http://www.toyota-global.com/sustainability/report/er/%0Ahttp://www.toyota-global.com/sustainability/report/sr/%0Ahttp://www.toyota-global.com/investors/ir_library/annual/%0Ahttp://www.toyota.co.jp/jpn/investors/library/negotiable/%0Ahttp://www.toyota-glo.

Alive & Thrive. 2012. "Baseline Survey Report: 11-Province Master Report." Hanoi, Vietnam: Alive & Thrive.

Anh Kim Dang, Bach Xuan Tran, Cuong Tat Nguyen, Huong Thi Le, Hoa Thi Do, Hinh Duc Nguyen, Long Hoang Nguyen, et al. 2018. "Consumer Preference and Attitude Regarding Online Food Products in Hanoi, Vietnam." *International Journal of Environmental Research and Public Health* 15 (5). https://doi.org/10.3390/ijerph15050981.

Asian Development Bank. 2010. "Viet Nam: Rural Infrastructure Sector Project. Performance Evaluation Report." Mandaluyong City, Philippines: Asian Development Bank.

Asian Development Bank. 2013. "Vietnam: Environment and Climate Change Assessment." Mandaluyong City, Philippines: Asian Development Bank.

Asian Development Bank. 2018. "Urban Consumer Preferences Regarding Organic and Safe & Products in Vietnam and Myanmar."

Asian Development Bank, and FAO. 2013. "Gender Equality and Food Security: Women's Empowerment as a Tool against Hunger." Mandaluyong City, Philippines: Asian Development Bank.

Avieli, Nir. 2019. "Forbidden from the Heart: Flexible Food Taboos, Ambiguous Culinary Transgressions, and Cultural Intimacy in Hoi An, Vietnam." In *Food Anxiety in Globalising Vietnam*, edited by Judith Ehlert and Nora Katharina Faltmann, 77–103. Singapore: Palgrave Macmillan. https://doi.org/10.1007/978-981-13-0743-0_3.

Bach Xuan Tran, Hoa Thi Do, Luong Thanh Nguyen, Victoria Boggiano, Huong Thi Le, Xuan Thanh Thi Le, Ngoc Bao Trinh, et al. 2018. "Evaluating Food Safety Knowledge and Practices of Food Processors and Sellers Working in Food Facilities in Hanoi, Vietnam." *Journal of Food Protection* 81 (4): 646–52. https://doi.org/10.4315/0362-028X.JFP-17-161.

Berg, Håkan, Agnes Ekman Söderholm, Anna Sara Söderström, and Nguyen Thanh Tam. 2017. "Recognizing Wetland Ecosystem Services for Sustainable Rice Farming in the Mekong Delta, Vietnam." *Sustainability Science* 12 (1): 137–54. https://doi.org/10.1007/s11625-016-0409-x.

Berthouly, Cécile. 2008. "Characterisation of the Cattle, Buffalo and Chicken Populations in the Northern Vietnamese Province of Ha Giang (PhD Thesis)." AgroParisTech.

Berti, Peter R., Rachelle E. Desrochers, Hoi Pham van, An L?? V??n, Tung Duc Ngo, Ky Hoang The, Nga Le Thi, and Prasit Wangpakapattanawong. 2016. "The Process of Developing a Nutrition-Sensitive Agriculture Intervention: A Multi-Site Experience." *Food Security*, 1–16. https://doi.org/10.1007/s12571-016-0625-3.

Bingxin Yu, Tingju Zhu, Clemens Breisinger, and Nguyen Manh Hai. 2010. "Impacts of Climate Change on Agriculture and Policy Options for Adaptation: The Case of Vietnam." *IFPRI Discussion Paper*. Washington, DC: International Food Policy Research Institute (IFPRI).

Bordier, Marion, Aurelie Binot, Quentin Pauchard, Dien Thi Nguyen, Thanh Ngo Trung, Nicolas Fortané, and Flavie Luce Goutard. 2018. "Antibiotic Resistance in Vietnam: Moving towards a One Health Surveillance System." *BMC Public Health* 18 (1): 1–14. https://doi.org/10.1186/s12889-018-6022-4.

Brünjes, Jürgen, and Javier Revilla Diez. 2016. "Obtaining Non-Farm Wage Employment in Rural Vietnam." *Asia Pacific Viewpoint* 57 (2): 263–79. https://doi.org/10.1111/apv.12116.

Bui, Tan Van, Christopher L. Blizzard, Khue Ngoc Luong, Ngoc Le Van Truong, Bao Quoc Tran, Petr Otahal, Velandai Srikanth, et al. 2016. "Fruit and Vegetable Consumption in Vietnam, and the Use of a 'standard Serving' Size to Measure Intake." *British Journal of Nutrition* 116 (1): 149–57. https://doi.org/10.1017/S0007114516001690.

Carrique-Mas, Juan J., and J. E. Bryant. 2013. "A Review of Foodborne Bacterial and Parasitic Zoonoses in Vietnam." *EcoHealth* 10 (4): 465–89. https://doi.org/10.1007/s10393-013-0884-9.
CEL Consulting. 2018. "Food Losses in Vietnam: The Shocking Reality." 2018. https://www.cel-consulting.com/single-post/2018/08/10/Food-Losses-in-Vietnam-the-shocking-reality.
CGFAR. 2018a. "The Vietnam Urban Food Consumption and Expenditure Study. Factsheet 5: Where Do Consumers Buy Different Food Items?" Adelaide, Australia: University of Adelaide, Centre for Global Food and Resources (CGFAR).
CGFAR. 2018b. "The Vietnam Urban Food Consumption and Expenditure Study Factsheet 4: Where Do Consumers Shop? Wet Markets Still Dominate." Adelaide, Australia: University of Adelaide, Centre for Global Food and Resources (CGFAR).
Chaparro, C., L. Oot, and K. Sethuraman. 2014. "Vietnam Nutrition Profile." Washington, DC: FHI 360/FANTA.
Chen, Xinyin, and Leora C. Swartzman. 2001. "Health Beliefs and Experiences in Asian Cultures." In *Handbook of Cultural Health Psychology*, edited by S. Kazarian and D. Evans, 390–411. San Diego, CA: Academic Press. https://doi.org/10.1016/B978-012402771-8/50016-7.
Chi Cong, Le, Svein Ottar Olsen, and Ho Huy Tuu. 2013. "The Roles of Ambivalence, Preference Conflict and Family Identity: A Study of Food Choice among Vietnamese Consumers." *Food Quality and Preference* 28 (1): 92–100. https://doi.org/10.1016/j.foodqual.2012.08.015.
CIAT. 2017. "The Food System: Drivers, Actors, Activities and Outcomes." 2017.
Codling, Karen, Nguyen Vinh Quang, Le Phong, Do Hong Phuong, Nguyen Dinh Quang, France Bégin, and Roger Mathisen. 2015. "The Rise and Fall of Universal Salt Iodization in Vietnam: Lessons Learned for Designing Sustainable Food Fortification Programs with a Public Health Impact." *Food and Nutrition Bulletin* 36 (4): 441–54. https://doi.org/10.1177/0379572115616039.
Coe, Neil M., and Rachel Bok. 2018. "Retail Transitions in Southeast Asia." *The International Review of Retail, Distribution and Consumer Research* 24 (5): 479–99. https://doi.org/10.1080/09593969.2014.977324.
Cornell University, INSEAD, and WIPO. 2017. "The Global Innovation Index 2017: Innovation Feeding the World." Ithaca, Fontainebleau and Geneva: Cornell University, INSEAD and WIPO.
Cornell University, INSEAD, and WIPO. 2018. "Global Innovation Index 2018: Energizing the World with Innovation." Ithaca, Fontainebleau and Geneva: Cornell University, INSEAD and WIPO.
Cuong, Nguyen Van, Nguyen Thi Nhung, Nguyen Huu Nghia, Nguyen Thi Mai Hoa, Nguyen Vinh Trung, Guy Thwaites, and Juan Carrique-Mas. 2016. "Antimicrobial Consumption in Medicated Feeds in Vietnamese Pig and Poultry Production." *EcoHealth* 13 (3): 490–98. https://doi.org/10.1007/s10393-016-1130-z.
Dang K. Nhan, Le T. Phong, Marc J.C. Verdegem, Le T. Duong, Roel H. Bosma, and David C. Little. 2007. "Integrated Freshwater Aquaculture, Crop and Livestock Production in the Mekong Delta, Vietnam: Determinants and Role of the Pond." *Agricultural Systems* 94 (2): 445–58. https://doi.org/10.1016/j.agsy.2006.11.017.
Dao The Anh, and Denis Sautier. 2011. "Local Food Systems in Vietnam: Strengths and Opportunities." In *International Seminar on Strengthening Local Food Systems for Small-Scale Farmers in the Asian and Pacific Region, 10-17 October, 2011*. Séoul, South Korea.
Dasgupta, Susmita, Craig Meisner, David Wheeler, Nhan Thi Lam, and Khuc Xuyen. 2005. "Pesticide Poisoning of Farm Workers: Implications of Blood Test Results from Vietnam." *Policy Research Working Paper Series No. 3624*. Washington, DC: World Bank.
Decision Lab. 2016. "Out-of-Home Food and Drink Consumption Trends Vietnam." Decision Lab. 2016.
Demombynes, Gabriel, and Linh Hoang Vu. 2016. "Vietnam's Household Registration System." Washington, DC: World Bank.
Department of Planning. 2018. "Agricultural Products Processing Industry and Mechanization of Agricultural Production - Status and Solutions." Hanoi, Vietnam.
Development Initiatives. 2017. "Global Nutrition Report 2017: Nourishing the SDGs." Bristol, UK: Development Initiatives.
Development Initiatives. 2018a. "2018 Global Nutrition Report: Shining a Light to Spur Action on

