



universität
wien

MASTERARBEIT / MASTER'S THESIS

Titel der Masterarbeit / Title of the Master's Thesis

“Policy recommendations for the promotion of
sustainable and healthy diets: a review”

verfasst von / submitted by

Camila Rauchwerger MSc

angestrebter akademischer Grad / in partial fulfilment of the requirements for the degree of
Master of Arts (MA)

Wien, 2023 / Vienna 2023

Studienkennzahl lt. Studienblatt /
degree programme code as it appears on
the student record sheet:

UA 066 824

Studienrichtung lt. Studienblatt /
degree programme as it appears on
the student record sheet:

Masterstudium
Politikwissenschaft

Betreut von / Supervisor:

Univ. Prof. Mag. Dr. Barbara Prainsack

ACKNOWLEDGEMENTS

I am thankful to everyone who has supported me during the process of writing this thesis. Primarily, I am grateful to my supervisor Univ.-Prof. Mag. Dr. Prainsack, who guided me with invaluable feedback while granting me enough flexibility to shape my research approach to the topic.

My deepest gratitude goes to Isa and Alex, who have remained by my side and supported me throughout the process of writing this thesis.

Thank you.

STATUTORY DECLARATION

I hereby declare to have written this master's thesis entitled "A review of policies for the promotion of sustainable and healthy diets" on my own, without having used other references and resources than the ones quoted. Thoughts from other resources having been integrated directly or indirectly into this thesis have been indicated as such. This thesis or parts of it have not yet been published or used in academic assessments.

Table of Content

List of Figures.....	9
List of Tables.....	10
List of Abbreviations	11
1. Introduction.....	15
2. Research Question.....	17
3. State of the Art on Policy Recommendations for Sustainable and Healthy Diets	17
4. Conceptual Framework: The Food Environment.....	19
4.1. The Food Environment: Part of the Food System.....	19
4.2. Modelling The Food Environment.....	22
4.2.1. The Latest Food Environment Model.....	24
4.3. The Food-EPI Model: An Update	27
5. Problems with our Current Food Systems	29
5.1. The impact of our food system on the environment.....	30
5.2. The impact of our food system on public health.....	35
5.3. The importance of changing today's food environments.....	38
6. The potential of sustainable and healthy diets	42
7. Methods.....	49
8. Results: Policy Recommendations to Promote the Adoption of Sustainable and Healthy diets ..	53
8.1. Policy domains	53
8.1.1. Food Retail.....	53
8.1.2. Food Pricing.....	57
8.1.3. Food Composition.....	64
8.1.4. Food Labelling.....	65
8.1.5. Food Promotion	67
8.1.6. Food Provision	69
8.1.7. Food in Trade and Investment Agreements.....	71
8.1.8. Food Education	75
8.2. Infrastructure Support Domains	79
8.2.1. Leadership.....	79

8.2.2.	Governance	82
8.2.3.	Monitoring and Intelligence.....	84
8.2.4.	Platforms for Interaction.....	88
8.2.5.	Funding and Resources.....	89
8.2.6.	Workforce development.....	90
8.2.7.	Health-and-sustainability-in-all Policies.....	91
9.	Discussion	95
10.	Limitations of this study	102
11.	Literature.....	104
Appendix 1: Abstracts		113
Appendix 2: Overview of all policy recommendations		114

List of Figures

Figure 1 Conceptual framework of food systems for diets and nutrition	20
Figure 2 Overview of the conceptual framework of the food environment from Turner et al. (2018) depicting the food environment as the interface connecting the food supply chains and consumer behavior	24
Figure 3 Environmental effects per serving of food produced for the impact categories: greenhouse gas emissions, land use, energy use, acidification potential, and eutrophication potential	32
Figure 4 Greenhouse gas emissions across the supply chain of different foods.....	34
Figure 5 Avoided deaths through dietary change	44
Figure 6 Diet-related GHG emissions in 2030 by diet type and food group	45
Figure 7 Illustration of methodological proceeding of study based on the 2009 PRISMA Flow Diagram	51

List of Tables

Table 1. Policy domains and infrastructure support domains from the Healthy Food Environment Policy Index model developed by the International Network for Food and Obesity/Non-Communicable Diseases Research, Monitoring and Action Support (INFORMAS) by Swinburn et al. (2013).....	28
Table 2 List of policy recommendation reports from international organizations and research institutes included in the analysis of this thesis	51
Table 3 Overview of the 15 categories (eight policy and seven infrastructure support domains) used for the analysis of the policy recommendation reports for this thesis	52

