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COMPENDIUM OF INDICATORS FOR FOOD SYSTEM ASSESSMENT

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CITATION

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Cover photos credits

Top left: Diverse fruits and vegetables at the market, India. Credit: Krishnasis Ghosh.

Top right: Desh Ratna Dangi is lead farmer and former treasurer of the Barpipal Saving and Credit Cooperative Limited, which is situated in the Doti, a hilly district of Nepal. Credit: Aakash Koirala.

Bottom left: Preparing and eating traditional foods in Kitui, Kenya. Credit: Bioversity International/S. Collins.

Bottom right: Fruit vendor in Đ□ng Đa district, Hanoi, Vietnam. Credit: Bioversity International/Gennifer Meldrum.

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The Alliance is part of CGIAR, the world's largest agricultural research and innovation partnership for a food-secure future dedicated to reducing poverty, enhancing food and nutrition security, and improving natural resources.

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CGIAR

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OVERVIEW AND PROCESS

The CGIAR Research Program on Agriculture for Nutrition and Health (A4NH) has a research flagship on Food Systems for Healthier Diets (FSHD). The FSHD project is managed by Wageningen University (WUR) in collaboration with Bioversity International, the Center for International Tropical Agriculture (CIAT) and International Food Policy Research Institute (IFPRI). As part of the capacity development efforts in leadership on food systems research, researchers from FSHD developed this Compendium of Indicators for Food System Assessment.

Food systems research is a vast topic with many entry points and food systems themselves are very dynamic and can change quickly. The entry point or "lens" used to guide the choice of indicators used in this compendium has been promotion of healthy diets, beginning with diets and consumers. A healthy diet helps to prevent or alleviate malnutrition in all its forms and includes the dietary elements of macronutrient and micronutrient adequacy, dietary diversity, moderation and safety. It is through this lens that food system indicators covering different food system domains including diet, consumer behaviour, food environment, food supply chains and food system drivers were selected.

Process

To initiate the work on developing this compendium, a one-day workshop was held in February 2018 at Wageningen University. Workshop participants were members of the FSHD flagship and represented the Wageningen Economic Centre for Research, Bioversity International, IFPRI, CIAT and WUR.

The workshop had the following objectives:

i. To select the conceptual framework and agree on the purpose of the compendium as well as criteria for the selection of indicators;

ii. To describe and review validated metrics that can be used to assess diet quality and food system characteristics and document data source and/or guidance on method;

iii. To begin to compile a draft set of metrics (and tools) for assessing diet quality and characterizing food systems;

iv. To identify preliminary communication and outreach ideas for the compendium.

During the workshop, the conceptual framework of the High-Level Panel of Experts on Food Security and Nutrition of the UN Committee on World Food Security was chosen to guide the flow of the compendium (HLPE, 2017). Based on this conceptual framework, five domains within food systems (Diets, Consumer Behaviour, Food Environment, Food Supply, and Food System Drivers) were identified for population with indicators. An FSHD managing partner led the process of selecting indicators for each of the domains.

Guiding principles for indicator selection were:

- The indicator should be oriented toward the goal of better-quality diets;
- The indicator should reflect the situation at a national scale, rather than sub-national;
- The indicator should ideally have a standard method used for data collection and a standardized formula for construction to enable cross-country comparisons;
- The data used to construct the metric/indicator should be routinely collected by National Statistics or housed by the United Nations (e.g. FAO STAT database, Child Growth Database, NCD Non communicable disease database), World Bank Living Standards

Measurement Survey (LSMS), ideally in a maintained and updated publicly-accessible database;

- The following exceptions to the above guiding principles should be noted:
    - When not available through databases, calculated data can be found in published reports (e.g. Global Gender Gap Index);
    - Some of the proposed indicators assess the availability of relevant legislation or the presence of relevant government bodies in the country (e.g. National Food Safety agencies), these indicators can be found in specific repositories (e.g. Global Database on the Implementation of Nutrition Action (GINA)) or country government websites.

FSHD has a focus primary focus on four countries: Bangladesh, Ethiopia, Nigeria and Vietnam. These countries are used as examples within the compendium, only for purposes of convenience, when country-level illustrations of available data are presented.

Limitations of the Compendium

There are gaps in defining validated indicators and open access databases that house indicators of choice for some food system domains. This is particularly the case for some aspects of diet quality (e.g. ultra-processed food intakes), consumer behaviour and the food environment.

Data on dietary intake is disparate and often not available in an open-access data platform. The Global Individual food consumption Data Tool (GIFT) project of WHO/FAO is aiming to remedy this situation, but the platform was still being populated with data sets at the time of this writing. This means that it can be quite difficult depending on the country to find open access data on dietary intake.

Selecting appropriate national-level indicators was limiting for some of the domains. In particular, the food environment domain was challenging to define at the national level. This domain is better suited to understanding spatial relationships between consumers and their immediate surroundings.

In some cases, indicators do not have a standard definition or means of construction. For example, indicators on land tenure are broadly defined in the same way but use different national-level constructs.

Not all indicators selected are available for all countries in an open-access database. Also, there were cases where a new indicator was not included in the main body of the compendium, when, for example, it was proposed in a peer-reviewed publication and has promise for widespread application but exists only for the analysis in a single publication or report. In most of these cases, these indicators appear in the Annex tables as supplementary information that could be collected within that domain.

Despite these shortcomings, we hope this first attempt to map indicators to a food system framework is helpful to the ever-growing community of researchers, practitioners, and those advising policy makers using food systems frameworks to guide agriculture, nutrition, and health decision making.

Due to the limitations mentioned above and the rapidly changing nature of food systems, our aim is to launch this tool as a living document. This means user feedback is appreciated and user contributions will be solicited through various channels. It also means that this version of the compendium will be updated as needed to keep abreast of new indicators and open access datasets.

Conceptual Framework

During the February 2018 food system indicators meeting, several conceptual frameworks for food systems were reviewed. They included those developed by the Global Panel on Agriculture and Food Systems for Nutrition (GLOPAN), and by the Nutrition and Food Systems report by of the High-Level Panel of Experts (HLPE) on Food Security and Nutrition (2017). After discussion, it was decided to use the HLPE 2017 framework because of its comprehensiveness and suitability for matching to indicators. Food systems are defined in that report as *"all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to production, processing, distribution, preparation and consumption of food, and the output of these activities, including socio-economic and environmental outcomes."*

Workshop participants agreed to divide the HLPE framework into five domains for the purpose of mapping indicators (Figure 1):

1. Diets
2. Consumer Behaviour
3. Food Environments
4. Food Supply Chains
5. Drivers

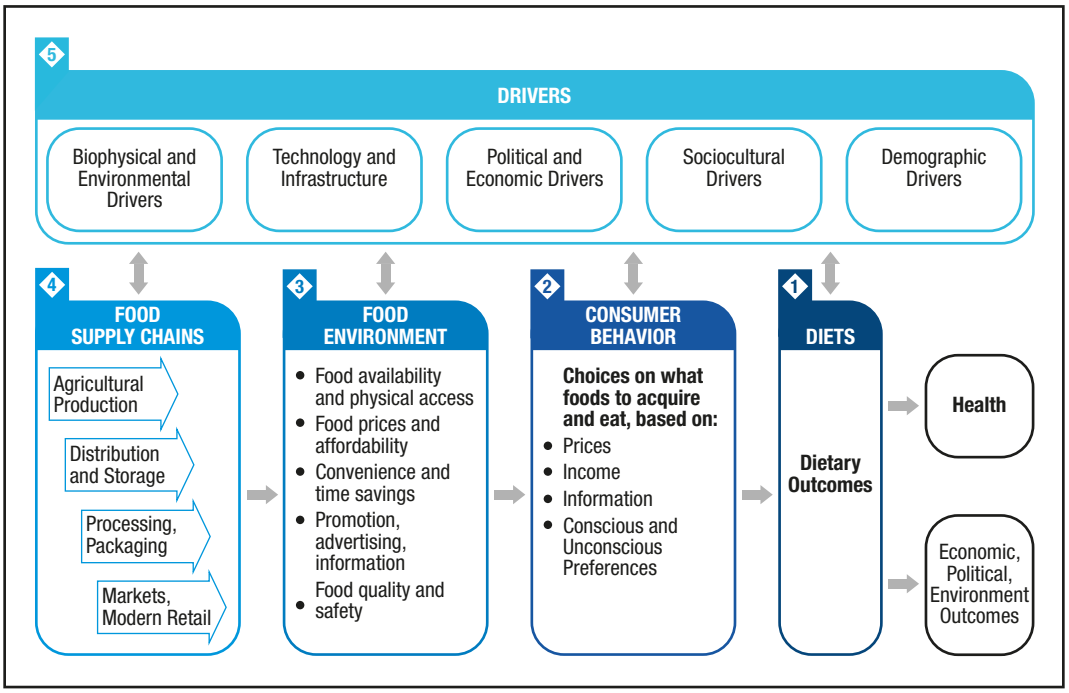
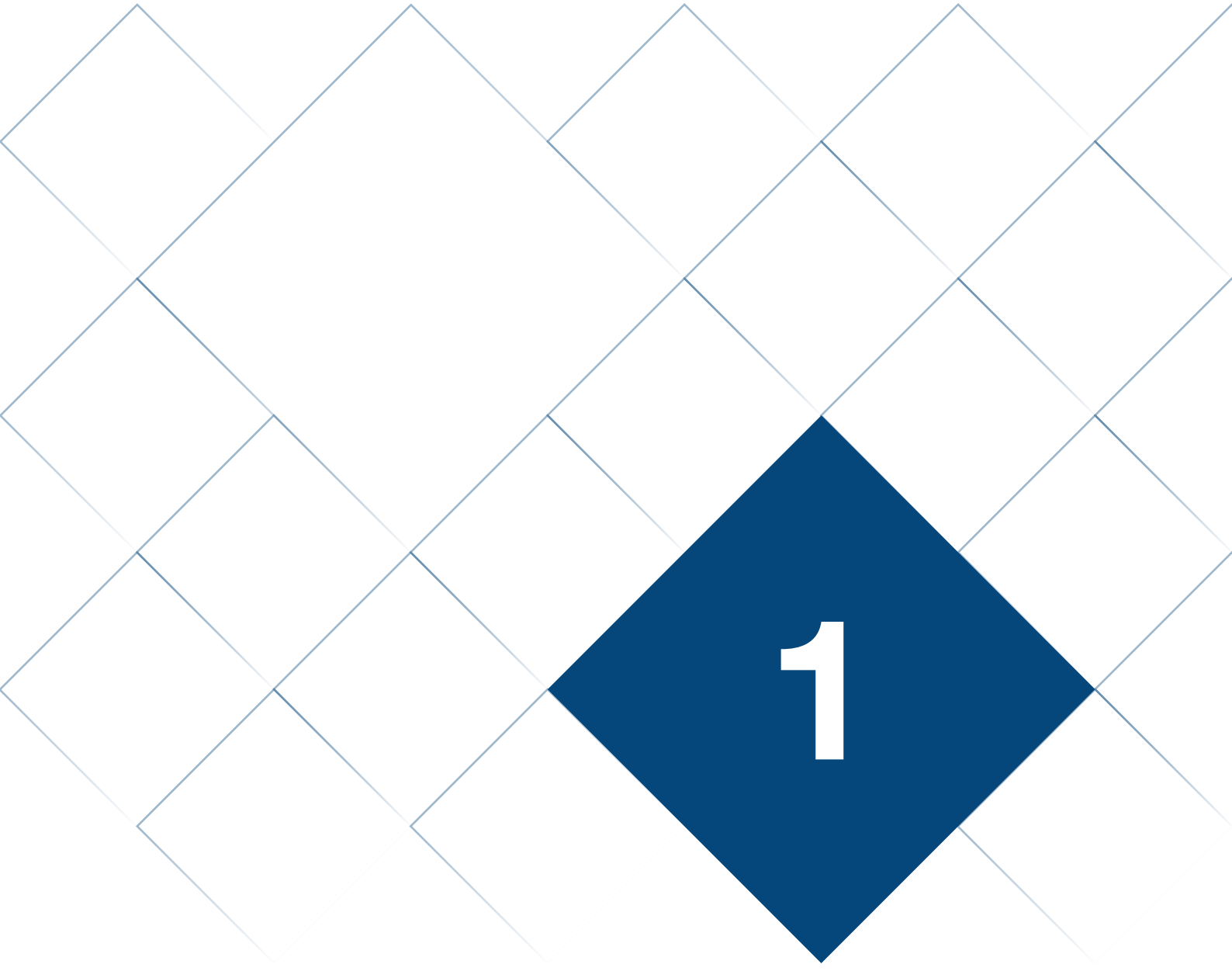


Figure 1: Conceptual framework of food systems for diets and nutrition. Adapted from de Brauw et al. (2019), based on the HPLE (2017) framework.