Nutrition." Bristol, UK: Development Initiatives.
Development Initiatives. 2018b. "2018 Nutrition Country Profile: Vietnam." Bristol, UK: Development Initiatives.
Dijk, M. Van, H. Hilderink, W Van Rooij, M. Rutten, Vu Cong Lan, K. Kartikasari, and R. Ashton. 2012. "Land Use, Food Security, and Climate Change in Vietnam." *Policy Brief*.
Dries, Mark, Greg Tyng, and Truong Minh Dao. 2013. "Retail Foods. Sector Report 2013." Hanoi, Vietnam: GAIN (Global Agricultural Information Network). Report number: VM3062.
Duan, Van, and Nguyen Huong. 2016. "Declaring War on Banned Substances in Livestock." Nguoi Lao Dong. 2016.
Duc, Anh. 2019. "Propak Vietnam 2019: Staying Abreast of Packaging Trends." Vietnam Investment Review. 2019. https://www.vir.com.vn/propak-vietnam-2019-staying-abreast-of-packaging-trends-66297.html.
Duc Son Nguyen Trung Le. 2011. "School Meal Program in Ho Chi Minh City, Vietnam: Reality and Future Plan." *Asia Pacific Journal of Clinical Nutrition* 21 (1): 139–43.
Dung Duc Tran, Gerardo van Halsema, Petra J.G.J. Hellegers, Fulco Ludwig, and Andrew Wyatt. 2018. "Questioning Triple Rice Intensification on the Vietnamese Mekong Delta Floodplains: An Environmental and Economic Analysis of Current Land-Use Trends and Alternatives." *Journal of Environmental Management* 217: 429–41. https://doi.org/10.1016/j.jenvman.2018.03.116.
Dutch embassy. 2017. "Factsheet - Doing Business in Vietnam." Hanoi and Ho Chi Minh City, Vietnam: Embassy of the Netherlands in Hanoi and Consulate General in Ho Chi Minh City.
Eidse, Noelani, Sarah Turner, and Natalie Oswin. 2016. "Contesting Street Spaces in a Socialist City: Itinerant Vending-Scapes and the Everyday Politics of Mobility in Hanoi, Vietnam." *Annals of the American Association of Geographers* 106 (2): 340–49. https://doi.org/10.1080/00045608.2015.1117936.
Ericksen, Polly. 2008a. "Conceptualizing Food Systems for Global Environmental Change Research." *Global Environmental Change* 18 (1): 234–45. https://doi.org/10.1016/j.gloenvcha.2007.09.002.
Ericksen, Polly. 2008b. "What Is the Vulnerability of a Food System to Global Environmental Change?" *Ecology and Society* 13 (2). https://doi.org/10.5751/ES-02475-130214.
EVBN. 2018. "Vietnam's Distribution and Retail Channels. Edition 2018. Research Report." Ho Chi Minh City, Vietnam: EU-Vietnam Business Network (EVBN).
FAO. 2008. "Poultry Production Systems in Viet Nam." Edited by Nguyen Van Duc and T. Long. *GCP/RAS/228/GER Working Paper No.4*. Rome, Italy: Food and Agriculture Organization of the United Nations (FAO).
FAO. 2011. "Strengthening Capacities to Enhance Coordinated and Integrated Disaster Risk Reduction Actions and Adaptation to Climate Change in Agriculture in the Northern Mountain Regions of Viet Nam." Hanoi: FAO. http://www.fao.org/climatechange/34068-0d42acdf5fb7c4d80f3013c038ab92ce6.pdf.
FAO, IFAD, UNICEF, WFP, and WHO. 2018. "The State of Food Security and Nutrition in the World 2018. Building Climate Resilience for Food Security and Nutrition." https://doi.org/10.1109/JSTARS.2014.2300145.
FAOSTAT. 2018. "Food and Agricultural Data." Rome, Italy: Food and Agriculture Organization of the United Nations (FAO).
Figuié, M., and T. Fournier. 2008. "Avian Influenza in Vietnam: Chicken-Hearted Consumers?" *Risk Analysis* 28 (2): 441–51. https://doi.org/10.1111/j.1539-6924.2008.01039.x.
Figuié, Muriel. 2004. "Perception of Food-Related Risks by Consumers in Hanoi, Vietnam." *A CIRAD/IOS Survey 2002*. Hanoi, Vietnam: CIRAD-MALICA.
Figuié, Muriel, Nicolas Bricas, Vu Pham Nguyen Thanh, and Nguyen Duc Truyen. 2004. "Hanoi Consumers' Point of View Regarding Food Safety Risks: An Approach in Terms of Social Representation." *Vietnam Social Sciences* 3 (101): 63–72.
Food Safety News. 2012. "Vietnam Urged To Enlist Public in Food Safety Campaign." 2012.
Foundation for Food and Agriculture Research. 2019. "Innovative Consortium Reduces Post-Harvest Loss and Food Waste." 2019. https://foundationfar.org/2019/04/17/innovative-consortium-reduces-

post-harvest-loss-and-food-waste/.
Friederichsen, Rupert, Thai Thi Minh, Andreas Neef, and Volker Hoffmann. 2013. "Adapting the Innovation Systems Approach to Agricultural Development in Vietnam: Challenges to the Public Extension Service." *Agriculture and Human Values* 30 (4): 555–68. https://doi.org/10.1007/s10460-013-9433-y.
Friel, Sharon, Deborah Gleeson, Anne-Marie Thow, Ronald Labonte, David Stuckler, Adrian Kay, and Wendy Snowdon. 2013. "A New Generation of Trade Policy: Potential Risks to Diet-Related Health from the Trans Pacific Partnership Agreement." *Globalization and Health* 9 (1): 46. https://doi.org/10.1186/1744-8603-9-46.
GBD 2017 Risk Factor Collaborators. 2018. "Global, Regional, and National Comparative Risk Assessment of 84 Behavioural, Environmental and Occupational, and Metabolic Risks or Clusters of Risks for 195 Countries and Territories, 1990–2017: A Systematic Analysis for the Global Burden of Disease Stu." *The Lancet* 392 (10159): 1923–94. https://doi.org/10.1016/S0140-6736(18)32225-6.
General Statistics Office of Vietnam. 2004. "Household Living Standard Survey." Hanoi, Vietnam.
General Statistics Office of Vietnam. 2006. "Household Living Standard Survey." Hanoi, Vietnam.
General Statistics Office of Vietnam. 2014. "Result of the Vietnam Household Living Standards Survey 2014." Hanoi, Vietnam.
General Statistics Office of Vietnam. 2016. "Result of the Vietnam Household Living Standards Survey 2016. Consumption Expenditure." Hanoi, Vietnam.
General Statistics Office of Vietnam. 2018a. "Agriculture, Forestry and Fishery Statistical Data." Hanoi, Vietnam.
General Statistics Office of Vietnam. 2018b. "International Merchandise Trade Vietnam." Hanoi. https://www.gso.gov.vn/default_en.aspx?tabid=515&idmid=5&ItemID=19086.
General Statistics Office of Vietnam. 2018c. "National Accounts, State Budget and Insurance." In *Statistical Yearbook of Viet Nam*, 133–58. Hanoi. https://www.gso.gov.vn/default_en.aspx?tabid=515&idmid=5&ItemID=19299.
General Statistics Office of Vietnam. 2018d. "Results of the Rural, Agricultural and Fishery Census 2016." Hanoi.
General Statistics Office of Vietnam. 2019. "Trade, Price and Tourist." Thematic Data. 2019. https://www.gso.gov.vn/default_en.aspx?tabid=780.
General Statistics Office of Vietnam and UNFPA. 2016. "The 2015 National Internal Migration Survey: Major Findings." Hanoi, Vietnam: Vietnam News Agency Publishing House.
General Statistics Office of Vietnam, and UNICEF. 2015. "Vietnam Multiple Indicator Cluster Survey 2014." Hanoi, Vietnam.
Giesecke, James A., Nhi Hoang Tran, Erwin L. Corong, and Steven Jaffee. 2013. "Rice Land Designation Policy in Vietnam and the Implications of Policy Reform for Food Security and Economic Welfare." *Journal of Development Studies* 49 (9): 1202–18. https://doi.org/10.1080/00220388.2013.777705.
Glewwe, Paul, Nisha Agrawal, and David Dollar. 2004. "Economic Growth, Poverty, and Household Welfare in Vietnam." Washington, DC: World Bank. https://doi.org/https://doi.org/10.1596/0-8213-5543-0.
Global Panel on Agriculture and Food Systems for Nutrition. 2016. "Food Systems and Diets: Facing the Challenges of the 21st Century." London, UK: Global Panel on Agriculture and Food Systems for Nutrition.
Global Panel on Agriculture and Food Systems for Nutrition. 2017. "Improving Nutrition through Enhanced Food Environments. Policy Brief No. 7." London, UK: Global Panel on Agriculture and Food Systems for Nutrition.
Government of Vietnam. 2004. *Decision No. 559/QD-TTg of May 31, 2004 Approving the Program on Development till the Year 2010*. Vietnam.
Government of Vietnam. 2010. *Order No. 06/20101L-CTN of June 28, 2010 on the Promulgation of the Law on Food Safety No. 55/2010/QH12*. Vietnam.
Government of Vietnam. 2012a. *Decision No. 1895/QD-TTg of December 17, 2012 of the Prime Minister*

Approving the Agriculture Development Program of Hi-Tech Application of the National Program of Hi-Tech Development through 2020. Vietnam.

Government of Vietnam. 2012b. *Decision No. 226/QD-TTg of February 22, 2012 of the Prime Minister Approving the National Nutrition Strategy for the 2011-2020 Period, with a Vision toward 2030*. Vietnam.

Government of Vietnam. 2015. *Decision No. 376/QD-TTg of March 20, 2015 of the Prime Minister Approving the National Strategy on Prevention of Cancer, Cardiovascular, Diabetes, Chronic Obstructive Pulmonary Disease, Asthma and Other Non-Communicable Diseases for the Period Period From*. Vietnam.

Government of Vietnam. 2017a. *Report No. 211/BC-CP of May 18, 2017 by the Central Government of Vietnam on Reporting the Situation of Policy Implementation on Food Safety Management in the Period of 2011-2016 in Vietnam.* Vietnam.

Government of Vietnam. 2017b. *Resolution No. 19-2017/NQ-CP of February 6, 2017 on Continuing the Implementation of the Major Tasks and Solutions to Improve Business Environment, National Competitiveness in 2017, Orientations till the Year 2020*. Vietnam.

Gustavsson, Jenny., Christel Cederberd, Ulf Sonesson, Robert van Otterdijk, and Alexandre Meybeck. 2011. *Global Food Losses and Food Waste*. Food and Agriculture Organization (FAO); World Health Organization (WHO).

Ha Dinh Tuan, Nguyen Ngoc Hue, B.R. Sthapit, and D.I. Jarvis, eds. 2003. "On-Farm Management of Agricultural Biodiversity in Vietnam." In *Proceedings of a Symposium, 6-12 December, 2001*, 135. Hanoi, Vietnam: International Plant Genetic Resources Institute (IPGRI).

Ha T.P. Do, Johanna M. Geleijnse, Mai B. Le, Frans J. Kok, and Edith J.M. Feskens. 2015. "National Prevalence and Associated Risk Factors of Hypertension and Prehypertension among Vietnamese Adults." *American Journal of Hypertension* 28 (1): 89–97. https://doi.org/10.1093/ajh/hpu092.

Ha, Thanh Mai, Shamim Shakur, and Kim Hang Pham Do. 2019. "Consumer Concern about Food Safety in Hanoi,Vietnam." *Food Control* 98 (November): 238–44. https://doi.org/10.1016/j.foodcont.2018.11.031.