List of Abbreviations

ASF	Animal-sourced food
ATNI	Access to Nutrition Initiative
BMK	Benchmark
CAP	Common Agriculture Policy
CO ₂ e	CO ₂ equivalent
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
Food-EPI	Food Environment Policy Index
FBDG	Food-based dietary guideline
F2FS	Farm to Fork Strategy
GBD	Global Burden of Disease
GHG	Greenhouse gas
GPAFSN	Global Panel on Agriculture and Food Systems for Nutrition
HLPE	High Level Panel of Experts on Food Security and Nutrition
HSF	Healthy and sustainable food
INFORMAS	International Network for Food and Obesity / Non-communicable Diseases (NCDs) Research, Monitoring and Action Support
ICN2	Second International Conference on Nutrition
IPCC	Intergovernmental Panel on Climate Change
NAMA	Nationally Appropriate Mitigation Action
NAP	National Adaptation Plan
NCD	Non-communicable diseases
NDC	Nationally Determined Contributions
NGO	Non-governmental organization
R&D	Research and development
SHD	Sustainable and healthy diet
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations International Children's Emergency Fund
UNSCN	United Nations System Standing Committee on Nutrition
WFP	World Food Programme
WHO	World Health Organization
WTO	World Trade Organization

1. Introduction

The changes the global food system has undergone in the last century have made the system more efficient and productive than ever. This has led to a significant decrease in world hunger rates in the last 50 years (World Bank, n.d.), but the food systems are also contributing to a worldwide epidemic of obesity and non-communicable diseases (NCDs). The causes of this epidemic are multiple, but the growing global shift toward unhealthy diets that are dense in calories, heavily processed, and abundant in animal-based foods has been identified as a leading contributor (Willet et al., 2019). Today, one in three people worldwide suffers from some form of malnutrition, due to hunger, micronutrient deficiencies or overweight and NCDs (FAO & WHO, 2019), such as cardiovascular diseases and cancer. NCDs are today's main cause of death worldwide (Ritchie & Roser, 2019). Furthermore, the global food system is also the biggest driver of anthropogenic environmental degradation and a significant contributor to the climate crisis, emitting 19-29% of all anthropogenic global greenhouse gas (GHG) emissions. This is primarily due to the food systems' heavy reliance on animal-sourced foods (UNSCN, 2017, p. 3). Reforming the food system is certainly one of the greatest challenges of our time and will require unprecedented levels of global commitment.

Following up on current trends in population growth and, most significantly, on diet shifts, the Food and Agriculture Association (FAO) expects a 'food gap' of 70% by 2050, especially as global demand for animal-sourced foods (ASF) is expected to increase by 80% between 2006 and 2050 (Ranganathan et al., 2016, pp. 2–3). This development is especially problematic as the growing prevalence of NCDs has been linked to excessive consumption of not only ultra-processed foods but also to that of some ASF, primarily red meat (Denniss et al., 2021; Rohrmann et al., 2013; Zheng et al., 2019). ASF, especially meat, dairy, and prawns, have an environmental impact several factors of magnitude larger than plant-derived products (Ritchie & Roser, 2020; UNSCN, 2017). The predicted increases in ASF would not only significantly surpass the planetary limits and more than double food-related GHG emissions by 2050, but also negatively affect the availability and affordability of various basic food commodities worldwide (UNSCN, 2017, p. 11), especially as global temperatures continue rising and the impacts of climate change materialize further. If the food sector's GHG emissions are not addressed, meeting the 2°C goal of the Paris Agreement will be impossible, even if emissions in all other sectors are mitigated (Clark et al., 2020).

A comprehensive study of the food system's heavy pressure on various planetary boundaries was first published in 2006 in the United Nations' (UN) publication "*The Long Shadow of Animal Agriculture*" (Steinfeld et al., 2006). Nevertheless, international attention on the subject has only slowly gained momentum. A sequence of international events after the Second International Conference on Nutrition (ICN2) in 2014 have gradually brought the topic into view: the Agenda 2030 and the UN Sustainability Development Goals (SDGs) in 2015 and the start of the UN Decade of Action on Nutrition in 2016 (FAO et al., 2022). In addition, other international organizations, such as the World Health Organization (WHO), and scientific panels, such as the Intergovernmental Panel on Climate Change (IPCC), have joined the call to address the problems in our food systems.

While all actors in society play an important role in addressing the issues with our food systems, governments have the primary responsibility as they define and enforce the ground rules upon which the food systems is based. The transformation needed to address the sustainability issues will require massive changes from both the demand and the supply side. While changes in the latter include important steps such as better management of natural resources and food across supply chains to reduce food waste, the main potential lies on the demand side, and specifically on people's dietary habits (Creutzig et al., 2022; HLPE, 2017; Willett et al., 2019).