Structure of the Compendium

The compendium is divided into the five domains as expressed above: Diets, Consumer Behaviour, Food Environment, Food Supply Chains and Food System Drivers. In each domain, a number of indicators are suggested. For each indicator, the definition and a description of how to calculate the indicator is provided. This is followed by a description of the data needed. In the data needed section is a link to a dataset containing the already-constructed indicator or instructions on how to find the data needed to calculate the indicator. The phrase “data need to be calculated” in this section means the user can find the raw data, but then should follow the description on indicator calculation.

DIETS



1. DIETS

A healthy diet helps to prevent or alleviate malnutrition in all its forms: from stunting, wasting, and micronutrient deficiencies to overweight, obesity, and nutrition-related non-communicable diseases (NCD), including diabetes, heart disease, stroke, and cancer (WHO, 2015; WHO, 2016; FAO/WHO, 2019). Although there is no universal definition of the concept of a healthy, high-quality diet, there is general agreement that it comprises four main dimensions (Alkerwi, 2016; GLOPAN, 2016):

1. Adequacy
2. Diversity
3. Moderation[1]
4. Safety[2]

1.1 Adequacy

Refers to the provision of appropriate dietary energy and amounts of essential nutrients required for a particular stage in life.

Adequacy	▸ Energy and nutrient adequacy

ADEQUACY

▸ Energy and nutrient adequacy

Description

A measure that expresses the prevalence of inadequate intakes for groups as a percentage (capped at 100 percent) of the corresponding Estimated Average Requirement (EAR). The EAR is used for population-level assessment and is the intake level for a nutrient that meets the needs of 50 percent of the population (appropriate to age and sex). If the intake of a nutrient exceeds the EAR, the ratio is capped at 100[3].

One simply counts how many individuals in the group of interest have usual intakes that are below the EAR and divides this by the total number of individuals. The proportion is the estimate of the proportion of individuals in the group with inadequate intakes.

[1] With moderation we refer to those foods, food groups and nutrients to consume in moderation (small quantities or not at all). Some schools of thought group this with the adequacy, but for ease of explanation of the different indicators we categorized it as a separate dimension.

[2] Refers to food that is free of all hazards that may make food injurious to the health of the consumer. Indicators of safety are presented in the section on food environment.

[3] For iron it could be chosen to use the probability approach, a step by step guide on the analysis can be found here: https://www.ncbi.nlm.nih.gov/books/NBK217531/.

Data needed (data need to be calculated)

For this indicator, individual intakes of energy and nutrients are needed[4]. This information is derived from individual dietary recall methods (24hR, weighed food record, etc.). Table 1 shows an example of a results table. Table 2 shows energy and nutrient EARs according to the European Food Safety Authory (EFSA)[5].

Table 1: Percentage of individuals with consumption below EAR

Energy	Protein	Fat	Calcium	Iron	Etc.

[4] Ideally, at least two days intake records are needed or in the absence of a second day, a day-to-day variance estimate either from the country of interest or a neighbouring country can be used.

[5] The EFSA EARs are developed later than the WHO requirements, thus based on newer literature, therefore chosen in this compendium to be used as the reference values. However, should you prefer to use the WHO reference values, this can be argued for (EFSA, 2017).

Table 2: Estimated Average Requirement according to EFSA

Age group	Energy (MJ/d)	Protein (g)	Total fat (g)	Calcium (mg)	Vitamin C (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin B6 (mg)	Folate (ug DFE)	Vitamin B12 (Cobalamin) (ug)	Vitamin A (ug RAE)	Iron (mg) with 5% absorption	Zinc (mg)
Women														
7-11 mo	2.6	9.2	27.6	280	20	0.19	0.4	3.4	0.3	80	1.5	190	16	2.4
1 y	3	10.9	27.9	390	15	0.22	0.5	3.9	0.5	90	1.5	205	10	3.6
2-3 y	4.3	9.1	39.9	390	15	0.31	0.5	5.6	0.5	90	1.5	205	10	3.6
4-6 y	5.93	13.5	47.2	680	25	0.43	0.6	7.7	0.6	110	1.5	245	10	4.6
7-10 y	7.23	21.3	57.5	680	40	0.52	0.8	9.4	0.9	160	2.5	320	16	6.2
11-14 y	9.63	32.9	76.6	960	60	0.69	1.1	12.5	1.2	210	3.5	480	22.4	8.9
15-17 y	10.6	38.9	84.4	960	75	0.76	1.4	13.8	1.3	250	4	490	22.4	9.9
18- 24 y	9	38.6	71.6	860	80	0.65	1.3	11.7	1.3	250	4	490	25.2	7.6
≥ 25 y	8.7	38.6	69.3	750	80	0.63	1.3	11.3	1.3	250	4	490	25.2	10.2
Pregnant 1st	9.29	47.1	74.0	860/ 750	105	0.67	1.5	12.1	1.5	600	4.5	540	25.2	11.5
Pregnant 2nd	10.1	53.7	80.4											
Pregnant 3rd	11.1	69.5	88.4											
Lactating 0-6 pp[6]	11.1	53.6	88.4	860/750	145	0.80	1.7	14.4	1.4	380	5	1020	25.2	10
Lactating >6 pp		48.6												
Men														
7-11 mo	2.9	10.0	30.8	280	20	0.21	0.4	3.8	0.3	80	1.5	190	16	2.4
1 y	3.3	11.6	30.6	390	15	0.24	0.5	4.3	0.5	90	1.5	205	10	3.6
2-3 y	4.6	9.6	42.7	390	15	0.33	0.5	6.0	0.5	90	1.5	205	10	3.6
4-6 y	6.37	13.8	50.7	680	25	0.46	0.6	8.3	0.6	110	1.5	245	10	4.6
7-10 y	7.75	21.8	61.7	680	40	0.56	0.8	10.1	0.9	160	2.5	320	16	6.2
11-14 y	10.65	33.0	84.8	960	60	0.77	1.1	13.8	1.2	210	3.5	480	25.6	8.9
15-17 y	13.3	46.2	105.9	960	85	0.96	1.4	17.3	1.5	250	4	580	25.6	11.8
18-24 y	11.2	44.9	89.2	860	90	0.81	1.3	14.6	1.5	250	4	570	19.2	9.3
≥ 25 y	10.8	44.9	86.0	750	90	0.78	1.3	14.0	1.5	250	4	570	19.2	12.7

[6] Post-partum.

1.2 Diversity

Diversity refers to the consumption of a variety of nutritionally desirable foods or food groups (including plenty of plant foods such as fruits, vegetables, legumes, and whole grains).

Diversity	▸ Minimum Dietary Diversity of women of reproductive age (MDD-W) ▸ Minimum Dietary Diversity of Young children (6-23 months) (MDD)

Diversity

▸ MDD-W (Minimum Dietary Diversity of women of reproductive age)

Description

The number of food groups (out of 10) that were consumed by women 15-49 years in the previous 24 hours (FAO & FHI 360, 2016). Each of the 10 food groups receives a dichotomous score where 0=not consumed and 1=consumed during the recall period. Description of validation of this indicator can be found in Martin-Prével et al. (2015) and Arimond et al. (2010). The indicator is calculated as follows:

$$\text{MDD} - \text{W} = \frac{\textit{No of women } 15\text{-}49 \textit{ years of age consuming } 5 \textit{ or more out of } 10 \textit{ food groups}}{\textit{Total no of women } 15\text{-}49 \textit{ years}}$$

Table 3: MDD-W food groups

No	Food group	Examples of products	Consumed yes=1/no=0
1	Starchy staples	Maize, rice, wheat, potatoes, or products made of these ingredients, like bread	
2	Beans and peas	Dried beans, lentils and products made from these	
3	Nuts and seeds	Nuts, seeds, peanut butter	
4	Dairy	Milk, yoghurt, cheese but NOT butter	
5	Eggs	Eggs, omelette	
6	Flesh foods	Beef, chicken, pork, goat, fish, shellfish	
7	Vitamin A-rich dark green leafy vegetables	Spinach, kale, cow pea leaf, cassava leaf (and other locally available species)	
8	Other vitamin A-rich fruits and vegetables	Mango, cantaloupe, carrot, orange sweet potato (and other locally available Vitamin A rich species)	
9	Other vegetables	All other vegetables	
10	Other fruits	All other fruits	

Data needed (data need to be calculated)

For this indicator, individual intakes of food groups are needed. This information is derived from individual dietary recall methods (e.g. 24hR, weighed food record) or by using the dietary diversity questionnaire described (FAO & FHI 360, 2016). Table 3 defines the 10 food groups with a short description of items that need to be tailored to the specific food available within the survey area.

Minimum Dietary Diversity of Young children (6-23 months)

Description

This indicator is defined as the number of food groups (out of seven food groups, see Table 4), which were consumed by young children age 6-23 months in the previous 24 hours (WHO, 2008). Each of the seven food groups is scored dichotomous, thus scored 1/0 – either consumed or not consumed during the recall period. The cut-off of the proportion of children 6–23 months of age who receive foods from four or more food groups was selected because it is associated with better quality diets for both breastfed and non-breastfed children. Description of validation of this indicator can be found in Jones et al. (2014). This indicator was part of the 2008 WHO/UNICEF/USAID indicators of Infant and Young Child Feeding (IYCF) and has been included as an indicator in the Global Nutrition Monitoring Framework adopted by the WHO.

The indicator is calculated as follows:

$$\text{Minimum Dietary Diversity} = \frac{\textit{Children age 6–23 months who received foods from} \geq \textit{4 food groups the previous day}}{\textit{Children 6–23 months of age}}$$

Table 4: Minimum dietary diversity for young children food groups[7]

No	Food group	Consumed yes=1/no=0
1	Grains, roots, and tubers	
2	Legumes and nuts	
3	Dairy products (milk, yogurt, cheese)	
4	Flesh foods (meat, fish, poultry, and liver/organ meats)	
5	Eggs	
6	Vitamin A-rich fruits and vegetables	
7	Other fruits and vegetables	

Data needed (data need to be calculated)

For this indicator, individual intakes of food groups are needed. This information is derived from individual dietary recall methods (24hR, weighed food record, etc.).

[7] In 2017 it was advised to include breastfeeding as an 8th food group (see https://apps.who.int/iris/bitstream/handle/10665/259904/9789241513609-eng.pdf?sequence=1), However for now given that we advise to use already existing data, and data on breastfeeding will most likely thus not yet be part of those datasets, we do not include breastfeeding here, Keeping in mind this is a living document eventually breastfeeding is expected to be included as a food group.

1.3 Moderation

Refers to limiting unhealthy foods, food groups, and dietary energy. This includes food high in fats (especially saturated and trans-fat), sugar, (including sugar-sweetened beverages (SSB)), and sodium. Many ultra-processed foods contain added sugar and sodium and are high in fat. Therefore, these foods should be taken in moderation.