Haddad, Lawrence, Corinna Hawkes, Patrick Webb, Sandy Thomas, John Beddington, Jeff Waage, and Derek Flynn. 2016. "A New Global Research Agenda for Food." *Nature News* 540 (7631): 30–32. https://doi.org/10.1038/540030a.

Haggar, Jeremy, and Kathleen Schepp. 2012. "Coffee and Climate Change: Impacts and Options for Adaption in Brazil, Guatemala, Tanzania and Vietnam." *Natural Resource Institute Working Paper Series: Climate Change, Agriculture and Natural Resources No. 4*. Vol. 4. London, UK: Natural Resources Institute, University of Greenwich.

Hanoi People's Committee. 2006. *Decision No. 146/2006/QD-UB of August 25, 2006 of the Hanoi People's Commitee Promulgating the "Mechanism on Investment Promotion for the Construction of Trade Centers and Supermarkets in Hanoi City."* Vietnam.

Hansen, Arve. 2018. "Meat Consumption and Capitalist Development: The Meatification of Food Provision and Practice in Vietnam." *Geoforum* 93 (July): 57–68. https://doi.org/10.1016/j.geoforum.2018.05.008.

Hardy, Andrew, Mauro Cucarzi, and Patrizia Zolese. 2009. *Champa and the Archaeology of Mỹ Sơn (Vietnam)*. Singapore: NUS Press.

Hedberg, N., I. Stenson, M. Nitz Pettersson, D. Warshan, H. Nguyen-Kim, M. Tedengren, and N. Kautsky. 2018. "Antibiotic Use in Vietnamese Fish and Lobster Sea Cage Farms; Implications for Coral Reefs and Human Health." *Aquaculture* 495 (September 2017): 366–75. https://doi.org/10.1016/j.aquaculture.2018.06.005.

Helmisaari, Tommi. 2015. "Changing Food Choices in a Changing City: Vietnamese Youth in Contemporary Hanoi (MSc Thesis)." Uppsala University.

Henson, Spencer, and Julie Caswell. 1999. "Food Safety Regulation: An Overview of Contemporary Issues." *Food Policy* 24 (6): 589–603. https://doi.org/10.1016/S0306-9192(99)00072-X.

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, Italy.

Hoa K. Hoang. 2017. “Analysis of Food Demand in Vietnam and Short-Term Impacts of Market Shocks on Quantity and Calorie Consumption.” *Agricultural Economics* 49 (1): 1–13. https://doi.org/10.1111/agec.12397.

Hoa K. Hoang, and William Meyers. 2015. “Food Demand in Vietnam: Structural Changes and Projections to 2030.” In *International Association of Agricultural Economists Conference, August 9-14, 2015*. Milan, Italy.

Hoang Xuan Thanh, Dinh Thi Thu Phuong, Dang Thi Thanh Hoa, and Le Dinh Lap. 2015. “Urbanisation and Rural Development in Vietnam’s Mekong Delta. Revisiting Livelihood Transformations in Three Fruit-Growing Settlements, 2006-2015. IIED Working Paper.” London, UK.

Hoang Xuan Thanh, Truong Tuan Anh, Luu Trong Quang, Dinh Thi Giang, and Dinh Thi Thu Phuong. 2013. “Food Security in the Context of Vietnam’s Rural-Urban Linkages and Climate Change. IIED Country Report.” London, UK: International Institute for Environment and Development (IIED).

Hung Nguyen-Viet, Sinh Dang-Xuan, Phuc Pham-Duc, Kristina Roesel, Nguyen Mai Huong, Toan Luu-Quoc, Pham Van Hung, et al. 2019. “Rapid Integrated Assessment of Food Safety and Nutrition Related to Pork Consumption of Regular Consumers and Mothers with Young Children in Vietnam.” *Global Food Security* 20: 37–44. https://doi.org/10.1016/J.GFS.2018.12.003.

Hutt, David. 2017. “Will Vietnam Grow Old before It Gets Rich? A Closer Look at the Country’s Aging Population and What That Means.” The Diplomat. 2017.

Huynh, Like. 2018. “The Packaging and Printing Industry Is Growing Strongly.” Vietnambiz. 2018. https://vietnambiz.vn/nganh-dong-goi-va-in-an-dang-tang-truong-manh-20190301103851299.htm.

IFPRI. 2016. “Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030.” Washington, DC: International Food Policy Research Institute (IFPRI). https://doi.org/10.2499/9780896295841.

Iodine Global Network. 2017. “Global Scorecard of Iodine Nutrition in 2017 in the General Population and in Pregnant Women (PW).” Zurich, Switzerland. http://www.ign.org/cm_data/IGN_Global_Scorecard_AllPop_and_PW_May2017.pdf.

Jensen, Paul N., Tran Quoc Bao, Tran Thi Thanh Huong, Susan R. Heckbert, Annette L. Fitzpatrick, James P. LoGerfo, Truong Le Van Ngoc, and Ali H. Mokdad. 2018. “The Association of Estimated Salt Intake with Blood Pressure in a Viet Nam National Survey.” *PLoS ONE* 13 (1): 1–12. https://doi.org/10.1371/journal.pone.0191437.

JICA. 2013. “Agricultural Transformation & Food Security 2040: ASEAN Region with a Focus on Vietnam, Indonesia, and Philippines. Vietnam Country Report.” Japan International Cooperation Agency (JICA).

Kanepackage Vietnam. 2018. “Vietnam Packaging Industry and Development Opportunities.” Industry News. 2018. http://kanepa.com.vn/nganh-cong-nghiep-bao-bi-viet-nam-va-co-hoi-phat-trien.html.

Kawarazuka, Nozomi. 2016. “Building a Resilient City for Whom? Exploring the Gendered Processes of Adaptation to Change. A Case Study of Street Vendors in Hanoi.” *IIED Asian Cities Climate Resilience, Working Paper Series No.34*. London, UK: International Institute for Environment and Development (IIED).

Kelly, Mattew. 2016. “The Nutrition Transition in Developing Asia: Dietary Change, Drivers and Health Impacts.” In *Eating, Drinking: Surviving*, edited by P. Jackson, W. Spiess, and F. Sultana, 83–90. Cham, Switzerland: SpringerBriefs in Global Understanding, Springer. https://doi.org/10.1007/978-3-319-42468-2_9.

Khoi Dang, Chinh Kim, Nhung Nguyen, My Bui, Thinh Pham, Trang Le, Dao Nguyen, and Oanh Pham. 2015. “Vietnam’s ‘Green Agriculture’ Strategies and Policies: Closing the Gap between Aspirations and Application.” Hanoi, Vietnam: Center for Agricultural Policy (CAP).

Köhler, Realm, Sudathip Sae-tan, Christine Lambert, Hans Konrad Biesalski, Christine Lambert, and Hans Konrad Biesalski. 2018. “Plant-Based Food Taboos in Pregnancy and the Postpartum Period in Southeast Asia – a Systematic Review of Literature.” https://doi.org/10.1108/NFS-02-2018-0059.

Koning, J. I. J. C. De, M. R. M. Crul, R. Wever, and J. C. Brezet. 2015. “Sustainable Consumption in Vietnam: An Explorative Study among the Urban Middle Class.” *International Journal of Consumer Studies* 39 (6): 608–18. https://doi.org/10.1111/ijcs.12235.

Kyeyune, Victoria, and Sarah Turner. 2016. “Yielding to High Yields? Critiquing Food Security Definitions and Policy Implications for Ethnic Minority Livelihoods in Upland Vietnam.” *Geoforum* 71: 33–43. https://doi.org/10.1016/j.geoforum.2016.03.001.

Laborte, Alice G., Mary Anne Gutierrez, Jane Girly Balanza, Kazuki Saito, Sander J. Zwart, Mirco Boschetti, M. V.R. Murty, et al. 2017. “Data Descriptor: RiceAtlas, a Spatial Database of Global Rice Calendars and Production.” *Scientific Data* 4 (170074). https://doi.org/10.1038/sdata.2017.74.

Lachat, Carl, Le Nguyen Bao Khanh, Nguyen Cong Khan, Nguyen Quang Dung, Nguyen Do Van Anh, Dominique Roberfroid, and Patrick Kolsteren. 2009. “Eating out of Home in Vietnamese Adolescents: Socioeconomic Factors and Dietary Associations.” *American Journal of Clinical Nutrition* 90 (6): 1648–55. https://doi.org/10.3945/ajcn.2009.28371.

Lachat, Carl, Thi Thanh Tuyen Huynh, R. Verstraeten, E. Nago, D. Roberfroid, and P. Kolsteren. 2011. “Factors Associated with Eating out of Home in Vietnamese Adolescents.” *Appetite* 57 (3): 649–55. https://doi.org/10.1016/j.appet.2011.08.003.

Lançon, Frédéric, Denis Sautier, and Dao The Anh. 2014. “Vietnam: Rural Connectivity and Agriculture Logistics in Domestic Market Supply Chains.” Washington, DC: World Bank.

Lanier, Clinton. 2013. “Food Sentry Releases Preliminary Analysis on International Food Safety Violations.” 2013. https://www.prweb.com/releases/foodsafety/foodsentry/prweb10594602.htm.

Lapar, L., and Nguyen Ngoc Toan. 2010. “Demand for Pork by Vietnamese Consumers: Implications for pro-Poor Livestock Policy and Development Agenda in Vietnam. Improving the Competitiveness of Pig Producers in Vietnam. Project Brief.”

Lapping, Karin, Edward A. Frongillo, Phuong H. Nguyen, Jennifer Coates, Patrick Webb, and Purnima Menon. 2014. “Organizational Factors, Planning Capacity, and Integration Challenges Constrain Provincial Planning Processes for Nutrition in Decentralizing Vietnam.” *Food and Nutrition Bulletin* 35 (3): 382–91. https://doi.org/10.1177/156482651403500310.

Lee, Guenwoo, Aya Suzuki, and Hoang Nam Vu. 2019. “The Determinants of Detecting Veterinary Drug Residues: Evidence from Shrimp Farmers in Southern Viet Nam.” *Aquaculture Economics and Management* 23 (2): 135–57. https://doi.org/10.1080/13657305.2019.1568612.

Lemke, U., M. Mergenthaler, R. Rößler, Le Thi Than Huyen, P. Herold, B. Kaufmann, and A Valle Zárate. 2008. “Pig Production in Vietnam: A Review.” *CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources* 3 (023). https://doi.org/10.1079/PAVSNNR20083023.

LIFSAP. 2018. “Let Me Tell You about LIFSAP. Improvement of Competitiveness of Household-Based Livestock Producers - Results and Intervention Orientation from LIFSAP.” Hanoi, Vietnam: Word Bank, LIFSAP, Ministry of Agriculture and Rural Development (MARD).