The most significant change international organizations and researchers alike highlight to make the food system more sustainable is to shift people's diets toward so-called "sustainable and healthy diets" (SHDs). These are generally understood as diets "[...] with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations" (UNSCN, 2017, p. 13). While the health aspect of SHDs requires people to reduce their caloric intake and increase their consumption of whole foods, for diets to become sustainable, a significant reduction in the consumption of ASF is indispensable. This shift is especially important in modern food systems, due to their heavy reliance on ASF. Transitioning to more plant-based diets is estimated to reduce not only global mortality by 6-10% but also food-related GHG emissions by 29-70% or even up to 80% – depending on the intensity of the shift (Springmann et al., 2016). Thus, the promotion of SHDs is essential for both public health and sustainability reasons.

To enable this shift towards SHDs, it is essential to understand that food choices do not happen in a vacuum but within *food environments*, the context in which consumers interact with food systems (HLPE, 2017, p. 11). Key aspects of food environments are influenced by

policies that directly and indirectly affect the physical, social, and economic determinants of people's interactions with food and, ultimately, their food choices. The question is what governments around the world can do to reform the food environments to promote and, most importantly, enable the adoption of SHDs among their populations. This thesis addressed this question via a literature review of policy recommendations from international organizations and research associations promoting SHDs in the food environments of high-income countries. Before answering the question in the results section, it provides an overview of the conceptual framework of the food environment, including its role within the concept of the food system. This is followed by a detailed elaboration on the problems with our current food systems and the potential of SHDs. Next, the methods of the analysis are described, and the results presented. The thesis ends in a discussion of the results, the context of this work within the wider literature, and the limitations of this study.

2. Research Question

The aim of this master's thesis is to answer the following research question:

What policies can high-income countries implement to promote sustainable and healthy diets in their food environments?

3. State of the Art on Policy Recommendations for Sustainable and Healthy Diets

So far, there has only been one literature review on global nutrition initiatives to promote SHDs by improving countries' food environments and citizens' food choices (Reyes et al., 2021). The review includes the analysis of 13 documents published between January 2015 and June 2020, including reports by the Committee on Global Food Security, the FAO, the Global Nutrition Report, and the UN (Reyes et al., 2021). The analysis resulted in 13 so-called *action themes* – categories developed by the authors themselves during the analysis covering the main themes of the recommendations they reviewed. These included calls for action to “prioritize agricultural production of a diverse range of nutrient-rich foods [and] redesign safety net/social protection programs toward improved nutritional outcomes” (Reyes et al., 2021, p. 5) to “improve the acceptability of healthy foods” (Reyes et al., 2021, p. 7).

Despite providing an overview of general themes in global initiatives for the promotion of SHDs, the paper by Reyes and colleagues falls short of differentiating between recommendations for high-income, middle-income, and low-income countries. Such a differentiation is crucial, as the food systems of these groups of countries, and thus their advantages, challenges and trade-offs are fundamentally different (Turner et al., 2018) and need to be addressed in different manners. At the same time, the policy recommendations remained just that, a conglomeration of policy recommendations governments could consider when shaping the food environment. Policymakers usually lack the time to go through each report to extract the key messages and thus profit from reviews like Reyes et al. (2020). Nevertheless, there are a few key aspects in which this review falls short. It does not focus exclusively on food environments but entails recommendations for other aspects of food systems. While food systems consist of more than the food environment, the main changes in the systems need to happen within the food environments. The review does not provide a systematic approach to the recommendations for the different policy domains affecting the food environment.

Swinburn and colleagues¹ (2013) provide the framework to systematically evaluate food environments and compare them to best case practices. The Food Environment Policy Index (Food-EPI) tool was developed exactly for this purpose by the International Network for Food and Obesity / Non-communicable Diseases (NCDs) Research, Monitoring and Action Support (INFORMAS) (Swinburn et al., 2013). It provides a framework evaluating how well food environments promote and enable the adoption of healthy diets in the population and covers 14 policy domains. It has already been widely implemented worldwide and provides governments with an overview of their status quo and a contrast to best practice examples from the literature. However, as its name indicates, this model only evaluates the promotion of healthy diets and not of SHDs. This thesis reviews policy recommendations from recognized international organizations and research associations for the basis of the Food-EPI model's best practice examples to promote SHDs.