Moderation	▸ Percent of dietary energy from ultra-processed foods, using the NOVA classification

Moderation

▸ Percent of dietary energy from ultra-processed foods, using the NOVA classification

Description

This indicator expresses the dietary energy from ultra-processed food (UPF) products, as a percentage of total dietary energy intake, using the NOVA classification (Monteiro et al., 2013). It is a food classification scheme based on level of processing. UPFs are '*industrial formulations typically with five or more (usually more than five) ingredients. Such ingredients often include sugar, oils, animal fats, salt, anti-oxidants, stabilizers, and preservatives. Ingredients only found in ultra-processed products include substances not commonly used in culinary preparations, and additives whose purpose is to imitate sensory qualities of unprocessed foods or of culinary preparations of these foods, or to disguise undesirable sensory qualities of the final products*' (Monteiro et al., 2013). Description of validation of this indicator can be found in e.g. Louzada et al. (2015) and Tavares et al. (2012). For this indicator, foods need to be described as ultra-processed or not ultra-processed, then the indicator is calculated as follows:

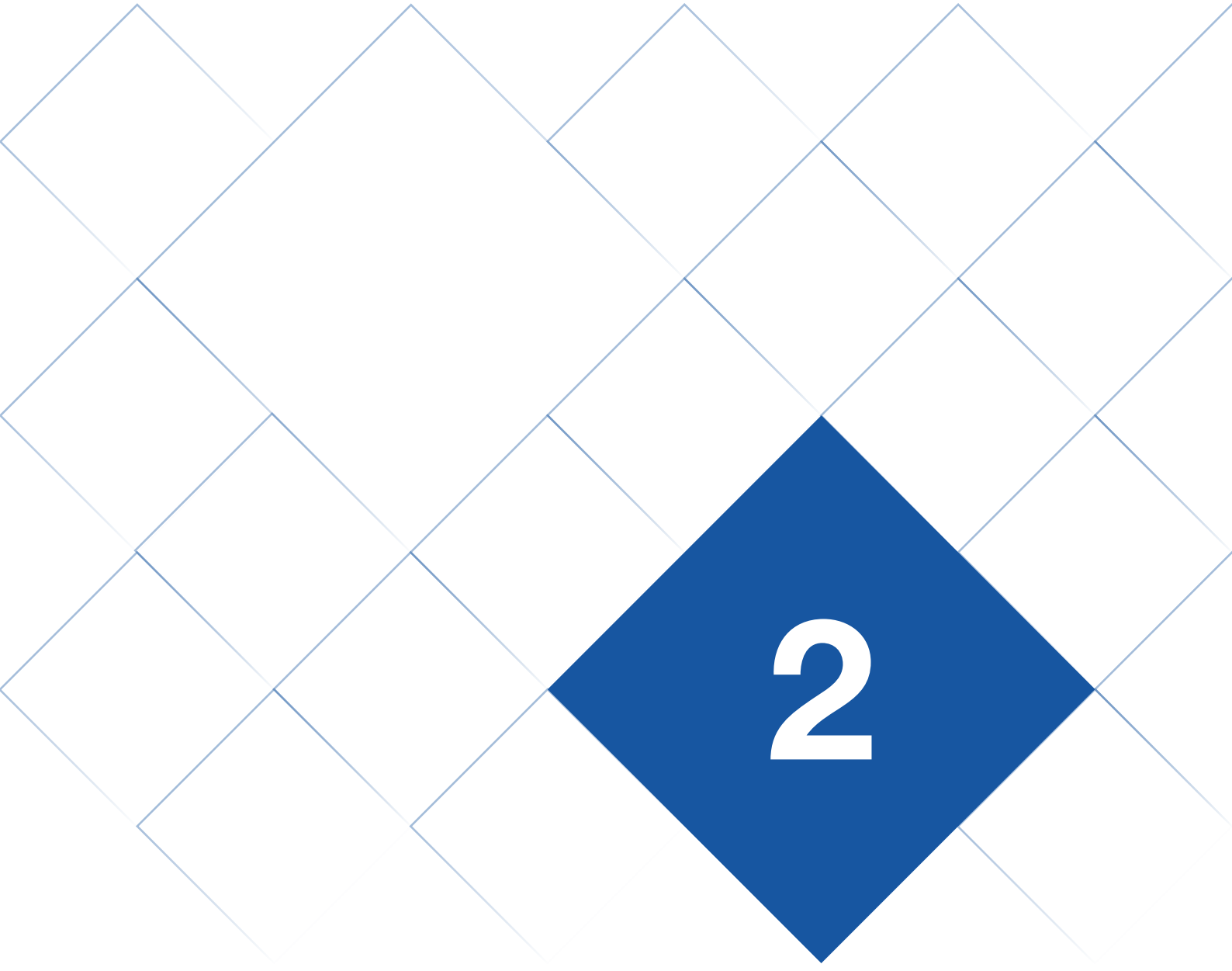
$$1)\ \textit{percentage of energy from UPF} = \frac{\textit{Energy intake from UPF as consumed by the respondent}}{\textit{Total energy consumed by respondent}}$$

2) Calculate the average dietary energy from UPF of the population.

Data needed (data need to be calculated)

For this indicator, individual intakes of UPF are needed. This information is derived from individual dietary recall methods (24hR, weighed food record, etc.). It requires appropriate coding of all ultra-processed food and beverage items according to the classification scheme. To compute the indicator, total dietary energy intake must also be known. Food items and ingredients are coded by level of processing, and percent of energy intake is calculated for ultra-processed foods as a group. '*A practical way to identify ultra-processed products is to check if its list of ingredients contains at least one item characteristic of the NOVA ultra-processed food group, which is to say, either food substances never or rarely used in the kitchen..., or classes of additives designed to make the final product palatable or more appealing*' (Monteiro et al., 2019).

CONSUMER BEHAVIOUR



2. CONSUMER BEHAVIOUR

Based on the HLPE (2017) definition, consumer behaviour considers the entire process from acquisition to consumption of food as reflective of "*all the choices and decisions made by consumers, at the household or individual level, on what food to acquire, store, prepare, cook and eat, and on the allocation of food within the household (including gender repartition and feeding of children)*". According to the HLPE report and the available literature, food choices are determined by personal attitudes and motives, such as familiarity with the foods (Devine et al., 1998), taste preferences (Drewnowski, 1997; Tiu Wright et al., 2001), convenience (time scarcity, food prices) (Jabs & Devine, 2006; Steenhuis, et al., 2011; Djupegot et al., 2017), perceived safety of foods (Yeung & Morris, 2001) and health-related motives (Sun, 2008). Nutrition knowledge, as well as skills and availability of time for food preparation, can have an impact on consumer food choices and can lead people to opt for healthier or less healthy foods (Wardle, Parmenter & Waller, 2000; Hartmann et al., 2013; Monsivais et al., 2014).

Building on this evidence, although largely coming from high-income countries (HICs), this compendium proposes metrics for measuring the **consumer behaviour** (adapted from Marías & Glasauer, 2014) that can be applicable in low- and middle-income countries (LMICs) and used with existing datasets, for which the following sub-components were considered:

1. Knowledge, Attitudes, and Motives
2. Practices

A brief summary of each sub-domain and suggested indicators follows.

2.1 Knowledge, Attitudes, and Motives

A useful indicator of the "Knowledge" of a healthy diet is the "Share of population that is aware of Food-Based Dietary Guidelines (FBDGs) (percent)" (Marías & Glasauer, 2014); however, since information to construct this indicator is not routinely collected at national level, this indicator is listed in Annex 1 (Additional indicators). Another interesting indicator to measure the "Attitudes/Motives" underlying food choices is the "Share of population that states health as a primary motive for their food choice (percent)" (Adapted from Marías & Glasauer, 2014); however, there are no existing datasets providing this kind of data.

2.2 Practices

This aspect of the consumer behaviour refers to all those factors (time required for food shopping, cooking and cleaning up, food preparation skills, availability of a kitchen and cooking equipment) that influence the preparation and consumption of food. Existing datasets to measure this aspect are frequently collected at national scale. For example, it would be relevant to explore data on time allocated to cooking, frequency of consumption of ready to eat/prepared meals or out-of-home eating, and travel time to reach food outlets. As a proxy, the time required to collect water for food preparation and cleaning up and the access to improved cooking facilities can be used for the time required for food preparation.

Time required for food preparation	▸ Share of population accessing water in more than 30 mins (percent) ▸ Share of population with access to clean fuels and technologies for cooking (percent)

TIME REQUIRED FOR FOOD PREPARATION

▸ Share of population accessing water in more than 30 mins (percent)

Description

This indicator measures the travel time over 30 min required to fetch water as this contributes to the time required for cooking.

Data needed (data already calculated)

Data are available through the WHO-UNICEF Joint Monitoring Programme website under "See data for a country", by selecting the "Households" button and typing the name of the country of interest. Then select the tab "Drinking water" and the chart "Rural and urban drinking water service levels (2000 and 2017)" by clicking on the button "Edit". Then under the heading "*Measure*", select "Coverage" and "Drinking water", under the heading "*Inequality*" select both "Urban" and "Rural", and under the heading "*Ladder type*" select "Analyse by service level" and "Limited" and "Basic". Data on "Limted" shows the share on population that spend more than 30 mins for a round trip to collect water[8]. Where possible it could be useful to analyze trends over time.

▸ Share of population with access to clean fuels and technologies for cooking (percent)

Description

This indicator measures the "access to clean fuels and technologies for cooking is the proportion of total population primarily using clean cooking fuels and technologies for cooking" (Source: World Bank, Sustainable Energy for All (SE4ALL) database from WHO Global Household Energy database).

Data needed (data already calculated)

Data are available through the World Bank database by selecting the variable "Access to clean fuels and technologies for cooking (% of population)". Where possible it could be useful to analyze trends over time.

[8] More information about the definitions can be found here: https://washdata.org/monitoring/drinking-water.

FOOD ENVIRONMENT

3

3. FOOD ENVIRONMENT

The HLPE report recognizes a number of 'key elements' of the food environment. These are the availability and physical access, affordability of food options, the marketing and advertising of food[9], the availability of nutrition information and messaging (food labels, FBDGs), and the quality (product properties, nutrient values) and safety of food (availability of food safety regulations) (adapted from HPLE, 2017).

In addition to these elements, 'Convenience and time saving' was recognised as a key element to be considered in food environment research. Recently, the 'sustainability' aspect of the food environment, which includes considerations about carbon and water footprints associated with food products and food waste, sustainability of packaging, and equity in food access, has been explored. However, these aspects are not yet fully adopted into the food environment framework, furthermore, sustainability and equity can be considered as cross-cutting within the food system.

Several definitions had been developed to conceptualize the food environment (Table 6). Our scope is to develop metrics for assessing food environments for healthy diets, and the following definition from FAO (2016) best represents the interplay between consumers and the food environment:

"*Food environments may be thought of as all the foods which are available and accessible to people in the settings in which they go about their daily lives. That is, the range of foods in supermarkets, small retail outlets, wet markets, street food stalls, coffee shops, tea houses, school canteens, restaurants and all the other venues where people procure and eat food. Food environments differ enormously depending on context. They can be extensive and diverse, with a seemingly endless array of options and price ranges, or they can be sparse, with very few foods on offer. Because they determine what foods consumers can access at a given time, at what price and with what degree of convenience, food environments both constrain and prompt food choices.*"

Table 5: Other definitions of the food environment

Definition	Perspective	Reference
"We define the food environment as the availability, affordability, convenience, and desirability of various foods."	**Markets**	Herforth & Ahmed (2015)
"The food environment is the interface that mediates one's food acquisition and consumption within the wider food system. It encompasses multiple dimensions such as the availability, accessibility, affordability, desirability, convenience, marketing, and properties of food sources and products."	**Food system**	Turner et al., (2017)
"Food environment refers to the physical, economic, political and socio-cultural context in which consumers engage with the food system to make their decisions about acquiring, preparing and consuming food."	**Food system**	HLPE, (2017)

In recent years, food environments are attracting considerable interest, with a growing number of studies focusing on understanding the impacts they can have on food choices and ultimately on diets (Glanz, 2009; McKinnon, 2009; Caspi et al., 2012; Herforth & Ahmed, 2015; Lytle & Sokol, 2017).

[9] Promotion and advertising have been studied as external influences on desirability that affect food choice (Scully et al., 2012; Zimmerman & Shimoga, 2014).

The food environment represents the "*range of foods that can be accessed in the context where people live and can enable or restrict healthy dietary choices*" (FAO, 2016). According to HPLE (2017), food environments are considered healthy when they "*enable consumers to make nutritious food choices with the potential to improve diets and reduce the burden of malnutrition.*"

Building on this evidence, although largely coming from high-income countries (HICs), metrics for measuring the food environment (adapted from HLPE, 2017) that can be applicable in low- and middle-income countries (LMICs) and used with existing datasets, for which the following sub-components were considered:

1. Food availability and physical access
2. Food prices and affordability
3. Convenience and time savings
4. Promotion, advertising and information
5. Food quality and safety

Several validated metrics for monitoring the food environment are available, such as those developed under the INFORMAS framework and the nutrition environments measures under the NEMS tools, currently under evaluation in LMICs settings. The drawback for this compendium is that the most accurate assessments of the food environment require primary data collection at a local, context-specific scale. This compendium is based upon use of existing information that ideally is already routinely collected. Therefore, the following section describes a selected list of indicators that at best serve as national-scale proxies for each sub-domain considered. The choice of indicators is based on a review of the available literature and supported by expert opinion. The complete list of all the proposed indicators is available in Annex 1 (Additional indicators).

3.1 Food availability and physical access

For this sub-domain, one indicator to estimate the availability of recommended food groups within the national food supply was selected. This indicator could also fall into the food supply sub-system. Interpreting data on food availability under food environment should be considered as a proxy for availability of diverse foods supplied at the national level.