Lim, J, MC Duong, HL Yang, and CC Tam. n.d. “Determinants Influencing Antibiotic Use in Singapore’s Small-Scale Aquaculture Sector.” *Palgrave Communications*, 1–15.

Linh Vu Hoang. 2009. “Analysis of Calorie and Micronutrient Consumption in Vietnam.” 2009/14. *Working Papers No. 2009/14*. Development and Policies Research Center Working Paper Series. Hanoi, Vietnam: Development and Policies Research Center (DEPOCEN).

Linh Vu Hoang, and Paul Glewwe. 2011. “Impacts of Rising Food Prices on Poverty and Welfare in Vietnam.” *Journal of Agricultural and Resource Economics* 36 (1): 14–27.

Lundberg, Pranee C., and Trieu Thi Ngoc Thu. 2011. “Vietnamese Women’s Cultural Beliefs and Practices Related to the Postpartum Period.” *Midwifery* 27 (5): 731–36. https://doi.org/https://doi.org/10.1016/j.midw.2010.02.006.

Luu Tien Dung, and Nguyen Thi Kim Hiep. 2017. “The Revolution of Agriculture 4.0 and Sustainable Agriculture Development in Vietnam.” In *International Conference Proceedings. Emerging Issues in Economics and Business in the Context of International Integration*, 317–28. Hanoi, Vietnam: National Economics University Press.

Malhotra-Kumar, Surbhi, Basil Britto Xavier, Anupam J. Das, Christine Lammens, Ha Thi Thu Hoang, Ngoc Thi Pham, and Herman Goossens. 2016. “Colistin-Resistant Escherichia Coli Harbouring Mcr-1 Isolated from Food Animals in Hanoi, Vietnam.” *The Lancet Infectious Diseases* 16 (3): 286–87. https://doi.org/10.1016/S1473-3099(16)00014-1.

Maruyama, Masayoshi, and Le Viet Trung. 2011. "Modern Retailers in Transition Economies: The Case of Vietnam." *Journal of Macromarketing* 32 (1): 31–51. https://doi.org/10.1177/0276146711421932.
MDG Achievement Fund. 2013. "Integrated Nutrition and Food Security Strategies for Children and Vulnerable Groups in Viet Nam. Final Narrative Report." MDG Achievement Fund.
Menon, Nidhiya, Yana Van der Meulen Rodgers, and Huong Nguyen. 2014. "Women's Land Rights and Children's Human Capital in Vietnam." *World Development* 54 (C): 18–31. https://doi.org/10.1016/j.worlddev.2013.07.005.
Menon, Nidhiya, Yana Van der Meulen Rodgers, and Alexis R. Kennedy. 2017. "Land Reform and Welfare in Vietnam: Why Gender of the Land Rights Holder Matters." *Journal of International Development* 29 (4): 454–72. https://doi.org/10.1002/jid.3203.
Mergenthaler, Marcus, Katinka Weinberger, and Matin Qaim. 2009a. "Consumer Valuation of Food Quality and Food Safety Attributes in Vietnam." *Review of Agricultural Economics* 31 (2): 266–83. https://doi.org/10.1111/j.1467-9353.2009.01437.x.
Mergenthaler, Marcus, Katinka Weinberger, and Matin Qaim. 2009b. "The Food System Transformation in Developing Countries: A Disaggregate Demand Analysis for Fruits and Vegetables in Vietnam." *Food Policy* 34 (5): 426–36. https://doi.org/10.1016/j.foodpol.2009.03.009.
Minh Do, Loan, Toan Khanh Tran, Bo Eriksson, Max Petzold, Chuc T K Nguyen, and Henry Ascher. 2015. "Preschool Overweight and Obesity in Urban and Rural Vietnam: Differences in Prevalence and Associated Factors." *Global Health Action* 8 (1): 1–10. https://doi.org/10.3402/gha.v8.28615.
Ministry of Agriculture and Rural Development. 2009. *Atlas of Vietnam Animal Husbandry*. Edited by Nguyen Thanh Vinh. Hanoi, Vietnam: Agriculture Publishing House.
Mishra, Deepak. 2011. "Vietnam Development Report 2012. Market Economy for a Middle-Income Vietnam." *Joint Donor Report to the Vietnam Consultative Group Meeting December 06, 2011*. Washington DC: World Bank. https://doi.org/10.4324/9780203183342.ch2.
Mishra, Vinod, and Ranjan Ray. 2009. "Dietary Diversity, Food Security and Undernourishment: The Vietnamese Evidence." *Asian Economic Journal* 23 (2): 225–47. https://doi.org/10.1111/j.1467-8381.2009.02010.x.
Molini, Vasco. 2006. "Food Security in Vietnam during the 1990s: The Empirical Evidence." *WIDER Research Paper, No. 2006/67*. Helsinki.
Moustier, Paule, and Nguyen Thi Tan Loc. 2015. "The Role of Proximity and Standards in Guaranteeing Vegetable Safety in Vietnam." *World Food Policy* 2 (1): 52–77. https://doi.org/10.18278/wfp.2.1.4.
N. T.D. Thuy, E. Melchinger-Wild, A. W. Kuss, N. V. Cuong, H. Bartenschlager, and H. Geldermann. 2006. "Comparison of Vietnamese and European Pig Breeds Using Microsatellites." *Journal of Animal Science* 84 (10): 2601–8. https://doi.org/10.2527/jas.2005-641.
Nair, Samiksha. 2015. "Shrimp Aquaculture in Ca Mau, Vietnam." In *Steps toward Green: Policy Responses to the Environmental Footprint of Commodity Agriculture in East and Southeast Asia*, edited by S. Scherr, K. Mankad, S. Jaffee, and C. Negra. Washington, DC: EcoAgriculture Partners and the World Bank. https://doi.org/10.1007/s10577-011-9252-1.
Naziri, Diego, Magali Aubert, Jean-Marie Codron, Nguyen Thi Tan Loc, and Paule Moustier. 2014. "Estimating the Impact of Small-Scale Farmer Collective Action on Food Safety: The Case of Vegetables in Vietnam." *Journal of Development Studies* 50 (5): 715–30. https://doi.org/10.1080/00220388.2013.874555.
Newman, Carol. 2015. "Gender Inequality and the Empowerment of Women in Rural Viet Nam." WIDER Working Paper 2015/066. Helsinki, Finland: UNU-WIDER.
Ngoc Dien, Le, Nguyen Minh Thang, and Margaret E Bentley. 2004. "Food Consumption Patterns in the Economic Transition in Vietnam." *Asia Pacific Journal of Clinical Nutrition* 13 (1): 40–47.
Nguyen-Viet, Hung, Suwit Chotinun, Esther Schelling, Winda Widyastuti, Nguyen Viet Khong, Manish Kakkar, Arlyne Beeche, et al. 2017. "Reduction of Antimicrobial Use and Resistance Needs Sectoral-Collaborations with a One Health Approach: Perspectives from Asia." *International Journal of Public Health* 62: 3–5. https://doi.org/10.1007/s00038-016-0933-6.
Nguyen-Viet, Hung, Tran Thi Tuyet-Hanh, Fred Unger, Sinh Dang-Xuan, and Delia Grace. 2017. "Food

Safety in Vietnam: Where We Are at and What We Can Learn from International Experiences." *Infectious Diseases of Poverty* 6 (1): 39. https://doi.org/10.1186/s40249-017-0249-7.
Nguyen Duc Thanh, Nguyen Thi Thu Hang, Ken Itakura, Nguyen Thi Linh Nga, and Nguyen Thanh Tung. 2015. "The Impacts of TPP and AEC on the Vietnamese Economy: Macroeconomic Aspects and the Livestock Sector." Hanoi, Vietnam: Vietnam Institute for Economic and Policy Research (VEPR).
Nguyen Hai Thi Hong, Steve Wood, and Neil Wrigley. 2013. "The Emerging Food Retail Structure of Vietnam: Phases of Expansion in a Post-Socialist Environment." *International Journal of Retail and Distribution Management* 41 (8): 596–626. https://doi.org/10.1108/IJRDM-07-2012-0069.
Nguyen, Hoa Xuan. 2019. "Exploring the Willingness of Traditional Traders to Sell Safe Vegetables in Hanoi , Vietnam." KU Leuven.
Nguyen Huu Dung, Tran Chi Thien, Nguyen Van Hong, Nguyen Thi Loc, Dang Van Minh, Trinh Dinh Thau, Huynh Thi Le Nguyen, Nguyen Tan Phong, and Thai Thanh Son. 1999. "Agro-Chemicals, Productivity and Health in Vietnam. Policy Brief. Economy and Environment Program for Southeast Asia."
Nguyen Minh Cong, and Paul Winters. 2011. "The Impact of Migration on Food Consumption Patterns: The Case of Vietnam." *Food Policy* 36 (1): 71–87.
Nguyen Minh Thang, and B M Popkin. 2004. "Patterns of Food Consumption in Vietnam: Effects on Socioeconomic Groups during an Era of Economic Growth." *European Journal of Clinical Nutrition* 58 (1): 145–53. https://doi.org/10.1038/sj.ejcn.1601761.
Nguyen, Phuong H, Hieu Nguyen, Ines Gonzalez-Casanova, Erika Copeland, Garrett Strizich, Alyssa Lowe, Hoa Pham, et al. 2014. "Micronutrient Intakes among Women of Reproductive Age in Vietnam." *PloS One* 9 (2): e89504. https://doi.org/10.1371/journal.pone.0089504.
Nguyen Tam Ninh, F. Roehrig, G. Grosjean, Tran Dai Nghia, and Vu Thi Mai. 2017. "Climate Smart Agriculture in Vietnam. CSA Country Profiles for Asia Series." Hanoi, Vietnam: International Center for Tropical Agriculture (CIAT) and The Food and Agriculture Organization (FAO).
Nguyen Thanh Tuan, Pham Duy Tuong, and B. M. Popkin. 2008. "Body Mass Index (BMI) Dynamics in Vietnam." *European Journal of Clinical Nutrition* 62 (1): 78–86. https://doi.org/10.1038/sj.ejcn.1602675.
Nguyen Thi Duong Nga, Ho Ngoc Ninh, Pham Van Hung, and M.L. Lapar. 2014. "Smallholder Pig Value Chain Development in Vietnam: Situation Analysis and Trends. ILRI Project Report." Nairobi, Kenya: International Livestock Research Institute (ILRI).
Nguyen, Tran Lam. 2019a. "Empowering Women and Youth in Sustainable Agribusiness." Hanoi, Vietnam: Rikolto.
Nguyen, Tran Lam. 2019b. "Supporting Inclusive and Sustainable Agricultural Value Chain Development Benefitting Smallholder Farmers in Vietnam: A Study on Vegetable Production and Marketing in Hanoi." Hanoi: Rikolto.
Nguyen Trung Hung. 2016. "Non-Farm Employment and Labor Market in Rural Vietnam: Trends and Determinants (PhD Thesis)." University of Köln.
Nguyen, Tuan T., and Minh V. Hoang. 2018. "Non-Communicable Diseases, Food and Nutrition in Vietnam from 1975 to 2015: The Burden and National Response." *Asia Pacific Journal of Clinical Nutrition* 27 (1): 19–28. https://doi.org/10.6133/apjcn.032017.13.
Nguyen, Tuan T., Phuong H. Nguyen, Nemat Hajeebhoy, Huan V. Nguyen, and Edward A. Frongillo. 2016. "Infant and Young Child Feeding Practices Differ by Ethnicity of Vietnamese Mothers." *BMC Pregnancy and Childbirth* 16 (1): 1–9. https://doi.org/10.1186/s12884-016-0995-8.
Nguyen Van Cong. 2017. "An Overview of Agricultural Pollution in Vietnam: The Aquaculture Sector." Washington, DC: World Bank.
Nguyen Van Huong, Tran Huu Cuong, Tran Thi Nang Thu, and P. Lebailly. 2018. "Efficiency of Different Integrated Agriculture Aquaculture Systems in the Red River Delta of Vietnam." *Sustainability* 10 (2). https://doi.org/10.3390/su10020493.
Nguyen Van Phuong, Tran Huu Cuong, and Marcus Mergenthaler. 2014. "Effects of Socio-Economic and Demographic Variables on Meat Consumption in Vietnam." *Asian Journal of Agriculture and Rural*