¹ Vandevijvere, Kraak, Sacks, Snowdon, Hawkes, Barquera, Friel, Kelly, Kumanyika, L'Abbé, Lee, Lobstein, Ma, Macmullan, Mohan, Monteiro, Neal, Rayner, Sanders and Walker

4. Conceptual Framework: The Food Environment

In the last 20 years, the concept of the *food environment* has received increasing attention from academia (Caspi et al., 2012; Herforth & Ahmed, 2015; Swinburn et al., 2013; Turner et al., 2018). In general, food environments are complex, encompassing, and constantly evolving structures within the food system; shaped by various political and economic processes they determine the factors in which people interact with food and make food choices. While some organizations, such as the FAO use the concept more in terms of the accessibility and availability of food itself within people's physical environment (FAO, 2016a), others include the broader socio-economic picture within the concept (HLPE, 2017; Turner et al., 2018; UNSCN, 2017). The definition used in this analysis is more aligned with the latter approach (see the subchapter "Modelling the Food Environment" for an in-depth discussion).

This section first provides an insight into the wider context of the food environment: the food system. This short introduction to the food system is followed by an explanation of what the food environment consists of, including the latest model of the food environment by Turner et al. (2018). The next segment describes Swinburn et al.'s (2013) Food-EPI model, the deductive analysis framework, and the reasoning for the adaptations made.

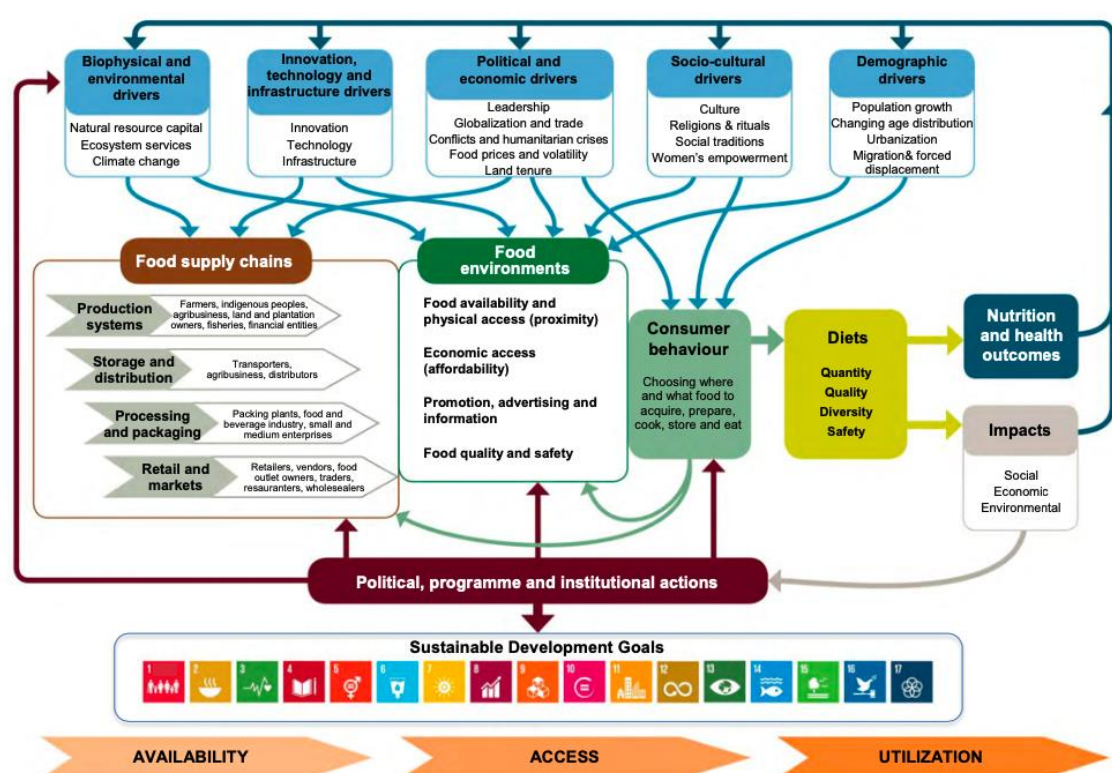
4.1. The Food Environment: Part of the Food System

The food environment is one of the constituent elements of the food system. The food system ultimately "[...] gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, and the outputs of these activities, including socio-economic and environmental outcomes" (HLPE, 2017, p. 11). It has three components: the "food supply chains", the "food environment" and "consumer behavior". The food supply chains make up all steps between food production and consumption. They entail all intermediary steps: collection, storage, distribution, processing, packaging, retailing, and marketing. Consumer behavior is understood as the choices made by individual consumers and those made at the household level about what food to acquire, keep in store, prepare, and eat. These choices are influenced by personal preferences, which are determined by taste, convenience, cultural practices, and other factors but also – most relevant to this thesis – by the food environment, which is the context within which people interact with the food system (HLPE, 2017, p. 11).