The HLPE report on nutrition and food systems highlights infrastructure and the presence of food entry points as important considerations of physical access to food. Some of these considerations can also be represented as drivers of food choice and thus there may be some overlap. The ideal indicators to understand food environment would be measured at the sub-national level. The set of indicators below can be applied to the smallest geographical scope possible in order to better identify differential physical access within a country.

Recommended food groups available in the supply	▸ Food supply adequacy
Physical access to markets	▸ Distance to the nearest market (Km) ▸ Percentage of paved roads over total roads (percent) ▸ Distance to main road (Km)

Recommended food groups available in the supply

Food supply adequacy

Description

This indicator estimates to what extent the national food supply is adequately meeting the daily requirements per person (g/capita/day) of the food groups recommended for a healthy diet (fruits, vegetables, pulses, milk).

The ratio is calculated as follows:

$$Food\ supply\ adequacy\ = \frac{Food\ supply\ quantity\ (g/capita/day)}{Recommended\ daily\ intake\ (g/capita/day)}$$

The ratio is calculated for each food group and ranges from 0 to 1, where 1 represents the food supply meeting the recommended daily requirements per person. If food supply quantity is greater than the recommended intake, then the ratio is equal to 1.

Table 6: Optimal level of intake

Food groups	Optimal level of intake	Definition
Fruits	≥250 g/day	Average daily consumption of fruits (fresh, frozen, cooked, canned, or dried fruits, excluding fruit juices and salted or pickled fruits)
Vegetables	≥360 g/day	Average daily consumption of vegetables (fresh, frozen, cooked, canned, or dried vegetables, excluding legumes and salted or pickled vegetables, juices, nuts and seeds, and starchy vegetables such as potatoes or corn)
Legumes/Pulses	≥60 g/day	Average daily consumption of legumes (fresh, frozen, cooked, canned, or dried legumes)
Milk	≥435 g/day	Average daily consumption of milk (including non-fat, low-fat, and full-fat milk, excluding soy milk and other plant derivatives)

Source: Adapted from GBD 2016 Risk Factors Collaborators, (2017).

Data needed (data need to be calculated)

Data on the per capita food supply (kg/capita/year) are available through FAOSTAT by selecting "Food balances" under the "Food Balance" section. A simple Excel spreadsheet can be used to convert kg/capita/year into g/capita/day available, which can then be compared to recommendations. For each food group, the reference daily intake (Recommended daily intake g/capita/day) follows the recommendations provided in the Global Burden of Disease 2016 Risk Factors Collaborators (2017) (Table 4.2). Items to select per food group are detailed in the "Definitions" section of the FAO (2014) publication (see Annex 2 – Food groups). These are "Fruit, excluding wine", "Vegetables", "Pulses", and "Milk". It is recommended to consider the three-year average of the most recent data.

Physical access to markets

Distance to the nearest market (Km)

Description

This indicator may be used as proxy for households' physical access to retail outlets (e.g. kiosk/markets), however, this indicator is not specific to "what" is sold at the market (eg. availability of food groups, such as fruits, vegetables, nuts/seeds, whole grains, and milk, since it is unknow what the nearest market has on offer).

Data needed (data already calculated)

Data at national level are provided by the World Bank in the LSMS reports by selecting the variable "dist_market". For example, these data are available for Ethiopia (Socioeconomic Survey 2015-2016, Wave 3) and Nigeria (General Household Survey, Panel 2015-2016, Wave 3).

Percentage of paved roads over total roads (percent)

Description

This indicator may be considered as proxy for physical access to markets.

Data needed (data already calculated)

Data are provided by FAO under the indicator "Percentage of paved roads over total roads (percent)" and are available through the Land Portal website. It should be noted that data are updated up to 2011 and this indicator was listed under the FAO "Suite of Food Security Indicators".

Distance to main road (Km)

Description

This indicator may be considered as proxy for physical access to markets.

Data needed (data already calculated)

Data are provided by the World Bank in the LSMS reports by selecting the variable ("dist_road"). For example, these data are available for Ethiopia (Socioeconomic Survey 2015-2016, Wave 3) and Nigeria (General Household Survey, Panel 2015-2016, Wave 3).

3.2 Food prices and affordability

The following indicators are aimed at capturing households' ability to afford recommended non-staple food groups that make a healthy diet. Several methodologies have been developed to measure the cost of a healthy food basket, such as the Cost of Diet tool (CoD), the Nutritious Food Basket tool and others (see Annex 1), however, these require the availability of data on non-staple food prices, which are not extensively monitored through the existing datasets. The WFP VAM prices tool could be used to calculate the cost of a food basket, however, this tool mainly monitors staple foods prices.

Therefore, it is recommended to consider both the share of food expenditures and the share of expenditure on non-staple foods as proxies for the affordability of a healthy diet.

Affordability of a healthy diet	▸ Share of income spent on food (percent) ▸ Share of income spent on non-staples (percent)

Affordability of a healthy diet

▸ Share of income spent on food (percent)

Description

This indicator is a proxy for household's economic access to food in terms of proportion of income spent on food at the household level.

Data needed (data already calculated)

Data on consumption expenditures are available through the World Bank Global Consumption Database, a repository of consumption data retrieved from each country's national surveys. Data are available at the national level, for rural and urban areas, and by consumption segment[10] (lowest, low, middle, and higher).

These data are available through the table "Consumption Shares 2010 by Country, Sector, Area and Consumption Segment (Percent)" and the variable to consider is "Food and beverages."

▸ Share of income spent on non-staples (percent)

Description

This indicator expresses the economic access to a healthy diet in terms of proportion of income spent on different recommended food groups other than staple foods at the household level.

Data needed (data already calculated)

Data on consumption expenditures are available through the World Bank Global Consumption Database. Data are available at the national level, for rural and urban areas, and by consumption segment (lowest, low, middle, and higher).

[10] More information about consumption segments can be found here: http://datatopics.worldbank.org/consumption/detail#datastandardization.

These data are available through the table “Consumption Shares 2010 by Country, Category of Products/Services, Area and Consumption Segment (Percent)” and the variables to consider are “Dairy”, “Meat and fish” and “Fruits and vegetables.” Data on the share of budget spent for pulses, nuts and seeds is desirable but currently not available.

3.3 Convenience and time savings

This aspect of the food environment refers to the activities taken by food retailers to make healthy food options also convenient. Examples of this type of activity would be “pre-washed” or “pre-cut” produce options, “pre-cooked” or “pre-mixed” meal or food item options and similar convenience products available at point of purchase within informal or formal retail outlets. Indicators of density of convenience food outlets (street food, fast food, restaurants) present in neighbourhoods that also offer healthy food choice options is another potential indicator fitting here. Currently, the databases that would house this type of information (e.g. Euromonitor) are not open access. However, this may change in the near future and countries may also begin to adopt more granularity of data collection at retail level that is then made open access or at least available through national statistics offices.

3.4 Promotion, advertising and information

Food marketing and advertising, the availability of nutrition information, and messaging (e.g. FBDGs, food labels) are important to consider when measuring the food environment (HPLE, 2017). However, it is challenging to find validated indicators and existing datasets on the food marketing and advertising environment, or information on the nutrition information and messaging available, especially in LMICs. The availability of legislation on food marketing was considered as a proxy indicator for restrictions on promotion of certain food or food products to consumers. Many countries have national codes of marketing of breast-milk substitutes as result of the 1981 WHO Code, and countries are also increasingly adopting legislation that incorporates the 2010 Set of Recommendations on Marketing of Foods and Non-alcoholic Beverages to Children and the 2017 Guidance on Ending the Inappropriate Marketing of Complementary Foods (WHO, 2010; WHO, 2017). The availability of legislation requiring ingredient or nutrition labelling, availability of Food Composition Tables and Food Based Dietary Guidelines can be used as proxies for the availability of nutrition information and messaging that can influence consumers.

Food promotion and advertising	▸ Availability of legislation on food marketing
Nutrition information and messaging	▸ Availability of legislation on ingredient labelling on packaged foods ▸ Availability of legislation on nutrition labelling ▸ Availability of National Food Composition Tables (FCT) ▸ Availability of Food Based Dietary Guidelines (FBDGs)

Food promotion and advertising

Availability of legislation on food advertising

Description

This indicator expresses the availability of mandatory legislation that regulates the advertisement of food products. "Yes" or "No" are assigned to each country based on the "availability" or "non-availability" of a mandatory legislation regulating food advertising.

Data needed

This information can be accessed through the Global database on the Implementation of Nutrition Action (GINA), which is an open-access repository of nutrition-relevant policies and interventions implemented by each country. WHO, UNICEF and the International BAby Food Action Network (IBFAN) biennially assess the status of implementation on legislation of breast milk substitutes in countries (WHO and UNICEF, 2018).

For example, Bangladesh and Viet Nam are both classified as having "full provisions into law" based on the 2013 Bangladesh Breastmilk Substitutes, Infant Foods, Commercially Manufactured Complementary Foods, and the Accessories Thereof (Regulation of Marketing) Act; the 2017 Bangladesh BMS Act Rules, and the 2014 Viet Nam Decree on Trading In and Use of Nutritious Products for Infants, Feeding Bottles and Pacifiers. Nigeria is classified as having "many provisions into law" based on the 2005 Marketing of infant and young children food and other designated products (Registration, sales, etc.) regulations, whereas Ethiopia only includes "some provisions into law" based on their 2014 Infant Formula and Follow-up Formula Directive No. 21.

Nutrition information and messaging

Availability of legislation on ingredient labelling on packaged foods

Description

This indicator expresses the availability of mandatory legislation on the ingredient labelling of pre-packaged food products in compliance with the Codex Standard 1-1985[11]. "Yes" or "No" are assigned to each country basing on the "availability" or "non-availability" of food labelling regulations.

Data needed

This information can be accessed through the Global database on the Implementation of Nutrition Action (GINA) and on country specific government websites. Examples include:

- Bangladesh, 2008: "Standards for the labelling of pre-packaged food" and the 2017 "Food Safety (Labelling) Regulations"
- Vietnam, 2014: "Guidelines for the labelling of pre-packaged foods, food additives and food processing aids[12]"

[11] Codex general standard for the labelling of pre-packaged foods. CODEX STAN 1-1985 (Rev. 1-1991). http://www.fao.org/3/Y2770E/y2770e02.htm.

[12] Joint Circular No. 34/2014/TTLT-BYTBNNPTNT-BCT.

- Ethiopia, 2009: "Ethiopian Food, Medicine and Healthcare Administration and Control Authority Proclamation No. 661/2009"; however, it is not specified what information is mandatory in the food labels. Codex Standard 1-1985 defines information needed to comply with the Codex standard[13].
- Nigeria:
  - 2018: "Pre-packaged food, water and ice (labelling) regulations 2018", under review (National Agency for Food and Drug Administration and Control (NAFDAC) website)
  - 2005: "Pre-Packaged Food (Labelling) Regulations 2005", cited in the Global Alliance for Improved Nutrition (GAIN) report "Food and Agricultural Import Regulations and Standards.

Availability of legislation on nutrition labelling

Description

This indicator expresses the availability of mandatory legislation that regulates the provision of nutrition labels on food products in compliance with the Guidelines on Nutrition Labelling (CAC/GL 2-1985)[14]. "Yes" or "No" are assigned to each country basing on the "availability" or "non-availability" of legislation that mandates the labelling of nutritional information on food products.

Data needed

This information can be accessed through the Global database on the Implementation of Nutrition Action (GINA).

Availability of National Food Composition Tables

Description

This indicator expresses the availability of information on food composition in each country. "Yes" or "No" are assigned to each country based on the "availability" or "non-availability" of the Food Composition Tables (FCT).

Data needed

This information can be accessed through the FAO International food composition table/database directory. For example, Ethiopia, Nigeria, Vietnam and Bangladesh developed their own Food Composition Tables.

Availability of Food-Based Dietary Guidelines (FBDGs)

Description

This indicator expresses the availability of Food Based Dietary Guidelines (FBDG). "Yes" or "No" are assigned to each country basing on the "availability" or "non-availability" of such guidelines.

[13] Codex general standard for the labelling of pre-packaged foods. CODEX STAN 1-1985 (Rev. 1-1991). http://www.fao.org/3/Y2770E/y2770e02.htm.

[14] Codex Guidelines on Nutrition Labelling. CAC/GL 2-1985. http://www.fao.org/ag/humannutrition/33309-01d4d1dd1abc825f0582d9e5a2eda4a74.pdf.

Data needed

This information can be accessed through the FAO web page on "Food-based dietary guidelines" where links to National FBDGs are provided. For example, FBDGs are available for Bangladesh, Nigeria, and Vietnam, and are being developed for Ethiopia at the time of this writing.