Development. Asian Economic and Social Society (AESS) 4 (1): 7–22.
Ngyuyen Thi Tinh, Maarten Warnaars, Ta Thi Bich Duyen, and Tran Thi Bich Ngoc. 2007. *Farming in the City: An Annotated Bibliography of Urban and Peri-Urban Agriculture in Vietnam with Emphasis on Hanoi*. Edited by Freda Wolf and Maarten Warnaars. Lima, Peru: International Potato Center (CIP).
Nhung Tran Thi Tuyet, and Yoshinori Hara. 2017. "Customer Experience in Traditional and Modern Retail Formats: A Case Study of Vietnam." In *Serviceology for Smart Service System*, edited by Yurico Sawatani, James Spohrer, Stephen Kwan, and Takeshi Takenaka, 119. Tokyo, Japan: Springer. https://doi.org/10.1007/978-4-431-56074-6.
Nielsen. 2013. "What Do Vietnamese Grocery Shoppers Want? 2013 and Beyond." Vietnam Grocery Report Series. 2013.
NWO. 2016. "Scaling-up Nutrition-Sensitive Agricultural Initiatives in Poor Mountainous Areas in Vietnam and Lao PDR. Research Project." 2016.
OECD. 2015. "Agricultural Policies in Viet Nam 2015." *OECD Food and Agricultural Reviews*. Paris, France: OECD Publishing. https://doi.org/10.1787/9789264235151-en.
Ogle, Britta M., Ho Thi Tuyet, Hoang Nghia Duyet, and Nguyen Nhut Xuan Dung. 2003. "Food, Feed or Medicine: The Multiple Functions of Edible Wild Plants in Vietnam." *Economic Botany* 57 (1): 103–17. https://doi.org/10.1663/0013-0001(2003)057[0103:FFOMTM]2.0.CO;2.
Pham, H.V., and T.A Dao. 2016. "An Toàn Thực Phẩm Nông Sản - Tiêu Chuẩn Sản Xuất Rau an Toàn." Hanoi.
Pham Thi Thu Huong, A. P. Everaarts, J. J. Neeteson, and P. C. Struik. 2013. "Vegetable Production in the Red River Delta of Vietnam. II. Profitability, Labour Requirement and Pesticide Use." *NJAS - Wageningen Journal of Life Sciences* 67: 37–46. https://doi.org/10.1016/j.njas.2013.09.003.
Pham, Tuong Vi. 2016. "Vietnam Food Sector Flourishes Despite Need for Capital Investment." HKTDC Research. 2016. http://economists-pick-research.hktdc.com/business-news/article/International-Market-News/Vietnam-Food-Sector-Flourishes-Despite-Need-for-Capital-Investment/imn/en/1/1X000000/1X0A617Q.htm.
Pham V. Hoi, Arthur P. J. Mol, Peter Oosterveer, Paul J. van den Brink, and Pham T. M. Huong. 2016. "Pesticide Use in Vietnamese Vegetable Production: A 10-Year Study." *International Journal of Agricultural Sustainability* 14 (3): 325–38. https://doi.org/10.1080/14735903.2015.1134395.
Pham Van Hoi, A. P. Mol, and P. J. Oosterveer. 2009. "Market Governance for Safe Food in Developing Countries: The Case of Low-Pesticide Vegetables in Vietnam." *Journal of Environmental Management* 91 (2): 380–88. https://doi.org/10.1016/j.jenvman.2009.09.008.
Pham Van Hung, T. Gordon MacAulay, and Sally P. Marsh. 2007. "The Economics of Land Fragmentation in the North of Vietnam." *Australian Journal of Agricultural and Resource Economics* 51 (2): 195–211. https://doi.org/10.1111/j.1467-8489.2007.00378.x.
Pingali, Prabhu. 2007. "Westernization of Asian Diets and the Transformation of Food Systems: Implications for Research and Policy." *Food Policy* 32 (3): 281–98. https://doi.org/10.1016/j.foodpol.2006.08.001.
Popkin, Barry M. 1998. "The Nutrition Transition and Its Health Implications in Lower-Income Countries." *Public Health Nutrition* 1 (1): 5–21. https://doi.org/10.1079/PHN19980004.
Popkin, Barry M. 2014. "Nutrition, Agriculture and the Global Food System in Low and Middle Income Countries." *Food Policy* 47: 91–96. https://doi.org/10.1016/j.foodpol.2014.05.001.
Pulliat, Gwenn. 2015. "Food Securitization and Urban Agriculture in Hanoi (Vietnam)." Articulo - Journal of Urban Research. 2015.
Quan Tran. 2018. "Vietnam - Grain and Feed Annual 2016." Global Agricultural Information Network report (GAIN). Report number:VM6024.
Quy-Toan Do, and Lakshmi Iyer. 2008. "Land Titling and Rural Transition in Vietnam." *Economic Development and Cultural Change* 56 (3): 531–79. https://doi.org/10.1086/533549.
Quynh T. H. Pham, Anthony Worsley, Mark Lawrence, and Bernie Marshall. 2016. "Awareness of Nutrition Problems among Vietnamese Health and Education Professionals." *Health Promotion International* 32 (5): 840–49. https://doi.org/10.1093/heapro/daw016.

Raneri, Jessica E., and Sigrid Wertheim-Heck. 2019. “Retail Diversity for Dietary Diversity: Resolving Food-Safety versus Nutrition Priorities in Hanoi.” *UNSCN Nutrition* 44: 61–69.

Raneri, Jessica E, Nga Le Thi, Ky Hoang The, Hoi Pham, and Gina Kennedy. 2017. “Improving Dietary Diversity and Diet Quality through System Innovations - A Pilot Study in Vietnam.” Rome.

Reardon, Thomas. 2006. “The Rapid Rise of Supermarkets and the Use of Private Standards in Their Food Product Procurement Systems in Developing Countries.” In *The Agro-Food Chains and Networks for Development*, edited by Ruerd Ruben, Maja Slingerland, and Hans Nijhoff, 1st ed., 79–105. Wageningen, Netherlands: Springer. https://doi.org/10.1007/1-4020-5006-2_8.

Reardon, Thomas, J. A. Berdegué, and C.P. Timmer. 2005. “Supermarketization of the ‘Emerging Markets’ of the Pacific Rim: Development and Trade Implications.” *Journal of Food Distribution Research* 36 (1): 3–12.

Reardon, Thomas, Ruben Echeverria, Julio Berdegué, Bart Minten, Saweda Liverpool-Tasie, David Tschirley, and David Zilberman. 2018. “Rapid Transformation of Food Systems in Developing Regions: Highlighting the Role of Agricultural Research & Innovations (in Press).” *Agricultural Systems*. https://doi.org/10.1016/j.agsy.2018.01.022.

Reardon, Thomas, and C. Peter Timmer. 2014. “Five Inter-Linked Transformations in the Asian Agrifood Economy: Food Security Implications.” *Global Food Security* 3 (2): 108–17. https://doi.org/10.1016/j.gfs.2014.02.001.

Reardon, Thomas, David Tschirley, Michael Dolislager, Jason Snyder, Chaoran Hu, and Stephanie White. 2014. “Urbanization, Diet Change, and Transformation of Food Supply Chains in Asia.” Global Center for Food Systems Innovation, Michigan State University.

Rikolto, and Vietnam National University of Agriculture. 2018. “Building Trust in Safe and Organic Vegetable Chains.” Hanoi.

Rocklöv, Joacim, Kim Bao Giang, Hoang Van Minh, Kristie Ebi, Maria Nilsson, Klas-Göran Sahlen, and Lars Weinehall. 2014. “Special Issue: Climate Change and Health in Vietnam.” *Global Health Action* 7 (9). https://doi.org/10.3402/gha.v7.26572.

Rubin, Julia. 2018. “Pesticide Use of Vegetables Farmers in the Red River Delta, Vietnam: Health, Exposures, and the Case for Continued Research.” University of California, Berkeley. https://doi.org/10.13140/RG.2.2.30665.03689.

Schram, Ashley, Ronald Labonte, Phillip Baker, Sharon Friel, Aaron Reeves, and David Stuckler. 2015. “The Role of Trade and Investment Liberalization in the Sugar-Sweetened Carbonated Beverages Market: A Natural Experiment Contrasting Vietnam and the Philippines.” *Globalization and Health* 11 (1): 41. https://doi.org/10.1186/s12992-015-0127-7.

Shairp, Rachel, Diogo Veríssimo, Iain Fraser, Daniel Challender, and Douglas MacMillan. 2016. “Understanding Urban Demand for Wild Meat in Vietnam: Implications for Conservation Actions.” *PLoS ONE* 11 (1). https://doi.org/10.1371/journal.pone.0134787.

Siemonsa, J. S., and Kasem Piluek, eds. 1993. *Plant Resources of South-East Asia. No. 8 Vegetables*. Wageningen, Netherlands: Pudoc Scientific Publishers.