Ultimately, these three components (food supply chains, the food environment, and consumer behavior) are each shaped by several societal factors, including political, programme and institutional actions that determine people's food decisions, ergo, their diets. These diets ultimately impact society, most evidently, public health, the economy, and – as this thesis elaborates –the environment. For an illustration of the food system framework by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (HLPE, 2017, p. 26), see Figure 1 below.

Figure 1

Conceptual framework of food systems for diets and nutrition



Note. From *Nutrition and food systems*, by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, 2017, p. 26 (https://www.fao.org/fileadmin/user_upload/hlpe/hlpe_documents/HLPE_Reports/HLPE-Report-12_EN.pdf). Copyright 2017 by the HLPE. Reprinted with permission.

Food systems and food environments look very different across the globe. Within countries and even within cities, a wide variety of food systems and environments can co-exist. The HLPE's report (2017) differentiates between three broad types of food systems along both

main components (supply chains and the food environment): traditional food systems, mixed food systems, and modern food systems (HLPE, 2017, p. 12).

In traditional food systems, people rely on seasonal foods, which are minimally processed, and either collected or produced for self-consumption or sold and purchased through informal markets. Food supply chains are usually short (HLPE, 2017, p. 12). Given the seasonality and perishability of the staple foods, including animal sourced foods, certain fruits and vegetables, they are only available for a short time. As a result, food environments are mostly limited to household's own production and often limited daily or weekly access to informal markets (HLPE, 2017, p. 12).

As the term suggests, mixed food systems exist between the traditional and modern food systems. Food producers in these systems sell their products in formal and informal markets. Nutrient-rich foods are less accessible, both physically and economically than highly processed foods. Food safety and quality standards and regulatory requirements, such as food labeling, are not homogeneously enforced. As a result, consumer information about food choices relies significantly on food producers' advertising (HLPE, 2017, p. 12).

In modern food systems, which are primarily found in high-income and increasingly in upper-middle-income countries, people have access to a wide diversity of food choices characterized by processing and packaging for shelf-life extension. Food markets in low-income areas often take the form of so-called *food deserts* and *food swamps* while being more formal in high-income areas. *Food deserts* are geographic areas with restricted or non-existent access to food, caused by a low density or even complete absence of accessible food entry points. On the other end, *food swamps* are areas with an overabundance of unhealthy foods and a scarcity of nutritious foods. Both food swamps and deserts in high-income countries seem to be primarily found in low-income, underserved areas (HLPE, 2017, p. 29; Walker et al., 2010). In high-income countries, staple foods are less expensive than animal-sourced foods and fruits and vegetables, especially when organic or locally produced. Foods in modern food systems are strictly monitored, and food labels with detailed information are usually required (HLPE, 2017, p. 12).

4.2. Modelling The Food Environment

The concept of the “food environment” has been in constant development since its inception. While some definitions, such as that of the FAO (2016), focus primarily on the accessibility of food, others include the wider socio-political infrastructure. The definition used in this thesis is more aligned with the second approach used by various international organizations, such as HLPE (2017) and the United Nations Standing Committee on Nutrition (UNSCN,2019), and academics, such as Turner et al. (2018). They understand the food environment as the complex, dynamic and ever-evolving structures within which people interact with their food and make their food choices, including socio-economic factors affecting these choices.

The concept builds on the socio-ecological understanding of humans being part of a social and natural context from which they cannot be regarded independently. It is also based on the understanding that health-related behaviors do not result from consumers’ rational choices alone but are determined by a wide array of interrelated environmental and personal factors (Turner et al., 2018, p. 94). One of the first definitions in this range was by Swinburn et al. (2013). They understood the food environment as the “[...] collective physical, economic, policy and sociocultural surroundings, opportunities and conditions that influence people’s food and beverage choices and nutritional status” (Swinburn et al., 2013, p. 2). Using this definition, they developed their INFORMAS Food-EPI tool, which is widely used to evaluate whether food environments enable healthy diets. This framework is further described below. Herforth and Ahmed (2015) further operationalized the concept by identifying a set of measurable dimensions of food: availability, affordability, convenience, and desirability (Herforth & Ahmed, 2015, p. 506).