3.5 Food quality and safety

Food safety and quality can have an impact on health, dietary habits, and the availability and affodability of food in a given country (FAO, 2016). Indicators to assess the food quality across the four focus countries could not be found. It is very challenging to find validated indicators or existing datasets about, for example, the properties of the foods on offer that could influence consumers' food choices.

With regards to food safety, methodologies suitable for measuring the food safety in LMICs need to be investigated further (Grace et al., 2018).

The following set of food safety indicators has been selected based both on the available literature and through expert opinion.

Food safety	▸ Burden of foodborne disease ▸ National agency to ensure the safety of food

Food safety

▸ Burden of foodborne diseases

Description

This indicator expresses the health burden associated with foodborne diseases[15]*. The DALY (Disability Adjusted Life Years) is a common reference measure to estimate health burden. DALY estimates are provided for all the hazards as well as by type of hazard (Enteric, Parasitic and Chemical/toxins hazards) (WHO, 2015).*

Data needed (data already calculated)

The first global estimates of the health burden of foodborne diseases are provided by WHO and are available in both the published report and in the online tool[16] (WHO, 2015). Data are available on a sub-regional basis (based on mortality) rather than at the country level. For example, Ethiopia belongs to the AFR E subregion, Nigeria to AFR D, Bangladesh to SEAR D, and Vietnam to WPR B. The value of DALY to consider is by subregion, per 100,000 population, for all ages and all types of hazards.

[15] This indicator was proposed by Gustafson et al. (2016) as an indicator of food safety.

[16] In case the tool does not open it may be required to use a different browser.

Agency to ensure the safety and health of food

Description

This indicator expresses the availability of a government body responsible for the food safety control in each country. "Yes" or "No" are assigned to each country based on the "availability" or "non-availability" of an agency responsible for food safety control. This indicator is included into the "Quality and safety index" developed by the Economist Intelligence Unit, which contributes to the Global Food Security Index as cited in Gustafson et al. (2016).

Data needed

This information can be accessed through each country's government websites.

FOOD SUPPLY CHAINS

4

4. FOOD SUPPLY CHAINS

The food supply chain is central to the food systems framework, as it literally embeds material flows of food from "farm to fork." The flow of food can be direct and local, through subsistence production, but globally, the bulk is indirect through (short to long) national food supply chains involving a range of transformations and distribution networks, and international networks of food export and import.

The nutrient content and composition of (un)healthy components can be modified along the food supply chain through contamination, degradation, leakages and losses, processing, fortification, and a range of other factors. The level of nutrition sensitivity of value chains is subject to processes along the food supply pipelines (De la Peña & Garrett, 2018; Fanzo et al., 2017). Environmental impacts of food systems – in the form of emissions and water use – are predominantly occurring along the food supply chain through input usage, production, storage, transformation, and transport (Chaudhary et al., 2018; Hoekstra & Wiedmann, 2014). However, agricultural production contributes the most to such impacts and for this reason measures of greenhouse gas (GHG) emissions and water consumption have been included under the 'Food production' subsection (Gustafson et al., 2016; Hoekstra & Mekonnen, 2012). In parallel, organizational models and revenue streams can be inclusive or exclusive of family farming and small and medium enterprises (SMEs). Trade-offs and synergies for nutrition sensitivity, environmental imprints, and inclusiveness do occur along the food supply chain.

In terms of metrics, indicators such as 'per capita non-renewable energy use' actually internalize production to retail, such as food value chain efficiency and environmental footprint values, based on life cycle assessment. However, data on the per capita use of non-renewable energy due to food systems are not routinely collected. The 'Share of non-renewable energy use' was selected as a proxy for the food system energy use and, for simplicity, is presented under 'food storage and distribution' (see below). Following the 2017 HLPE report, a total of four main 'sub-components' of food supply chains are recognized:

1. Food production
2. Food storage and distribution
3. Food processing and packaging
4. Retail and markets

A list of indicators for each subcomponent follows.

4.1 Food production

For this subsection, a set of indicators aimed at assessing the agricultural productivity and to what extent national production contributes to food supply within each country was selected. It is also important to consider indicators of equitability aimed at measuring the shares of smallholders and farmers living below the national poverty line (adapted from CGIAR, 2015). Measures of food system environmental impact, in terms of GHG emissions and water use, have been included here as these mainly occur in the production phase of the food system. The list of indicators for which existing/open access datasets could not be found are included in Annex 1.

Productivity	▸ Yield of main food items (crops, livestock, fish) per unit of production ▸ Share of land equipped for irrigation (percent)
Biofortified crops	▸ Biofortified crop variety releases in the countries
Environmental footprint	▸ Per capita GHG emissions from agricultural production ▸ Per capita water use from agricultural production
Producer equitability	▸ Share of smallholders and farmers living below the national poverty line

Productivity

▸ Yield of main food items (crops and livestock) per unit of production

Description

This indicator measures the yield of main food items, including crops and livestock, as a proxy for agricultural productivity.

Data needed (data need to be calculated)

Timeseries yield data are available through FAOSTAT, by selecting "Crops" and "Livestock primary" in the "Production" section. As this compendium is mainly focused on food system metrics for healthier diets, it would be relevant to measure agricultural productivity by food groups instead of by single food item using the function "Items aggregated" and selecting the food groups of interest. Data are provided in hectograms per hectare (hg/ha). Where possible it could be useful to analyze trends over time.

▸ Share of arable land equipped for irrigation (percent)[17]

Description

This indicator measures the share of arable land with irrigation equipment over the total arable land.

Data needed (data already calculated)

Data are available through FAOSTAT under the "Food security" section, selecting the "Suite of Food Security indicators" and the item "Percentage of arable land equipped for irrigation (%) (3-year average)".

[17] For more information see the Definitions and Standards section at http://www.fao.org/faostat/en/#data/FS.

Biofortified crops

Biofortified crop variety releases in the country

Description

This is a descriptive indicator of the number of biofortified crops and number of varieties by crop type released.

Data needed

The database is found on the Biofortification Priority Index website by clicking on "Country Pages" and selecting the country of interest. Record the number of crop types where at least one variety has been released and then record the number of varieties of that crop released.

Examples are:

- Ethiopia: 1 Crop (Vitamin A Sweet Potato) – 4 Varieties;
- Nigeria: 3 crops (Vitamin A Cassava – 6 varieties; Vitamin A Sweet Potato – 3 varieties and Vitamin A Maize – 8 varieties).

Environmental footprint

Per capita GHG emissions from agricultural production[18]

Description

This indicator measures the per capita GHG emissions related to agricultural production.

Data needed (data already calculated)

Data are available through FAOSTAT under "Emissions – Agriculture" and by selecting "Agriculture Total." Next steps are to click on the element "Emissions (CO_2eq)," select the function "items aggregated," and then select "Agriculture total (+ Total)." Data are expressed in gigagrams. These data need to be divided by the population number in order to obtain the per capita value. Where possible it could be useful to analyze trends over time.

Environmental footprint

Per capita water use from agricultural production[19]

Description

This indicator measures the per capita water consumption related to agricultural production.

Data needed (data already calculated)

Data are available through AQUASTAT by selecting the category "Water use" and then "Water withdrawal by source," and the variable "Agricultural water withdrawal." Data are expressed in

[18] This indicator is adapted from Gustafson et al., (2016) under "Per Capita Greenhouse Gas (GHG) Emissions".

[19] This indicator is adapted from Gustafson et al., (2016) under "Per Capita Net Freshwater Withdrawals".

109 m^3/yr. These data need to be divided by the population number in order to obtain the per capita value. Where possible it could be useful to analyze trends over time.

Producer equitability

Share of smallholder farmers living below the national poverty line

Description

This indicator measures the share of farmers living below the national poverty line or poverty rate[20]*.*

Data needed (data already calculated)

Data are available through the FAO Smallholder Data Portrait database by clicking on the tab "Income," then under the label "Poverty rate." Data are organized by considering a country-specific farm size threshold (FAO, 2017), which is calculated through a weighted median. The methodology used to classify the farm types in each country is available at the link.

[20] The original indicator is adapted from CGIAR (2015) and was "Income of smallholder farmers and fishing communities with respect to national poverty lines".

4.2 Food storage and distribution

For this subsection, a set of indicators aimed at measuring the food system's storage and distribution infrastructural capacity as a means for reducing food loss along the supply chain was selected. The importance of reducing food loss is twofold: it increases the availability of food for human consumption and reduces the environmental impact (FAO, 2013; HPLE, 2017).

Measures of food loss can also be considered a proxy to understand the actual food storage and distribution capacity. Although methodologies to calculate food loss, such as the FAO Food Loss index, were recently developed, a more extensive monitoring of such data at the country level is currently taking place. However, FAOSTAT provides data on food loss that, although partial[21], are useful to gain an understanding of the amount of food lost during transport and storage. To complement this measure, the food wastage footprint[22] (at the regional level) was also considered.

In this subsection, it is also important to include measures of the food availability dimension in relation to the food supply to assess the contribution of imports, exports, and national production to the supply of nutritious food items.

Measures of the food system's environmental impacts in terms of energy use have been included here for simplicity.

Food loss	▸ Food lost during storage and transportation ▸ Per capita food wastage footprint (per region)
Food self sufficiency	▸ Self-sufficiency (percent)
Food export	▸ Share of total production that is exported (percent)
Food import	▸ Share of annual import of main food items relative to national production (percent)
Environmental footprint	▸ Share of non-renewable energy use (percent)

Food loss

▸ Food lost during storage and transportation

Description

This indicator measures the amount of food lost during storage and transportation.

Data needed (data need to be calculated)

Data are available through the FAOSTAT by selecting "Food balance" under the "Food balance" section and the element "Losses."[23] It is recommended to aggregate food loss data referring to the eight food groups outlined in the FAO (2014) publication (see Annex 2 – Food groups) and to consider the three-year average of the most recent data for each food item. Note that food loss data for calculating the food group "Fish, Seafood and aquatic products" is missing and that data on food loss may be unavailable for some food items. Data are expressed in 1000 tonnes.

[21] More information available here: State-of-play on the Global Food Loss Index to monitor SDG target 12.3.

[22] The food wastage footprint is an estimate of the amount of GHG emissions associated with food loss and waste throughout the food system (FAO, 2013).

[23] For more information see the 'Definitions and standards' section of the Food Balance Sheets at http://www.fao.org/faostat/en/#data/FBSH.

Per capita food wastage footprint (per region)

Description

This indicator measures the per capita food wastage footprint. The food wastage footprint is calculated by considering the amount of food lost along the food system (from production to consumption) and the GHG emissions associated with production and waste (FAO, 2013).

Data needed (data already calculated)

Data are provided at the regional level[24]: for example, Nigeria and Ethiopia belong to the Sub-Saharan Africa region, while Bangladesh and Vietnam to the South and Southeast Asia region. The data are available only at the regional level, rather than national level.

These data are available in the FAO publication "Food wastage footprint & Climate Change" (FAO, 2015) and are expressed in Kg of CO_2.

Food self-sufficiency

Self-sufficiency (percent)

Description

This indicator measures the share of food available in the national supply coming from national production. It is calculated using the self-sufficiency ratio formula[25]:

$$Self\ Sufficiency\ Ratio\ (\%) = \frac{production}{(production + imports - exports)}\ x\ 100$$

Data needed (data need to be calculated)

Timeseries data are available through FAOSTAT, by selecting "Food balances" in the "Food balance" section, and the elements "Production quantity", "Import quantity" and "Export quantity". It is recommended to aggregate production, import and export data considering the three-year average of the most recent data for each item. Data are expressed in 1000 tonnes. It is recommended to calculate the self-sufficiency ratio for fruits and vegetables and other commodities considered to be nationally important dietary risk factors (GBD 2016 Risk Factors Collaborators, 2017). Items to select per food group are outlined in the FAO (2014) publication (see Annex 2 – Food groups).

[24] For more information on the countries included in each region see 'Annex 1' of FAO (2011).

[25] For more information about this indicator see the 'Metadata indicators' section of the FAO (2012) publication.

Food export

Share of total production that is exported (percent)

Description

This indicator measures the percentage of food produced that is exported. For each food group, this indicator is calculated as follows:

$$\textit{Share of exports over production (\%)} = \frac{\textit{Export quantity}}{\textit{Production quantity}} \; x\,100$$

Data needed (data need to be calculated)

Timeseries data are available through FAOSTAT, by selecting "Food balances" in the "Food balance" section, and the 'Elements' "Export quantity" and "Production quantity". It is recommended to aggregate export and production data referring to the eight food groups outlined in the FAO (2014) publication (see Annex 2 – Food groups) and to consider the three-year average of the most recent data for each item. Data are expressed in 1000 tonnes.