Sivapragasam A, HV Chien, SL Khing, and LM Duong. 2017. “Pest Smart Interventions and Their Influence on Farmer Pest Management Practices in Tra Hat Village, Bac Lieu Province, Vietnam.” https://cgspace.cgiar.org/handle/10568/83373.

T.P. Ha, Do, Edith J.M. Fesckens, Paul Deurenberg, Le B. Mai, Nguyen C. Khan, and Frans J. Kok. 2011. “Nationwide Shifts in the Double Burden of Overweight and Underweight in Vietnamese Adults in 2000 and 2005: Two National Nutrition Surveys.” *BMC Public Health* 11 (62). https://doi.org/10.1186/1471-2458-11-62.

Tarp, Finn, ed. 2017. *Growth, Structural Transformation, and Rural Change in Viet Nam: A Rising Dragon on the Move, UNU-WIDER Studies in Development Economics*. Oxford, UK: Oxford University Press. https://doi.org/http://dx.doi.org/10.1093/acprof:oso/9780198796961.001.0001.

Thanh Tung. 2018. “Agriculture Leaders Call for ASEAN Food System to Embrace Industry 4.0.” Vietnam Investment Review. 2018.

The GARP- Vietnam National Working Group, and Van Kinh Nguyen. 2010. “Situation Analysis: Antibiotic Use and Resistance in Vietnam.” Hanoi, Vietnam.

The University of Adelaide. 2017. “Vietnam Urban Food Consumption and Expenditure Study.” 2017.
The Voice of Vietnam. 2017. “APEC Encourages Agricultural Start-Ups, Innovation.” 2017.
Thuan Huu Vo, Nguyen Nhu Tran Minh, Vinh Le, Ninh Hoang Le, Huy Quang Nguyen, Tuan Van Le, and J. Pekka Nuorti. 2017. “Epidemiologic Characteristics of Foodborne Outbreaks in Southern.” *Journal of Microbiology and Infectious Diseases* 7 (1): 13–20. https://doi.org/10.5799/ahinjs.02.2017.01.0247.
Timsuksai, Pijika, and A. Terry Rambo. 2016. “The Influence of Culture on Agroecosystem Structure: A Comparison of the Spatial Patterns of Homegardens of Different Ethnic Groups in Thailand and Vietnam.” *PLoS ONE* 11 (1). https://doi.org/10.1371/journal.pone.0146118.
Tran Cong Thang, Do Lien Huong, and Le Nguyet Minh. 2013. “Who Has Benefited from High Rice Prices in Vietnam.” Hanoi, Vietnam: Oxfam International.
Tran Cong Thang, and Nguyen Le Hoa. 2016. “National Policy to Improve Food Self-Sufficiency and Food Security in Vietnam.” FFTC Agricultural Policy Articles. 2016.
Tran Thi Tuyet-Hanh, Dang Xuan Sinh, Pham Duc Phuc, Tran Thi Ngan, Chu Van Tuat, Delia Grace, Fred Unger, and Hung Nguyen-Viet. 2017. “Exposure Assessment of Chemical Hazards in Pork Meat, Liver, and Kidney, and Health Impact Implication in Hung Yen and Nghe An Provinces, Vietnam.” *International Journal of Public Health* 62 (1): 75–82. https://doi.org/10.1007/s00038-016-0912-y.
Tran Thi Tuyet-Hanh, and Hung Nguyen-Viet. 2013. “Environmental Health Risk Communication: Concept, Principles, and Challenges.” *Vietnamese Journal of Preventive Medicine* 23 (4): 77–82.
Tschirley, David. 2017. “Urbanization, Food Systems, and the Diet Transformation in Developing Countries: What Do We Know and What Do We Need to Know? Keynote Address for ‘Hungry Cities: The Global Revolution in Food Systems’, La Jolla, CA, 23 January, 2017.” ILSI Research Foundation. 2017.
Tu Hoang. 2015. “WBVietnam Urbanization among Fastest in Region.” The Saigon Times. 2015.
Tu, Janet. 2001. “Nutrition and Fasting in Vietnamese Culture.” Ethnomed. 2001.
Tung Xuan Dinh. 2017. “An Overview of Agricultural Pollution in Vietnam: The Livestock Sector.” Washington, DC: World Bank.
Turner, Sarah, and Laura Schoenberger. 2012. “Street Vendor Livelihoods and Everyday Politics in Hanoi, Vietnam: The Seeds of a Diverse Economy?” *Urban Studies* 49 (5): 1027–44. https://doi.org/10.1177/0042098011408934.
Udo, H. M J, H. A. Aklilu, L. T. Phong, R. H. Bosma, I. G. S. Budisatria, B. R. Patil, T. Samdup, and B. O. Bebe. 2011. “Impact of Intensification of Different Types of Livestock Production in Smallholder Crop-Livestock Systems.” *Livestock Science* 139 (1–2): 22–29. https://doi.org/10.1016/j.livsci.2011.03.020.
UN Women, and FAO. 2014. “Policy Brief and Recommendations on Rural Women in Viet Nam. Prepared for World Food Day in 2014 ‘Family Farming: Feeding the World, Caring for the Earth’ and International Day of Rural Women, 15 October, 2014.” Hanoi, Vietnam: UN Women and FAO Viet Nam.
UNDP. 2016. “Gender, Climate Change and Food Security. Policy Brief.” New York, USA: United Nations Development Programme (UNDP).
UNICEF-WHO-World Bank Group. 2019. “Prevalence of Stunting, Height for Age (% of Children under 5).” Joint Child Malnutrition Estimates. 2019. https://data.worldbank.org/indicator/SH.STA.STNT.ZS.
United Nations. 2015. “Transforming Our World: The 2030 Agenda for Sustainable Development.” New York. https://sustainabledevelopment.un.org/post2015/transformingourworld/publication.
United Nations. 2018. “World Urbanization Prospects 2018: The 2018 Revision.” United Nations, Department of Economic and Social Affairs, Population Division. 2018.
USAID. 2015. “National Opinion Survey 2015.” Hanoi, Vietnam: United States Agency for International Development (USAID).
Viet Nam Net. 2015. “Increased Pesticide, Fertiliser Use Contaminating Farmland.” 2015.
Viet Nam News. 2016. “Breeders Commit to Not Use Banned Substances.” 2016.

Viet Nam News. 2017. “BIVD Offers VNĐ10 Trillion Loan for High-Tech Agriculture.” 2017.
Vietnam Advisors. 2019. “Eight Funds Investing In Vietnamese Startups.” 2019.
Vietnam Ministry of Agriculture and Rural Development. 2008. *Decision No. 99/2008/QD-BNN of October 15, 2008 Promulgating the Regulation on Management of Vegetable Production and Trading, Fruit and Safety Only*. Vietnam.
Vietnam Ministry of Agriculture and Rural Development. 2017. “Statistics on Annual Crops in Vietnam. Annual Report of the Department of Crop Production.” Hanoi, Vietnam.
Vietnam Ministry of Health. 2010. “Fact Sheet: Vietnam STEPwise Approach to Surveillance (STEPS) 2009 - 2010.” Hanoi, Vietnam.
Vietnam Ministry of Health. 2016. “Vietnam STEPwise Approach to Surveillance (STEPS) 2015.” Hanoi, Vietnam.
Vietnam Ministry of Health, and General Department of Preventive Medicine. 2016. “National Survey on the Risk Factors of Non-Communicable Diseases (STEPS): Viet Nam 2015.” Hanoi, Vietnam: Vietnam Ministry of Health, General Department of Preventive Medicine.
Vietnam Ministry of Health, Ministry of Agriculture and Rural Development, and Ministry of Industry and Trade. 2014. *Joint Circular No. 34/2014/TTLT-BYT-BNNPTNT-BCT of October 27, 2014 on Guiding the Goods Label for Some Foods, Food Additives and Aids for Processing Packaged Foods*. Vietnam.
Vietnam Ministry of Industry and Trade. 2017. “Vietnam Logistics Report 2017.” Hanoi, Vietnam.
Vietnam Ministry of Natural Resources and Environment. 2015. “Vietnam National Biodiversity Strategy to 2020, Vision to 2030.”
Vietnam National Institute of Nutrition. 2003. “General Nutrition Survey 1999-2000.” Hanoi, Vietnam.
Vietnam National Institute of Nutrition. 2007. “Overweight-Obesity and Related Factors in Vietnamese Adults Aged 25-64 Years Old.” Hanoi, Vietnam.
Vietnam National Institute of Nutrition. 2013. “Nutrition Information 2013 (Vietnamese).” 2013.
Vietnam National Institute of Nutrition. 2015. “National Micronutrient Survey.” (n.p.).
Vietnam National Institute of Nutrition and Ministry of Health. 2015. “Recommended Dietary Allowances (RDAs) for Vietnamese People (Vietnamese).”
Vietnam National Institute of Nutrition and UNICEF. 2011. “A Review of the Nutrition Situation in Vietnam 2009-2010.” Hanoi, Vietnam.
Vietnam National Institute of Nutrition, Ministry of Health, and UNICEF. 2010. “General Nutrition Survey 2009-2010.” Hanoi, Vietnam: Medical Publishing House.
Vietnam National Institute of Nutrition, UNICEF, and Alive & Thrive. 2014. “Nutrition Surveillance Profiles 2013.” Hanoi, Vietnam.
Vietnam National University of Agriculture, and Rikolto. 2018. “Gender and Generation in Safe Vegetable Value Chains in Northern Vietnam.” Hanoi.
Vietnam Net. 2016. “Vietnamese Enterprises Dominating Processed Food Market.” 2016.
Vo, Kiet, and Gerald Smith. 2017. “Vietnam Retail Foods. Sector Report 2016.” Hanoi, Vietnam: GAIN (Global Agricultural Information Network). Report number: VM6081.
Vu Chi Cuong. 2014. “Research on the Application of Scientific and Technological Solutions in Industrial Pig Breeding to Reduce Environmental Pollution. Summary Report of the National-Level Research Project.” National Institute of Animal Husbandry, Ministry of Agriculture and Rural Development.
Vu Dang Toan. 2015. “Socialist Republic of Vietnam: The State of Vietnam’s Biodiversity for Food and Agriculture.” 2015.
Wertheim-Heck, Sigrid, Anh Ha Thi Lan, My Ha Thi Tra, Marion Klaver, and Huong Pham Thi Thanh. 2014. “Reaching Lower Income Groups with Safe and Healthy Foods - Mission Possible? An Insight into the Consumption of Lower Income Consumers in Urban Hanoi.” Fresh Studio.
Wertheim-Heck, Sigrid C O, and Jessica E Raneri. 2019. “A Cross-Disciplinary Mixed-Method Approach to Understand How Food Retail Environment Transformations Influence Food Choice and Intake among the Urban Poor: Evidence from Vietnam.” *Appetite* 142 (July): 104370. https://doi.org/10.1016/j.appet.2019.104370.