The Global Panel then used these frameworks on Agriculture and Food Systems for Nutrition (2016) and the FAO (2016a), which included the aspect of people’s daily lives: “Food environments comprise the foods available to people in their surroundings as they go about their everyday lives and the nutritional quality, safety, price, convenience, labelling and promotion of these foods” (FAO, 2016a, p. vii). Turner et al. (2018, p., 94-95) identified the FAO’s (2016a) framing of the food environment as the *interface* or *link* between food systems and diets as a key contribution to the concept of the food environment. This contributed to its key place within the food system between the other two elements, the food supply chains and consumer behavior, elaborated above.

Based on this realization of the link that the food environment represents within the food system, the HLPE (2017) defined the food environment as “[...] the physical, economic, political and socio-cultural context in which consumers engage with the food system to acquire, prepare and consume food” (HLPE, 2017, p. 11). This concept entails physical aspects, such as the so-called *food entry points* (i.e., the physical spaces and the built environments where people access food) and personal determinants of food choices, such as income, skills, and values. It also includes the socio-political and cultural norms in which these interactions take place, as well as other aspects influencing food choices, food acceptability and peoples’ diets, including the physical and affordability of food, food marketing and information, and food quality and safety (HLPE, 2017, p. 11).

In 2018, Turner et al. (2018) proposed to further differentiate between the *external* and the *personal domains* of the food environment with their following definition:

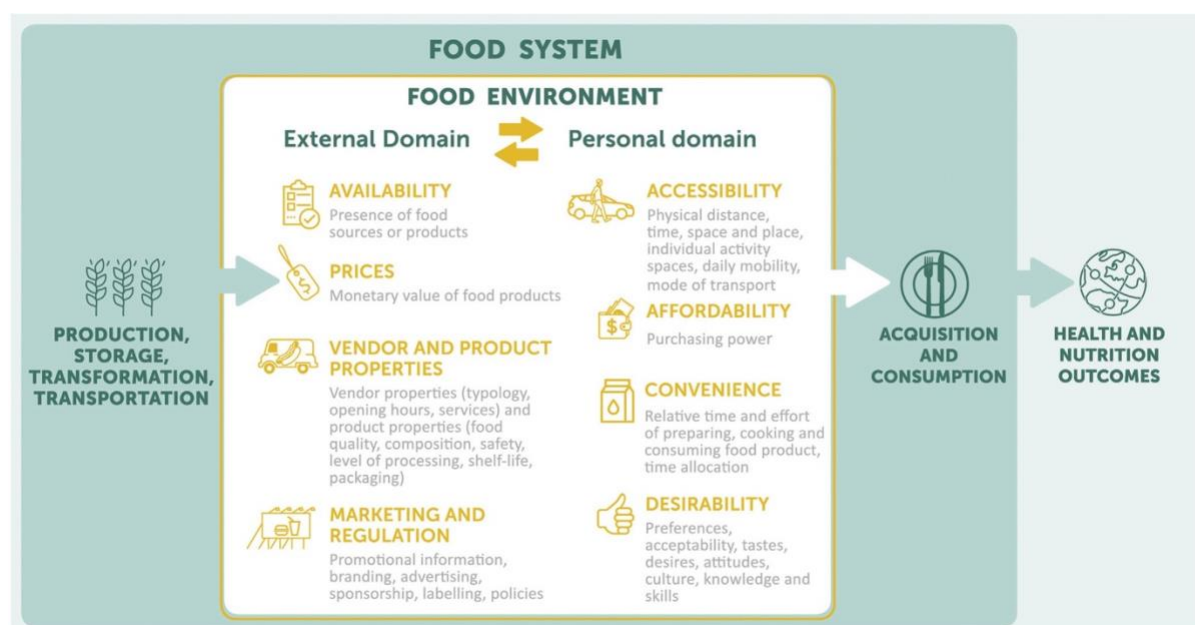
The food environment is the interface that mediates one’s food acquisition and consumption within the wider food system. It encompasses multiple dimensions such as the availability, prices, vendor and product properties, [regulation,] and promotional information; and personal dimensions such as the accessibility, affordability, convenience and desirability of food sources and products. (p. 95)

The definitions of the food environment proposed by the HLPE (2017), and Turner et al. (2018) complement one another, as both recognize the complex and interdependent relationship between the external and personal domains that influence consumers’ preferences and food choices. However, Turner et al. (2018) go a step further by explicitly differentiating between external and personal factors, a critical step toward conceptualizing the difference between accessibility and availability. They also differentiate one aspect largely neglected in other models of the food environment: convenience. Food consumption behavior is the result of a complex interplay between the external domains in the physical, economic, and socio-political context that determine the situation-specific external variables, such as the food's availability, price, and marketing, and the properties of the food and vendor (Turner et al., 2018). The personal domain outlined by Turner et al. (2018) includes the dimensions of the food’s accessibility, affordability, convenience, and desirability. Figure 2 (Turner et al., 2018, p. 96) provides an overview of Turner et al. (2018) conceptual framework of the food environment and includes a short list of each dimension's determining factors. These food environment dimensions are interrelated in the following ways:

"Availability" and "Accessibility," "Prices" and "Affordability," "Vendor and Product Properties" and "Convenience," and "Marketing and Regulation" and "Desirability."