Food import

Share of annual import of main food items relative to national production (percent)

Description

This indicator measures the percentage of imported food in relation to the national production. For each food group, this indicator is calculated as follows:

$$\textit{Share of imports over production (\%)} = \frac{\textit{Import quantity}}{\textit{Production quantity}} \; x\,100$$

Data needed (data need to be calculated)

Timeseries data are available through FAOSTAT, by selecting "Food balances" in the "Food balance" section, and the 'Elements' "Import quantity" and "Production quantity". It is recommended to aggregate import and production data referring to the eight food groups outlined in the FAO (2014) publication (see Annex 2 – Food groups) and to consider the three-year average of the most recent data for each item. Data are expressed in 1000 tonnes.

Environmental footprint

Share of non-renewable energy use (percent)

Description

This indicator measures share of non-renewable energy as a proxy for the food system's non-renewable energy use[26]. Although this indicator is overestimating the actual share of energy used by the food system, it can be considered as a proxy measure since there is no other database recording such data (Chaundary et al., 2018).

Data needed

These data are available and can be accessed through the World Bank database by selecting the variable "Renewable energy consumption (% of total final energy consumption)". The complement of this percentage represents the share of non-renewable energy use. Where possible it could be useful to analyze trends over time.

4.3 Food processing and packaging

Food can undergo transformations during processing, which may involve changes in nutrient content (e.g. loss of fibre or addition of nutrients through fortification) and the addition of unhealthy components (e.g. trans fats, salt, sugar). It has proven challenging to find food processing and packaging indicators relevant for LMIC. This is due to the lack of open data sources on the share of processed food available in the food supply (resulting from both national production and imports), including the degree of processing for these products (based on the NOVA classification) and related conservation techniques (packaging), as well as the contribution of SME to the food processing industry and the productivity of this sector.

Therefore, alternative measures were considered, such as the value added of the food and beverage processing sector, as proxy measures for the availability of processed foods in the food supply for the national markets, which is our primary focus, and potentially for international markets.

Similarly, indicators aimed at measuring the demand for ultra-processed food products, such as instant noodles, are useful to capture the extent to which these products are becoming available in the food supply.

Due to the lack of quantitative data on the availability of fortified food, indicators such as the availability of mandatory legislation on food fortification and/or the number of commonly consumed foods that are fortified have been considered as proxy measures.

The Annex section contains the list of additional indicators for which there are no existing/ open access datasets (Annex 1 - Additional indicators).

[26] This indicator is adapted from Gustafson et al., (2016) as cited in Chaundary et al. (2018) under "Per Capita Non-Renewable Energy Use".

Food processing sector	▸ Food and beverage value added as share of agriculture, forestry and fisheries sectors (percent)
Demand for processed foods	▸ Demand for instant noodles (n° of servings per year)
Food fortification	▸ Availability of mandatory legislation on food fortification ▸ Number of commonly consumed foods that are mandatorily fortified
Regulations on processed foods	▸ Availability of mandatory legislation for limiting salt use in food products ▸ Availability of mandatory legislation for removing trans fats in food products

Food processing sector

▸ Food and beverages value added as share of agriculture, forestry and fisheries sectors (percent)

Description

This indicator measures the value added of the food and beverage sector as a share of the agricultural sector value added.

Data needed (data already calculated)

These data are available through FAOSTAT under "Macro Statistics," then "Macro Indicators," and then "Value Added (manufacture of food and beverages)" and the element "Share of Agriculture, Forestry and Fisheries". Where possible it could be useful to analyze trends over time.

Demand for processed foods

▸ Demand for instant noodles (n° of servings per year)

Description

This indicator measures changes in demand for instant noodles and can be considered as a proxy measure for the demand of ultra-processed foods in the countries considered. According to the NOVA classification, instant noodles are considered ultra-processed foods (Monteiro et al., 2018).

Data needed (data already calculated)

Data on the demand for instant noodles per country (expressed in number of servings per year) is available through the World Instant Noodles Association (WINA) website. Data are available from 2014 to 2018.

Food fortification

▸ Availability of mandatory legislation on food fortification

Description

This indicator expresses the availability of mandatory legislation on the fortification of commonly consumed foods. "Yes" or "No" are assigned to each country based on the "availability" or "non-availability" of such policies.

Data needed

This information can be accessed through the Global Fortification Data Exchange database. This database contains all the policies related to the fortification of maize flour, oil, rice, salt, and wheat flour. For example, the fortification of oil (Vitamin A), salt (iodine), and wheat flour (Vitamin B12, A, folate, iron and zinc) are mandatory in Vietnam.

Number of foods that are mandatorily fortified[27]

Description

This indicator measures the number of foods whose fortification is mandatory in the country considered.

Data needed

This information can be accessed through the Global Fortification Data Exchange database. This database contains all policies related to the fortification of commonly consumed foods, such as maize flour, oil, rice, salt, and wheat flour. For example, the fortification of oil (Vitamin A), salt (iodine), and wheat flour (Vitamin B12, A, folate, iron and zinc) are mandatory in Vietnam. The score for mandatorily fortified foods in Vietnam would be three.

Regulations on processed foods

Availability of mandatory legislation for limiting salt in food products

Description

This indicator assesses the availability of mandatory legislation for limiting salt in food products. Country-level descriptions of the type of legislation and the products legislated are provided. For standardization purposes to enable cross-country comparisons, "Yes" or "No" are assigned based on the "availability" or "non-availability" of salt legislation in the country or countries of interest. Users are encouraged to add details on the type of legislation by country of interest described in the database.

Data needed

This information can be accessed through the NOURISHING database, in the section "Improve the nutritional quality of the whole food supply" under the subsection "Mandatory limits on level of salt in food products."

[27] This indicator was proposed by Melesse et al. (2019) under "Fortified food".

Availability of mandatory legislation for removing trans fats in food products

Description

This indicator assesses the availability of legislation for limiting trans-fat content in food products. Country level descriptions of the type of legislation and the products legislated are provided. For standardization purposes to enable cross-country comparisons, "Yes" or "No" are assigned based on the "availability" or "non-availability" of trans fat legislation by country or interest. Users are encouraged to add details on the type of legislation described in the database for each country of interest.

Data needed

This information can be accessed through the NOURISHING database, in the section "Improve the nutritional quality of the whole food supply" under the subsection "Mandatory removal of trans fats in food products."

4.4 Food retail and markets

The retail environment is becoming increasingly formal. According to the FAO definition (2017), "*a market is defined as formal when it is officially and legally recognized. Examples are structured markets, such as district markets, institutional agents (i.e. governmental agencies, cooperatives, NGOs) or who can provide a receipt, like private traders in local markets*".

There is a need to measure smallholder farmers' connectivity to both informal and formal markets (HLPE, 2017). In this regard, measures of the share of smallholders selling their products to local and formal markets, and the availability of policies supporting public procurement from local farmers, are considered as proxy measures for smallholders' integration into market systems.

For this subsection, two indicators which describe smallholder farmers' connectivity to formal markets and local markets were selected, and one indicator on policies that support public procurement.

While it is important to consider measures of food waste in the food retail and markets sector, data on food waste are currently not available for the food retail and market sector and methodologies to measure it, such as the Food Waste Index[28], are currently under development.

There are many other indicators that could be used, including those aimed at measuring both the density and types of food outlets, and the income of family-owned SMEs relative to the national poverty line. While these cannot be calculated with existing data, some examples have been included in Annex 1 section (Additional indicators).

Market access	▸ Share of households selling crops through formal channels (percent) ▸ Share of households selling crops in the local markets (percent)
Policies	▸ Availability of policies supporting public procurement

[28] For more information see "Sub-Indicator 12.3.1.b" available at: http://www.fao.org/sustainable-development-goals/indicators/1231/en/.

Market access

Share of households selling crops through formal channels (percent)

Description

This indicator measures the share of households with access to formal markets[29] to sell their produce and can be considered as a proxy measure for market access.

Data needed (data already calculated)

Data are available through the FAO Smallholder Data Portrait database by clicking on "Crop Market" and the variable "% of households selling crops through formal channels." Data are provided by farm type (smaller farm, other farm) and at the national level. The methodology used to classify the farm types in each country is available at the link.

Share of households selling crops in the local markets (percent)

Description

This indicator measures the share of households having access to local markets[30] to sell their produce and can be considered as a proxy measure for market access.

Data needed (data already calculated)

Data are available through the FAO Smallholder Data Portrait database by clicking "Crop Market" and selecting the variable "% of households selling crops in the local markets." Data are provided by farm type (smaller farm, other farm) and at the national level. The methodology used to classify the farm types in each country is available at the link.

Availability of policies supporting public procurement from local farmers

Description

This indicator assesses the availability of policies supporting the public procurement of food from local farmers. Country and sub-national level descriptions of the type of support to local farmers are provided. For standardization purposes to enable cross-country comparisons, "Yes" or "No" are assigned based on the "availability" or "non-availability" of legislation in place to support farmers in each country of interest. Users are encouraged to add details on the type of legislation described in the database for each country of interest.

Data needed

This information can be accessed through the NOURISHING database in the section "Harness supply chain & actions across sectors to ensure coherence with health" under the subsection "Public procurement through 'short' chains (e.g. local farmers)". Currently, Brazil and the US (New York City) have implemented policies to support public procurement.

[29] For more information see FAO (2017).

[30] For more information see FAO (2017).

DRIVERS

5

5. DRIVERS

Taking a food systems approach has received increased attention as a conceptual tool to understand the underlying drivers of food and nutrition outcomes. Hence, the list of indicators compiled in this section draw heavily upon the HLPE conceptual framework of food systems for diets and nutrition (HLPE, 2017).

According to this framework, a food systems approach considers enabling innovations and interactions among the food supply chains, food environments, consumer behaviour, and corresponding drivers. This framework helps capture the synergies and trade-offs among various components of the food system. Food system dynamics affect human and planetary health and influence producers' decisions and consumers' food choices. The HLPE identified five main sub-components of 'drivers' of food systems that influence diets and nutrition outcomes:

1. Biophysical and environmental
2. Innovation, technology and infrastructure
3. Political and economic
4. Socio-cultural
5. Demographic

The feedback linkage from nutrition and health outcomes to food systems drivers completes the food system circle. The feedback effect of diets on the main drivers also influences their effect on policies.

Data on indicators of food systems drivers are becoming increasingly available, with recent advances in collecting large household and community-level surveys. Notable among these are the LSMS-Integrated Surveys on Agriculture (LSMS-ISA) in several countries, implemented by national statistics offices in collaboration with the World Bank and their partners. In addition, geospatial indicators, including simple measures of distance, climatology, soil and terrain, and other environmental factors, are increasingly available, along with household and community-level data. Prior studies highlighted general ideas for relevant indicators (Gebru et al., 2018; Maziya-Dixon, in press). A summary of the main drivers of food systems and some of corresponding indicators with available data follows.

5.1 Biophysical and environmental drivers

For this subsection, a set of indicators aimed at measuring the biophysical and environmental conditions driving agricultural production was selected. Indeed, agricultural production is determined by soil quality and challenged by increased climate variability (inter-annual changes in precipitation and average temperature), including the rise in number of severe weather events (HPLE, 2017). Based on the availability of data for further analysis, additional indicators are suggested in Annex 1 section (Additional indicators).

Land use	▸ Share of land used for agriculture (percent)
Climate change – Rainfall and Temperature variability	▸ Precipitation variability (coefficient of variation) ▸ Annual average change in temperature

Land use

Share of land used for agriculture (percent)

Description

This indicator measures the percentage of land used for agriculture over the total land area[31]*.*

Data needed

Data can be accessed through FAOSTAT under "Agri-Environmental Indicators" and "Land Use indicators," then "Agricultural land" and "Share in land area." It is recommended to consider a 10-year reference period of the most recent data to analyze trends over time.

Climate change – Rainfall and Temperature variability

Precipitation variability

Description

This indicator measures the variability of precipitation by country. The coefficient of variation is a measure of the precipitation variability. The methodology to calculate the coefficient of variation[32] *is available at this link*[33]*.*

Data needed (data need to be calculated)

Data can be accessed through the World Bank Climate Change Knowledge portal by selecting the variable "Rainfall" and the reference period of interest. Data are available from 1901 to 2016. It is recommended to consider at least 25 years of the most recent data as a reference period for this analysis. A coefficient of variation lower than 20 percent indicates a low variability, between 20 and 30 percent a moderate variability, and higher than 30 percent indicates a high variability (Hare, 2003 as cited in Addisu et al., 2015).