Wertheim-Heck, Sigrid C O, Sietze Vellema, and Gert Spaargaren. 2014. “Constrained Consumer Practices and Food Safety Concerns in Hanoi” 38 (February): 326–36. https://doi.org/10.1111/ijcs.12093.
Wertheim-Heck, Sigrid, Jessica Evelyn Raneri, and Peter Oosterveer. 2019. “Food Safety and Nutrition for Low-Income Urbanites: Exploring a Social Justice Dilemma in Consumption Policy.” *Environment and Urbanization*, no. 4. https://doi.org/10.1177/0956247819858019.
Wertheim-Heck, Sigrid, and Gert Spaargaren. 2015. “Shifting Configurations of Shopping Practices and Food Safety Dynamics in Hanoi, Vietnam: A Historical Analysis.” *Agriculture and Human Values* 33 (3): 655–71. https://doi.org/10.1007/s10460-015-9645-4.
Wertheim-Heck, Sigrid, Sietze Vellema, and Gert Spaargaren. 2015. “Food Safety and Urban Food Markets in Vietnam: The Need for Flexible and Customized Retail Modernization Policies.” *Food Policy* 54: 95–106. https://doi.org/10.1016/j.foodpol.2015.05.002.
Wheeler, Tim, and Joachim von Braun. 2013. “Climate Change Impacts on Global Food Security.” *Science* 341 (6145): 508–13. https://doi.org/10.1126/science.1239402.
WHO. 2003. “Diet, Nutrition and the Prevention of Chronic Diseases: Report of a Joint WHO/FAO Expert Consultation.” *WHO Technical Report Series No. 916*. Geneva, Switzerland: World Health Organization (WHO).
WHO. 2016. “Global Nutrition Monitoring Framework Country Profile: Viet Nam.” Nutrition Landscape Information System: GNMF Profile. World Health Organization (WHO). 2016.
WHO. 2018. “Noncommunicable Diseases Country Profiles.” Geneva, Switzerland: World Health Organization (WHO).
Wijk, M. S. van, C. Trahuu, N. A. Tru, B. T. Gia, and P. V. Hoi. 2006. “The Traditional Vegetable Retail Marketing System of Hanoi and the Possible Impacts of Supermarkets.” In *Acta Horticulturae 699 - International Symposium on Improving the Performance of Supply Chains in the Transitional Economies*, edited by P.J. Batt, 465–76. Chiang Mai, Thailand. https://doi.org/10.17660/ActaHortic.2006.699.55.
World Bank. 2006. “Vietnam: Food Safety and Agricultural Health Action Plan.” Washington, DC: World Bank.
World Bank. 2011. “Vietnam: Country Gender Assessment.” Washington, DC: World Bank.
World Bank. 2016. “Transforming Vietnamese Agriculture: Gaining More from Less. Vietnam Development Report.” Washington, DC: World Bank.
World Bank. 2017. “Food Safety Risk Management in Vietnam: Challenges and Opportunities. Technical Working Paper.” Technical Working Paper. Washington, DC: World Bank, Vietnam.
World Bank. 2019. “World Development Indicators.” Databank. 2019. https://data.worldbank.org/indicator/TM.VAL.FOOD.ZS.UN?end=2017&locations=VN&name_desc=true&start=1999&view=chart.
World Instant Noodles Association. 2018. “Global Demand for Instant Noodles.” May. 2018.
Wu, Guohong Albert, Javier Terol, Victoria Ibanez, Antonio López-García, Estela Pérez-Román, Carles Borredá, Concha Domingo, et al. 2018. “Genomics of the Origin and Evolution of Citrus.” *Nature* 554: 311–16.

6. ANNEXES

Annex 1 - Vietnamese Legislations on Food Labeling

Decree No 89/2006/ND-CP of the Government stipulates the content, how to label and states management of labels of goods circulated in Vietnam, exported and imported goods. The foods' labeling must contain the mandatory contents as follows:

- The name of the food
- The name and address of organizations and individuals responsible for foods
- Origin of foods
- Quantities
- Net weight
- Date of manufacture
- Expiration date, Best before date
- List of ingredients or ingredient quantities
- Hygiene and safety information, warnings
- Instructions on use and storage.

Decree No. 100/2014/ND-CP stipulates the trade and use of nutrition products for infants, bottles and artificial sucking, including:

- the exact age of children using the product;
- The nutrition information of products;
- Not using language, images that the products having quality equal to or better than the breastmilk.

The Food Safety Law 2010 stipulates:

- Organizations and individuals producing and importing food, food additives and processing aids in Vietnam shall have to implement the foods labeling in complying with the laws on labeling of goods.
- For the date of minimum durability of food to be represented on the labels, depending on category of products, shall be recorded with phrase "hạn sử dụng" [expiration date], "sử dụng đến ngày" [using until date] or "sử dụng tốt nhất trước ngày" [best before ….].
- For functional food, food additives, irradiated food, genetically modified food shall comply the following provisions: + For functional food, the phrase “functional food” must be recorded and it is not permitted to express in any forms that its effect replaces medicine.
- For food additives, the phrase “food additives” and other information on scope of use, doses and use methods must be recorded.
- For irradiated food, the phrase “irradiated food” must be recorded; + For genetically-modified food, the phrase “genetically modified food” must be recorded.
- For food with variety of components having the presence of genetically-modified component, it should indicate this GM component.
- For food with added nutrients such as vitamins, mineral salts, substances having bioactive must compare to the Recommended Nutrient Intakes for each certain group.

Decree No.38/2012/ND-CP stipulating detailed regulations for implementing the Food Safety Law provides some provisions on the food labeling.

Circular No. 43/2014/TT-BYT stipulate on management of functional foods

Joint Circular No. 34/2014/TTLT-BYTBNNPTNT-BCT Guidelines for the labeling of prepackaged foods, food additives and food processing aids.

Annex 2 – List of Stakeholders Invited to the Consultation Workshop

Thematic Key Research Questions Assigned	No.	Full Name	Organization
Food Supply Chains	1	Dao The Anh	Vice-President of Vietnam Academy of Agricultural Sciences (VAAS)
	2	Dang Duc Chien	MALICA (Markets and Agricultures Linkages for Cities in Asia)
	3	Trinh Van Tuan	Centre for Agrarian Systems Research and Development (CASRAD)
	4	Nguyen Thi Tan Loc	MARD Fruit and Vegetable Research Institute
	5	Pham Van Hoi	Vietnam National University of Agriculture
	6	Bui Thi Nga	Vietnam National University of Agriculture
	7	Marion Bordier	CIRAD
	8	Nguyen Thi Sau	FAVRI
	9	Pham Thi Hanh Tho	Centre for Agrarian Systems Research and Development (CASRAD)
	10	Mai Van Trinh	Institution for Agriculture Environmental (IAE)
	11	Dietmar Stoian	Bioversity International
	12	Stef de Haan	CIAT
	13	Brice Even	CIAT
Food Environment	14	Nguyen Thi Thanh An	Australian Centre for International Agricultural Research (ACIAR)
	15	Tran Nam Anh	Australian Centre for International Agricultural Research (ACIAR)
	16	Thai Thi Minh	RIKOLTO in Vietnam
	17	Nguyen Tran Lam	RIKOLTO in Vietnam
	18	René van Rensen	Fresh Studio
	19	Ha Lan Anh	Fresh Studio
	20	Arnoud Vandeberg	Friesland Campilan in Vietnam
	21	Mai Van Trinh	Institution for Agriculture Environmental
	22	Nguyen Minh Cam	Emory University
Consumer Behavior	23	Tran Van Hoc	Vietnam Standards and Consumers Association
	24	Ms. Thao	Nielsen in Vietnam
	25	Giulia Rota Nodari	Bioversity International
	26	Sigrid Wertheim-Heck	Food Synetics
	27	Nguyen Phuong	IFPRI
	28	Ricardo Heinandex	CIAT
Diets, Food Safety, Nutrition and Health	29	Truong Tuyet Mai	National Institute of Nutrition (NIN)
	30	Do Thi Phuong Ha	National Institute of Nutrition (NIN)
	31	Bui Thi Mai Huong	National Institute of Nutrition (NIN)
	32	Nguyen Duy Son	National Institute of Nutrition (NIN)

Thematic Key Research Questions Assigned	No.	Full Name	Organization
Diets, Food Safety, Nutrition and Health (cont.)	33	Le Thi Huong	Hanoi Medical University
	34	Nguyen Thanh Tuan	FHI 360
	35	Le Thi Nga	Health Bridge
	36	Tran Thi Lan Huong	Vietnam National University of Agriculture (VNUA)
	37	Nguyen Minh Nhat	Food and Agriculture Organization of the United Nations (FAO)
	38	Pham Duc Phuc	HUPH Center for Public Health and Ecosystem Research (CENPHER), Hanoi University of Public Health (HUPH)
	39	Ngo Thi Kim Cuc	National Institute of Animal Sciences (NIAS)
	40	Nguyen Thanh Tung	International Fund for Agricultural Development (IFAD)
	41	Nguyen Anh Vu	World Vision
	42	Jessica E. Raneri	Bioversity International
	43	Gina Kennedy	Bioversity International
	44	Elise Talsma	Wageningen University & Research
	45	Inge Brouwer	Wageningen University & Research
Drivers	46	Vo Thanh Son	Word Bank (Vietnam office)
	47	Tran Cong Thang	Institute of Policy and Strategy for Agriculture and Rural Development (IPSARD
	48	Phung Duc Tung	Mekong Development Research Institute
	49	Nguyen Van Thuan	Embassy of Australia
	50	Chris Bene	CIAT
	51	Jody Harris	The Institute of Development Studies
	52	Nguyen Tri Kien	CIAT
	53	Doan Thi Hong Hanh	General Statistic Officer
	54	Nguyen Viet Hung	ILRI
	55	Nguyen Mai Trang	Wageningen University & Research
	56	Huynh Thi Thanh Tuyen	CIAT
	57	Duong Thi Thanh	CIAT

Annex 3 - Full List of Research Questions Organized by Rank (per number of votes received) Across All Food System Domains.