Figure 2

Overview of the conceptual framework of the food environment from Turner et al. (2018) depicting the food environment as the interface connecting the food supply chains and consumer behavior



Note. From “Concepts and critical perspectives for food environment research: A global framework with implications for action in low- and middle-income countries” by C. Turner, Aggarwal, A., Walls, H., Herforth, A., Drewnowski, A., Coates, J., Kalamatianou, S., & Kadiyala, S., 2018, *Global Food Security*, 18 (2018), p. 96 (<https://doi.org/10.1016/j.gfs.2018.08.003>). CC

4.2.1. The Latest Food Environment Model

The interrelated dimensions of the food environment elaborated below are based on the work of Turner et al. (2018). The definition of each dimension is further complemented by information from the HLPE (2017) food environment framework and remarks from this thesis’ author.

Food availability and (physical) accessibility

Turner et al. (2018) emphasized differentiating between *availability* and *accessibility*, two commonly conflated terms. As they elaborated, “[a]vailability refers to whether a vendor or product is present or not within a given context and is included within the external food environment domain” (Turner et al., 2018, p. 96). Food availability, an external dimension, is

a prerequisite for food accessibility, which is relative to individuals and thus part of Turner et al.'s (2018) personal food environment domain. Thus, if a particular food is unavailable to an individual's physical proximity, their accessibility is compromised. As Turner et al. (2018, p. 96) put it, "[a]ccessibility is highly dynamic and can include distance, time, space and place, daily mobility, and modes of transport that collectively shape individual activity spaces."

The term *food access* is often applied to describe a conglomerate of multiple determinants of food acquisition, including physical, social, and economic access to food. It is also often used to describe the action of the acquisition of food itself (Turner et al., 2018, p. 97). The HLPE (2017) for example, differentiates between physical access and economic access. According to the HLPE (2017, p. 29), physical access to food relies on the built environment, the establishment of food entry points – the physical environments in which people access food – themselves as well as the infrastructure to access them. The access and distribution of food in general, but especially perishable foods, can be challenging in certain geographic and technical conditions. This problem is primarily the case in low- and middle-income countries, but so-called food deserts and food swamps can also be found in high-income countries, primarily in low-income, underserved areas, as described above (HLPE, 2017, p. 29; Walker et al., 2010). Given how vital food availability is for dietary choices, ultimately, a bi-directional association, availability and access to healthy and sustainable food (HSF) options are key determinants in enabling SHDs (HLPE, 2017, p. 29).

It is important to note that even the same built environment can be experienced very differently by different consumers. People's access to them and their capacity to interact within the environment depend on various personal factors, including mobility, which is included within Turner et al.'s (2018) accessibility domain. individuals' health and disability conditions, which ultimately affects the individual's access to the marketplace, as the HLPE (2017, p. 29) points out.

Prices and Affordability

Another dimension within the external food environment domain is that of *food prices*, referring to the cost of food products and its interaction with people's purchasing power, ultimately affecting how individuals perceive the affordability of a food product within the personal food environment domain. These dimensions together capture the economic aspects within the food environment, often referred to as "economic access" to food (Turner et al., 2018, pp. 96–97). The HLPE (2017) uses the terms "affordability" and "economic access"

interchangeably and describe them as “[...] the relative cost of food compared with a household’s income and purchasing power” (HLPE, 2017, p. 29).

Vendor and Product Properties and Convenience

The vendor and product properties are one of the external food environment dimensions combining the type of food vendors offer, their opening hours, and the services provided with the intrinsic properties of the foods. These include aspects such as the food’s quality, safety, level of processing, shelf-life, and packaging. In sum, the vendor and product properties interact with individuals’ personal factors determining how individuals perceive convenience through factors such as time allocation and preparation facilities. Vendor and product properties have been a dominant research area within the food environment research field. Unfortunately, their relationship with the personal aspects of convenience and desirability has not been sufficiently studied (Turner et al., 2018, pp. 95–96).