Annual average change in temperature

Description

This indicator measures the average change in surface temperature[34] *by country.*

Data needed (data already calculated)

Data on mean annual temperature change can be accessed through FAOSTAT by selecting the "Temperature change" domain in the "Agri-Environmental Indicators" section, and the element "Temperature change." It is recommended to consider the annual mean temperature change by selecting the item "Meteorological year" to calculate the average temperature change over the years and considering at least 25 years as a reference period.

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31 For more information see the 'Definitions and standards' section at http://www.fao.org/faostat/en/#data/EL.

32 Depending on data availability, it would be recommended to calculate coefficient of variation (CV) at the subnational level, due to the differences in inter-annual variability across different climatic zones/regions.

33 San Francisco State University (n.d.). Measures of Temporal Precipitation Variability. Retrieved January 31, 2020, from: http://tornado.sfsu.edu/geosciences/classes/m356/RainfallVariability/TempVar.htm.

34 Depending on data availability, calculating changes in mean annual temperature at the subnational level is recommended, due to the differences in inter-annual variability across different climatic zones/regions.

5.2 Innovation, technology and infrastructure drivers

For this subsection, a set of indicators aimed at measuring innovation, technology, and infrastructure drivers of the food system was selected. These drivers range from yield-enhancing technologies to infrastructure and innovations that facilitate distribution, trade, availability, nutrient content, and safety of foods, and shape consumer behaviour through ways in which food becomes available and marketed.

Access to internet	▸ Share of population with access to internet (percent)
Innovation	▸ Agriculture, forestry, and fishing, value added per worker (constant 2010 US$)
Infrastructure	▸ Share of households with access to mobile phone (percent) ▸ Road density (Ratio of length of road network to land area) ▸ Freight transport (e.g. density of railway network– total route in km per 100 square km of land area) ▸ Share of households with access to cold storage (percent) ▸ Share of population with access to clean water (percent) ▸ Share of population with access to improved sanitation (percent)

Access to internet

▸ Share of population with access to internet (percent)

Description

This indicator measures the percentage of the population with internet access.

Data needed (data already calculated)

Data can be accessed through the World Bank database under "Individuals using the Internet (% of population)" for each country.

Innovation

▸ Agriculture, forestry, and fishing, value added per worker (constant 2010 US$)

Description

This indicator measures the value added per worker in the agriculture, forestry, and fishery sectors. This indicator can be considered as a measure of labour productivity, which is assumed to increase through innovation and technology investments in these sectors[35].

Data needed (data already calculated)

Data can be accessed through the World Bank database under "Agriculture, forestry, and fishing, value added per worker (constant 2010 US$)."

[35] More information about this indicator can be found in the 'Details' section of the World Bank Database available at: https://data.worldbank.org/indicator/NV.AGR.EMPL.KD.

Infrastructure

Share of households with access to mobile phones (percent)

Description

This indicator measures the percentage of the population with access to mobile phones.

Data needed (data already calculated)

Data on the percentage of households owning a mobile phone are provided in the Demographic and Health Surveys data repository by clicking "Choose an indicator" and then the category "Household characteristics," the subcategory "Households effects," and the variable "Households possessing a mobile telephone."

Road density (Ratio of length of road network to land area)

Description

This indicator measures the density of the road network and can be considered as a proxy indicator for the country's infrastructural capacity.

Data needed (data already calculated)

Data are provided by FAO under the indicator "Road density (per 100 square km of land area)" and are available through the Land Portal website. It should be noted that data are updated to 2011 and this indicator was listed under the FAO "Suite of Food Security Indicators".

Freight transport (e.g. density of railway network – total route in km per 100 square km of land area)

Description

This indicator measures the density of the railway network and can be considered as a proxy indicator for the country's infrastructural capacity.

Data needed (data already calculated)

Data on the density of the railway network per country[36] are available through FAOSTAT under the "Food security" section, selecting the "Suite of Food Security Indicators" and the "Rail lines density (total route in km per 100 square km of land area)" indicator.

[36] In case data are not available for a specific country, it can be calculated by using data on the total length of railway network (Km) and the total surface area (Km^2), which can be accessed through the World Bank database variables "Surface area (sq. km)" and "Rail lines (total route-km)."

Share of households with access to cold storage (percent)

Description

This indicator measures household access to cold storage facilities (refrigerator), allowing for the preservation of perishable foods.

Data needed (data already calculated)

Data on the percentage of households owning a refrigerator are available in the Demographic and Health Surveys data repository by clicking "Choose an indicator" and then the category "Household characteristics," the subcategory "Households effects," and the variable "Households possessing a refrigerator." It is assumed that households investing in refrigerators have access to electricity all year round.

Share of population with access to clean water (percent)

Description

This indicator measures the percentage of the population with access to clean water.

Data needed (data already calculated)

Data are available through the Demographic and Health Surveys data repository by clicking on "Choose an indicator" and then the category "Water and sanitation," the subcategory "Population" and the variable "Population living in households using an improved water source."

Share of population with access to improved sanitation (percent)

Description

This indicator measures the percentage of the population with access to improved sanitation services.

Data needed (data already calculated)

Data are available through the Demographic and Health Surveys data repository by clicking on "Choose an indicator" and then the category "Water and sanitation," the subcategories "Type of toilet/latrine facility" and "Population," and the variable "Population living in households with improved, non-shared toilet facilities."

5.3 Political and economic drivers

Policies are shaped by political processes, social norms, and institutional actions. These policies influence key drivers of food systems. Changes in food systems may have a feedback effect on existing policies. Policies with direct influence on food systems and nutritional and health outcomes in the population may include policies on food, agriculture, and trade.

For this subsection, a set of indicators aimed at assessing the political and economic drivers of the food system was selected. These include indicators of the macroeconomic performance, indicators of the trade of food commodities of health and nutrition importance, indicators of the business climate which are directly linked to the economic performance, and policies aimed at promoting positive nutrition outcomes.

Macroeconomic performance	▸ GDP growth (annual percent) ▸ Composition of GDP growth (percent) ▸ Income inequality (GINI index)
Trade	▸ Import dependency (percent)
Business climate	▸ Ease of doing business ▸ Corruption Perception Index
Policy environment	▸ Availability of legislation on the taxation of unhealthy food products ▸ Availability of policies supporting the voluntary taxation of unhealthy food products ▸ Availability of legislation discouraging the import of unhealthy food ▸ Availability of legislation promoting the import of healthy food ▸ Availability of legislation promoting the purchase of healthy food (subsidies)

MACROECONOMIC PERFORMANCE

▸ GDP growth (annual percent)

Description

This indicator measures the growth rate of the Gross Domestic Product (GDP).

Data needed (data already calculated)

Data are available through the World Bank database under "GDP growth (annual %)." Where possible it could be useful to analyze trends over time.

▸ Composition of GDP growth (percent)

Description

This indicator measures the contribution of each production sector (Agriculture, Industry, Manufacturing, and Services) to the GDP.

Data needed (data already calculated)

Data available through the World Bank database under the "World Development Indicators" by selecting "Structure of output."

Where possible it could be useful to analyze trends over time.

Income inequality (GINI index)

Description

This indicator measures the inequality of income distribution. The GINI index can be used as a measure of income inequality within the country. The index ranges from 0 to 100, where 0 indicates "inequality" and 100 indicates "equality[37]*".*

Data needed (data already calculated)

Data are available through the World Bank database under "GINI index (World Bank estimate)."

Trade

Import dependency (percent)

Description

This indicator measures the share of food available in the national supply that is imported. It is calculated through the Import Dependency Ratio (IDR) formula[38]:

$$Import\ Dependency\ Ratio\ (\%) = \frac{imports}{(production + imports - exports)}\ x\ 100$$

Data needed

Timeseries data are available through FAOSTAT, by selecting "Food balances" in the "Food balance" section, and the elements "Import quantity", "Production quantity" and "Export quantity". It is recommended to aggregate production, import and export data considering the three-year average of the most recent data for each item. Data are expressed in 1000 tonnes. It is recommended to calculate the import dependency ratio for fruits and vegetables and other commodities considered nationally important dietary risk factors (GBD Risk Factors Collaborators, 2016). Items to select per food group are outlined in the FAO (2014) publication (see Annex 2 – Food groups).

Business climate

Ease of doing business

Description

This indicator measures the "easiness" of establishing a new business in a given country.

Data needed (data already calculated)

The World Bank developed a methodology for assessing how accessible this is from a regulatory point of view (World Bank, 2020). Each country is given a score, based on the evaluation of selected indicators, which is used to produce the country rankings. The

[37] The definition of the 'GINI index' can be retrieved from the 'Details' section of the World Bank Database available at https://data.worldbank.org/indicator/NV.AGR.EMPL.KD.

[38] For more information about this indicator see the 'Metadata indicators' section of the FAO (2012) publication.

methodology used to calculate the score and to interpret results is available at this link. Data can be accessed through the Doing Business website.

Corruption Perception Index

Description

This indicator can be used as a proxy measure of the corruption level in a given country.

Data needed (data already calculated)

The Corruption Perception Index measures the degree to which corruption is perceived in each country's public sector. Each country is given a score from 0 to 100, where the higher the score, the lower the corruption level (Transparency International, 2018). The methodology used to calculate the score and to interpret results is available at this link. Data can be accessed through the Transparency International website.

Policy environment

Availability of legislation on the taxation of unhealthy food products

Description

This indicator assesses the availability of legislation on the taxation of unhealthy food products (e.g. soft drinks). Country level descriptions of the type of legislation are provided. For standardization purposes to enable cross-country comparisons, "Yes" or "No" are assigned based on the "availability" or "non-availability" of legislation in the countries of interest. Users are encouraged to add details on the type of legislation described in the database for each country of interest.

Data needed

This information can be accessed through the NOURISHING database in the section "Use economic tools to address food affordability and purchase incentives" and the subsection "Health-related food taxes."

Availability of policies supporting the voluntary taxation of unhealthy food products

Description

This indicator assesses the availability of policies promoting the voluntary taxation of unhealthy food products (e.g. soft drinks). Country-level descriptions of the type of legislation are provided. For standardization purposes to enable cross-country comparisons, "Yes" or "No" are assigned based on the "availability" or "non-availability" of legislation for each country of interest. Users are encouraged to add details on the type of legislation described in the database for each country of interest.

Data needed

This information can be accessed through the NOURISHING database in the section "Use economic tools to address food affordability and purchase incentives" and the subsection "Voluntary health-related food taxes."

Availability of legislation discouraging the import of unhealthy food

Description

This indicator assesses the availability of legislation aimed at discouraging the import of unhealthy food through increased import tariffs. Country-level descriptions of the type of legislation are provided. For standardization purposes to enable cross-country comparisons, "Yes" or "No" are assigned based on the "availability" or "non-availability" of legislation for each country of interest. Users are encouraged to add details on the type of legislation described in the database for each country of interest.

Data needed

This information can be accessed through the NOURISHING database in the section "Use economic tools to address food affordability and purchase incentives" and the subsection "Increasing import tariffs on specified "unhealthy" food."

Availability of legislation promoting the import of healthy food

Description

This indicator assesses the availability of legislation promoting the import of healthy food through decreased import tariffs. Country-level descriptions of the type of legislation are provided. For standardization purposes to enable cross-country comparisons, "Yes" or "No" are assigned based on the "availability" or "non-availability" of legislation for each country of interest. Users are encouraged to add details on the type of legislation described in the database for each country of interest.

Data needed

This information can be accessed through the NOURISHING database in the section "Use economic tools to address food affordability and purchase incentives" and the subsection "Lowering import tariffs on specified "healthy" food."

Availability of legislation promoting the purchase of healthy food (subsidies)

Description

This indicator assesses the availability of legislation promoting the purchase of healthy foods using subsidies. Country-level descriptions of the type of legislation are provided. For standardization purposes to enable cross-country comparisons, "Yes" or "No" are assigned based on the "availability" or "non-availability" of legislation for each country of interest. Users are encouraged to add details on the type of legislation described in the database for each country of interest.

Data needed

This information can be accessed through the NOURISHING database in the section "Use economic tools to address food affordability and purchase incentives" and the subsection "Targeted subsidies for healthy food."