Priority	Research Question	Domain	Priority (By Vote)
1	What are the trade-offs and associations between agricultural production, health, environment (including agrobiodiversity and ecosystem services) and economic outcomes?	Synergies & trade-offs	1
2	How to work with the private sector to promote healthy diets? What policies are necessary to regulate the private sector to promote better health and nutrition?	Food environment	2
3	What is the potential of smallholder-oriented innovations in the food distribution systems?	Food supply	3 (tie)
4	How can we improve the management system/governance of food supply in Vietnam?	Food supply	3
5	Can healthier food choices lead to healthier food supply systems?	Food supply	3
6	What are the trade-offs between food safety, food waste, nutrition and environment?	Synergies & trade-offs	3
7	What is the role of street food in Vietnamese diets and its nutritional outcomes?	Nutrition and consumer behavior	7 (tie)
8	What should Vietnam do to promote healthy and diverse diets within the context of trade (liberalization, imports, foreign investments)?	Synergies & trade-offs	7
9	How are the interactions/dynamics between family, school and communities ensuring healthy diets for children?	Food environment	8 (tie)
10	What are the costs and benefits for smallholders associated with the rise of different distribution and retail outlets?	Food supply	8
11	What are some options to make modernization of the supply system more inclusive?	Food supply	8
12	How do food policies interact with the determinants of obesity and NCDs?	Food environment	9 (tie)
13	What are the weak points along the supply chain regarding food loss management?	Food supply	9
14	What interventions targeted at smallholders can improve the food supply system in Vietnam?	Food supply	9
15	Who are the winners and losers regarding environment, economic, health and nutrition outcomes of food-related opportunities brought about by urbanization?	Synergies & trade-offs	9
16	To what extent, and how, are food system-related matters considered in urban planning?	Drivers	16 (tie)
17	How does the governance system (and its new laws, policies, etc.) affect the food system?	Drivers	16
18	How does trust (e.g. food safety, traceability, etc.) affect consumption behavior?	Nutrition and consumer behavior	16
19	What are the synergies and opportunities between the drivers of food system change?	Synergies & trade-offs	16
20	How has climate change influenced the nutrition transition in Vietnam?	Drivers	20 (tie)
21	How to harness the role of traditional beliefs and practices to improve diets, e.g. of ethnic minority community communities?	Drivers	20
22	How do new consumption trends and norms (e.g. vegetarianism, clean eating, etc.) affect the food system?	Drivers	20
23	What are the effects of marketing campaign strategies from the private sector on diets and health?	Food environment	20
24	What are storage knowledge gaps of farmers and traders?	Food supply	20

25	What are the major nutrition-sensitive agriculture promotion strategies for improving healthy diets, among general population, particularly 'vulnerable' groups including migrants and minority ethnic communities?	Nutrition and consumer behavior	20
26	What are child and adolescent initiated interventions that promote healthier diets at household, school and media levels?	Nutrition and consumer behavior	20
27	How can food labeling initiatives have positive effects on the food system? Specifically, how can they improve consumer knowledge and empower consumers to make healthier food choices while also creating demand for healthier and safer food options from food companies?	Nutrition and consumer behavior	20
28	How can emphasizing increasing consumer demand first help shape or change production patterns to be more sustainable? What are the demand and supply incentives that are needed?	Synergies & trade-offs	20
29	Have dietary consumption patterns followed agricultural production patterns or vice versa? How could the demand and supply relationship between production and consumption be better understood to shape healthier food systems, through shaping both agriculture and nutrition policies?	Synergies & trade-offs	20
30	What is the evidence of health benefits/harm of modernized diets compared to traditional ones?	Nutrition and consumer behavior	30 (tie)
31	What role does the media play in the food system?	Drivers	30
32	How do the alternative retail channels operate? What are the current policies regulating each? What are the gaps in policy/risks associated with each type of alternative retail market?	Food environment	30
33	How are the food production challenges and how are they influencing diet quality?	Food supply	30
34	What roles can the Vietnamese youth and women (including those from vulnerable groups) play in the food systems (e.g. from a consumption and/or production perspective)?	Drivers	34 (tie)
35	What are the characteristics of food safety interventions and policy in Southeast Asia and LMICs?	Food environment	34
36	How is the increasing market share of the private sector influencing children's health and diets?	Food environment	34
37	What are the barriers to consolidation of production systems and what can be done to address the risks associated with consolidation?	Food supply	34
38	How does climate change affect the food supply in Vietnam?	Food supply	34
39	How are more efficient value chains, which are serving the demand of urban consumers, affecting traditional seasonal variations in diets? Does this have an effect on diet quality and cultural aspects of diets?	Synergies & trade-offs	34
40	How are climate change considerations integrated in food and nutrition policy formulation and implementation?	Drivers	40 (tie)
41	What are effective diet interventions for elderly people in Vietnam?	Nutrition and consumer behavior	40
42	What are consumers' conceptions and perceptions on food labelling and the food industry's initiative on food labeling?	Nutrition and consumer behavior	40
43	Can nutrition-sensitive agriculture interventions be effective at reducing sugar intake and the prevalence of NCDs?	Nutrition and consumer behavior	40
44	What are the trade-offs between production, purchase cost and nutrition?	Synergies & trade-offs	40
45	How do climate-related shocks affect household food consumption?	Drivers	45 (tie)
46	How can the private sector and civil society influence the food system?	Drivers	45
47	What can be done to facilitate marginalized migrants' and minority ethnic groups access to healthy foods for better nutrition?	Nutrition and consumer behavior	45

48	What are drivers of trust in food consumption behavior of consumers?	Nutrition and consumer behavior	45
49	What are the existing and new opportunities for linkages between international actors (e.g. Transnational Corporations, certification agencies) and local stakeholders to improve diets?	Synergies & trade-offs	45
50	What are the impacts of non-tariff technical barriers/standards/certifications on the local food market for local production and consumption? What policies regulate this?	Synergies & trade-offs	45
51	How do climate coping strategies affect the food system?	Drivers	51 (tie)
52	What are the potential and impacts of some climate-smart interventions in the food system towards healthier diets?	Drivers	51
53	How do new trade agreements and FDI influence the food system?	Drivers	51
54	How is international migration driving the food systems in Vietnam?	Drivers	51

Annex 4 - Full List of Research Questions, ranked (per number of votes received) Per Food System Domain

Domain	Research Question	Priority (By Vote)
Drivers	To what extent and how are food system-related matters considered in urban planning?	1 (tie)
	How does the governance system (and its new laws, policies, etc.) affect the food system?	1
	How has climate change influenced the nutrition transition in Vietnam?	3 (tie)
	How to harness the role of traditional beliefs and practices to improve diets (e.g. of minority ethnic communities)?	3
	How do new consumption trends and norms (e.g. vegetarianism, clean eating, etc.) affect the food system?	3
	What role does the media play in the food systems?	6
	What roles can the Vietnamese youth and women (including those from vulnerable groups) play in the food system (e.g. from a consumption and/or production perspective)?	7
	How are climate change considerations integrated in food and nutrition policy formulation and implementation?	8
	How do climate-related shocks affect household food consumption?	9 (tie)
	How can the private sector and civil society influence the food system?	9
	How do climate coping strategies affect the food system?	11 (tie)
	What are the potential and impacts of some climate-smart interventions in the food system towards healthier diets?	11
	How do new trade agreements and FDI influence the food system?	11
	How is international migration driving the food system in Vietnam?	11
Food environment	How to work with the private sector to promote healthy diets? What policies are necessary to regulate the private sector to promote health?	1
	How are the interactions/dynamics between family, school and communities ensuring healthy diets for children?	2
	How do food policies interact with the determinants of obesity and NCDs?	3
	What are the effects of marketing campaign strategies from the private sector on diets and health?	4
	How do the alternative retail channels operate? What are the current policies regulating each? What are the gaps in policy/risks associated with each type of alternative retail market?	5
	What are the characteristics of food safety interventions/policy in Southeast Asia and LMICs?	6 (tie)
	How is the increasing market share of the private sector influencing children's health and diets?	6
Food supply	What is the potential of smallholder-oriented innovations in the food distribution system?	1 (tie)
	How can we improve the management system/governance of food supply in Vietnam?	1
	Can healthier food choices lead to healthier food supply?	1
	What are the costs and benefits for smallholders associated with the rise of different distribution and retail outlets?	4 (tie)
	What are some options to make modernization of the supply system more inclusive?	4
	What are the weak points along the supply chain regarding food loss management?	6 (tie)
	What interventions targeted at smallholders improve the food supply in Vietnam	6
	What are storage knowledge gaps of farmers and traders?	8
	What are the barriers to consolidation of production systems and what can be done to address the risks associated with consolidation?	9 (tie)
	How does climate change affect the food supply in Vietnam?	9

Nutrition and consumer behavior	What is the role of street food in Vietnamese diets and its nutritional outcomes?	1
	How does trust (e.g. food safety, traceability, etc.) affect consumption behavior?	2
	What are the major nutrition-sensitive agriculture promotion strategies for improving healthy diets, among the general population, particularly 'vulnerable' groups including migrants and minority ethnic communities?	3 (tie)
	What are child and adolescent initiated interventions that promote healthier diets at household, school, media levels?	3
	How can food labeling initiatives have positive effects on the food system? Specifically, how can they improve consumer knowledge and empower consumers to make healthier food choices while also creating demand for healthier and safety food options from food companies?	3
	What is the evidence of health benefits/harm of modernized diets compared to traditional ones?	6
	What are diet interventions for elderly people in Vietnam?	7 (tie)
	What are consumers' conceptions and perceptions on food labelling and food industry initiatives on food labeling?	7
	Can nutrition-sensitive agriculture interventions be effective at reducing sugar intake and the prevalence of NCDs?	7
	What can be done to facilitate marginalized migrants' access to healthy foods for better nutrition?	10 (tie)
	What are drivers of trust in food consumption behavior of consumers?	10
Synergies & trade-offs	What are the trade-offs and associations between agricultural production, health, environment (including agrobiodiversity and ecosystem services) and economic outcomes?	1
	What are the trade-offs between food safety, food waste, nutrition and environment?	2
	What should Vietnam do to promote healthy and diverse diets within the context of trade (liberalization, imports, foreign investments)?	3
	Who are the winners and losers regarding environment, economic, health and nutrition outcomes of food-related opportunities brought about by urbanization?	4
	What are the synergies and opportunities between the drivers of food system change?	5
	How can emphasizing increasing consumer demand first help shape or change production patterns to be more sustainable? What are the demand and supply incentives that are needed?	6 (tie)
	Have dietary consumption patterns followed agricultural production patterns or vice versa? How could the demand and supply relationship between production and consumption be better understood to shape healthier food systems, through shaping both agriculture and nutrition policies?	6
	How are more efficient value chains, which are serving the demand of urban consumers, affecting traditional seasonal variations in diets? Does this have an effect on diet quality and cultural aspects of diets?	8
	What are the trade-offs between production, purchase cost and nutrition?	9
	What are the existing and new opportunities for linkages between international actors (e.g. Transnational Corporations, certification agencies) and local stakeholders to improve diet?	10 (tie)
	What are the impacts of non-tariff technical barriers/standards/certifications on the local food market for local production and consumption? What policies regulate this?	10

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