5.4 Socio-cultural drivers

The key food systems drivers that influence diets and nutrition outcomes have both macro- and micro-dimensions. However, socio-cultural drivers tend to have more micro- and context-specific dimensions. These are often examined in micro-level studies that attempt to understand the link between diets and nutrition outcomes and consumer behaviour. Some of these micro-indicators are reflected along with macro-indicators in the following two tables.

To measure these drivers, indicators aimed at capturing gender dynamics, the education attainment in the population, the religious composition and type of land tenure arrangements, were selected.

Gender equality	▸ Global Gender Gap Index
Education	▸ Average education attainment in population (average years of education by gender)
Religious composition	▸ Distribution of population across major religions (percent)
Land tenure	▸ Type of land tenure arrangement (percent)

Gender equality

▸ Global Gender Gap Index

Description

This indicator is a measure of the gender-based disparities in a given country.

Data needed (data already calculated)

The Global Gender Gap Index (GGGI) is aimed at measuring such disparities based on the evaluation of several indicators. Each country is given a score from 0 to 1, respectively representing "disparity" and "parity" (World Economic Forum, 2018). The latest Global Gender Gap Index report[39] was published in 2018 and can be accessed on the World Economic Forum website.

Education

▸ Average education attainment in population (average years of education by gender)

Description

This indicator measures the average education attainment in the population by gender.

[39] Annual reports are available since 2006 and can be found by searching on the World Economic website, allowing for the analysis of trends over time.

Data needed (data already calculated)

Data are available through the Demographic and Health Surveys data repository by clicking on "Choose an indicator," and then the category "Education," the subcategory "Educational attainment of household population," and the variables "Median number of years of education: Female" and "Median number of years of education: Male."

Religious composition

Distribution of population across major religions (percent)

Description

This indicator measures the percentage of the population distributed across major religions to capture the main diet-related restrictions in a given country.

Data needed (data already calculated)

The Global Religious Landscape provides estimated data on the percentage of the population belonging to major religions within each country. Data are provided in the table "Religious composition by country" available through this link.

Land tenure

Type of land tenure arrangement (percent)

Description

This indicator measures the percentage of landholdings under different types of land tenure arrangements. Due to the differences in the methodology used to assess land tenure in each country, country comparisons should be avoided. However, this indicator may be useful to gain an understanding of the land tenure situation within each country.

Data needed (data already calculated)

This information is available in the LSMS country reports under different categories. For example, the Nigeria LSMS report (2015/2016) provides data on the percentage of plots under "Outright purchase" or "Rented" or "Used free of charge" and other categories, whereas the Vietnam Household Living Standards Survey (2004, 2008, and 2014) provides data on the share of land under "use right certificates."

5.5 Demographic drivers

For this subsection, a set of indicators aimed at measuring demographic drivers was selected, including changes in the population and variations in demography, such as dependency ratios. The latter aims to capture labour force potential in the economy and possibly the demand for food and nutrients. According to the HLPE (2017), it would also be important to consider variations in the rural and urban populations, as well as the number of persons who have been forcibly displaced within the country.

Population growth	▸ Population growth (annual percent)
Changing age distribution	▸ Dependency ratios (percent)
Urbanization	▸ Changes in rural population (percent) ▸ Changes in urban population (percent)
Forced displacement	▸ Number of forcibly displaced people

Population growth

▸ Population growth (annual percent)

Description

This indicator measures the percentage of population growth.

Data needed (data already calculated)

Data can be accessed through the World Bank database under "Population growth (annual %)" for each country. Where possible it could be useful to analyze trends over time.

Changing age distribution

▸ Dependency ratios (percent)

Description

This indicator measures the percentage of population distributed by age groups.

Data needed (data already calculated)

Data can be accessed through the World Bank database under the "World Development Indicators" under "Population dynamics". It is recommended to consider the age segments "Population ages 0-14 (% of total)," "Population ages 15-64 (% of total)," and "Population ages 65 and above, total". Where possible it could be useful to analyze trends over time.

Urbanization

Changes in rural population (percent)

Description

This indicator measures the changes in population living in rural areas.

Data needed (data already calculated)

Data are available through the World Bank database under "Rural population." Where possible it could be useful to analyze trends over time.

Changes in urban population (percent)

Description

This indicator measures the changes in population living in urban areas.

Data needed (data already calculated)

Data are available through the World Bank database under "Urban population." Where possible it could be useful to analyze trends over time.

Forced displacement

Number of internally displaced people

Description

This indicator measures the number of internally-displaced people[40] in each country.

Data needed (data already calculated)

Data are available through the UNHCR Population Statistics database by selecting the variable "Internally Displaced Persons (IDPs)." Where possible it could be useful to analyze trends over time.

[40] More information and definition available here: http://popstats.unhcr.org/en/overview.

ANNEXES

ANNEX 1

Additional indicators recommended by the team of authors are below. The indicators that are not provided with a reference have been suggested by the authors.

2. CONSUMER BEHAVIOUR		
2.1 Knowledge, attitudes and motives		
Sub-component	**Indicator**	**Reference**
Knowledge	Share of population that is aware of Food Based Dietary Guidelines (FBDGs) (percent)	Marías & Glasauer (2014)
Attitudes/Motives	Share of population that states health as a primary motive for their food choice (percent)	Adapted from Marías & Glasauer (2014)
2.2 Practices		
Sub-component	**Indicator**	**Reference**
Time available for cooking	Time allocated toward food preparation	Authors' suggestion

3. FOOD ENVIRONMENT		
3.1 Food availability and physical access		
Sub-component	**Indicator**	**Reference**
Recommended food groups available in the supply	Food supply adequacy of fish	Contributor's suggestion
Physical access to markets	Average distance to main market selling fruit, vegetables, whole grains, nuts/seeds, milk	Authors' suggestion
	Distance to fisheries (GPS coordinates)	Contributor's suggestion
3.2 Food prices and affordability		
Sub-component	**Indicator**	**Reference**
Cost of a food basket	Cost of a nutritious food basket[41]	Ministry of Health Promotion (2010) (Nutritious Food Basket)
	Cost associated with different diets	Save the Children (2017) (Cost of Diet tool - CoD)
	Daily cost of consuming a recommended diet	Herforth et al. (2019) (Cost of Recommended Diet – CoRD)
	Cost of a diverse diet	Masters et al. (2018) (Cost of Diet Diversity – CoDD)
	Cost of meeting nutrient adequacy	Masters et al. (2018) (Cost of Nutrient Adequacy – CoNA)
3.4 Promotion, advertising and information		
Sub-component	**Indicator**	**Reference**
	Policies to reduce the impact on children of marketing of foods and non-alcoholic beverages high in saturated fats, trans fatty acids, free sugars, or salt	WHO, online. Available from http://www9.who.int/nmh/ncd-tools/indicator23/en/

[41] Further information available at: http://proof.utoronto.ca/resources/the-nutritious-food-basket/.

3.5 Food quality and safety		
Sub-component	**Indicator**	**Reference**
	Legislation provides all the technical provisions necessary to implement food control activities and achieve the overarching objectives set in the food safety and quality policy.	FAO and WHO. 2019. *Food control system assessment tool: Introduction and glossary*. Food safety and quality series No. 7/1. Rome. License: CC BY-NC-SA 3.0 IGO.
	Surveillance systems in place for the detection and monitoring of foodborne diseases and food contamination	WHO. (2018). Joint external evaluation tool: International health regulations (2005).
	Mechanisms are established and functioning for the response and management of food safety emergencies	WHO (2018). Joint external evaluation tool: International health regulations (2005).

4. FOOD SUPPLY CHAINS		
4.1 Food production		
Sub-component	**Indicator**	**Reference**
Food production diversity	Shannon Diversity Index for production	Gustafson et al., (2016); Remans et al., (2014)
Producer equitability	Income of smallholder farmers and fishing communities relative to national poverty lines	CGIAR (2015)
4.2 Food storage and distribution		
Sub-component	**Indicator**	**Reference**
Food loss	Food Loss Percentage (FLP)	FAO (2018)
	Country, Food Loss Index (FLI)	FAO (2018)
4.3 Food processing and packaging		
Sub-component	**Indicator**	**Reference**
Productivity of the food chain	Total factor productivity of the food chain beyond the farm gate, overall and relative to wider economy	DEFRA (2013)
Level of participation of SMEs in food processing	Small & medium enterprises in the food sector	Melesse et al. (2019)
	Ratio of key foods processed by SMEs relative to large businesses (% total annual volume by sector)	Authors' suggestion
Share of processed foods	Per capita sales (in Kg or L) of ultra-processed food products	Baker & Friel (2016)
	Distribution share (%) of processed foods through modern grocery retail channels	Baker & Friel (2016)
4.4 Food retail and markets		
Sub-component	**Indicator**	**Reference**
Food waste	Food Waste Index (FWI)[42]	Authors' suggestion
Retail density and diversity	Number and type of food outlet per surface area	Authors' suggestion
	Retail Diversity Index	Babey et al. (2008)
SME equitability (retail)	Income of family-owned SMEs at markets and stores relative to national poverty lines	Adapted from CGIAR (2015)

[42] New index for future use under development by UNEP. Sub-Indicator 12.3.1.b, http://www.fao.org/sustainable-development-goals/indicators/1231/en/.

5. DRIVERS

5.1 Biophysical and environmental drivers

Sub-component	Indicator	Reference
Climate change impact - trend	Crop yield change (%) – of main crops	Ray et al. (2019)[43]
Climate change impact - variability	Crop yield change (%) – yield variability	Ray et al. (2019)
Soil fertility	Soil organic carbon content	FAO (2019)[44]
	Toxicity, excess salts (categorical scale) Rooting conditions and oxygen availability to roots (categorical scale)	FAO/IIASA/ISRIC/ISSCAS/JRC (2012)
Environmental outcomes	Enhanced vegetation index (EVI): • Average EVI in day of year 1-356 • Average EVI value at peak of greenness • Average total change in greenness within main growing season	Mann, Dinku & Greatrex (2014)
Natural disasters and severe weather events	Number of natural disasters per year over 10-year period	EM-DAT database (1) (Data access upon request)

5.2 Innovation, technology and infrastructure drivers

Sub-component	Indicator	Reference
Technological change – impact	Improved yield (% change) – of main crops	World Bank (1)
Infrastructure	Problems in accessing health care: Distance to health facilities	DHS (1)

5.3 Political and economic drivers

Sub-component	Indicator	Reference
Trade	Cereal import dependency ratio (percent) (3-year average)	FAOSTAT (1)
	Value of food imports in total merchandise exports (percent) (3-year average)	FAOSTAT (2)
	Political stability and absence of violence/terrorism (index)	FAOSTAT (3)

5.4 Socio-cultural drivers

Sub-component	Indicator	Reference
Gender parity in intra-household decision making	Married women participating in all three reported decisions	DHS (2)

5.5 Demographic drivers

Sub-component	Indicator	Reference
Urbanization	Urban population growth (annual %)	World Bank (2)

[43] Ray et al. (2019) provides a list of databases per country to calculate this indicator. These data may also be retrieved from country statistical offices.

[44] It should be noted that data can be retrieved selecting on the map the area of interest (FAO, 2019).

ANNEX 2

Food groups

The following categorization of food groups is provided in the FAO "Food and Nutrition in numbers 2014" publication (FAO, 2014)[45]. This information is provided in the "Definitions" section and includes a list of the specific 'items' that need to be selected in FAOSTAT to adequately cover each of the food groups.

Table 7: Items to select by food group

Food group	Items to select
Milk	Milk - Excluding butter
Meat and offal	Bovine meat, mutton and goat meat, pig meat, poultry meat, other meat, and edible offal.
Fish, seafood and aquatic products	Freshwater fish, demersal fish, pelagic fish, other marine fish, crustaceans, cephalopods, other mollusks, other aquatic animals and aquatic plants
Cereals, excluding beer	Wheat and products, rice (milled equivalent), barley and products, maize and products, rye and products, oats, millet and products, sorghum and products, and other cereals
Starchy roots	Cassava and products, potatoes and products, sweet potatoes, and other roots
Sugar and sweeteners	Sugar (raw equivalent), other sweeteners, and honey
Fruit, excluding wine	Oranges, mandarins, lemons, limes and products, grapefruit and products, other citrus, bananas, plantains, apples and products, pineapples and products, dates, grapes and products, and other fruit
Vegetables	Tomatoes and products, onions, and other vegetables
Additional food groups of interest	
Pulses	Beans, peas, and other pulses and products

[45] FAO (2014). Food and nutrition in numbers 2014. Food and Agriculture Organization of the United Nations (FAO). Rome, Italy. Retrieved from: http://www.fao.org/3/a-i4175e.pdf.

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