The HLPE (2017) food environment dimension “food safety and quality” falls within Turner et al.’s (2018) “Vendor and Product Properties” dimension of Turner et al. (2018). The concept of *food quality* entails all attributes of food that determine its value and on which consumers decide whether to consider the food acceptable or even desirable. This dimension includes all intrinsic aspects of food, such as its composition, flavor, texture, shape and color, and how it is produced or processed (HLPE, 2017, p. 31). *Food safety*, on the other hand, describes the food’s impact on human health and entails the avoidance of potential safety hazards that may make food unsafe for consumers (HLPE, 2017, p. 31).

Both aspects, food quality and safety, can influence people’s consumption preferences and food affordability. Food safety issues are known to affect consumer purchasing behavior significantly (FAO, 2016a). At the same time, food quality and safety also affect trade and public policy, as well as the food control systems in place (HLPE, 2017, p. 31).

Marketing and Regulation and Desirability

Marketing and regulation are part of the external food environment and cover all marketing-related aspects in and around the selling of food, such as promotional information, branding, advertising, and sponsorship, as well as the regulation that affects it, including food labelling and policy regulations. The combination of both aspects interacts with people’s individual food preferences and tastes, their acceptability and desires, and their attitudes, knowledge, and skills, which are also shaped by their culture. These factors determine the individuals’

desirability of food, a dimension within the personal domain of the food environment (Turner et al., 2018, p. 96).

This definition overlaps with the "Promotion, advertising and information" dimension of the HLPE (2017). Here, the HLPE (2017) accentuates that consumer information gathering is not exclusive to marketing and regulation but also entails other components, such as the national food-based dietary guidelines (FBDGs), a largely neglected information source on nutrition. Other ways consumers can obtain information on their food is through food labelling and the provision of declarations not only on food packaging but also in food retail outlets and menus (FAO, 2016a; HLPE, 2017, p. 31).

4.3. The Food-EPI Model: An Update

As described above, so far, there is only one well-established framework for the evaluation of national food environments worldwide: the Government Healthy Food Environment Policy Index (Food-EPI) tool, developed in 2013 by Swinburn et al. (2013). The Food-EPI tool includes seven policy domains and seven infrastructure support domains. While the policy domains represent key aspects of food environments, the infrastructure support domains are based on the WHO approach of “system building blocks” for health systems and a review of authoritative documents performed by Swinburn et al. (2013). Table 1 provides an overview of the 14 domains. Developed to evaluate the policy and political situation around food environments, the Food-EPI model matched the purpose of this study and was thus the main framework for this literature review's analysis. Therefore, this section provides a short description of the tool and the adaptations it underwent to fit the purposes of the study.

Table 1.

Policy domains and infrastructure support domains from the Healthy Food Environment Policy Index model developed by the International Network for Food and Obesity/Non-Communicable Diseases Research, Monitoring and Action Support (INFORMAS) by Swinburn et al. (2013)

Policy Domains	Infrastructure Support Domains
Food composition	Leadership
Food labelling	Governance
Food promotion	Monitoring and intelligence
Food provision	Funding and resources
Food retail	Platforms for interaction
Food prices	Workforce development
Food in trade and investment agreements	Health-in-all policies

Note. Adapted from “Monitoring and benchmarking government policies and actions to improve the healthiness of food environments: A proposed Government Healthy Food Environment Policy Index” by B. Swinburn, Vandevijvere, S., Kraak, V., Sacks, G., Snowdon, W., Hawkes, C., Barquera, S., Friel, S., Kelly, B., Kumanyika, S., L’Abbé, M., Lee, A., Lobstein, T., Ma, J., Macmullan, J., Mohan, S., Monteiro, C., Neal, B., Rayner, M., ... Informas, 2013, *obesity reviews* (2013) 14 (S1) p. 14 (<https://doi.org/10.1111/obr.12073>). CC-BY-NC.

The seven domains included in the policy component are understood to be aspects of the food environment policymakers can directly shape to enable healthy diets. The seven infrastructure support domains cover the context within which the policies on the food environment are determined, and the importance policymakers give to addressing the problems of the food environment. These aspects are essential to facilitating the development and implementation of policies that enable the adoption of SHD (Swinburn et al., 2013, pp. 27-29).

When evaluating food environments with the Food-EPI tool, each domain is characterized by several good practice indicators (47 in total) that encompass the directions necessary to improve the healthiness of food environments and help prevent obesity and diet-related NCDs. A comparison of national measures with benchmarks of current international best practices is meant to be performed by national experts, who formulate recommendations for

their respective governments based on the implementation gaps. The tool has been applied worldwide since its publication, from Australia and Canada to Fiji and Ghana. Most recently, it has gained traction in Europe and was even adapted to match the supranational nature of EU policy.

The Food-EPI model has an important advantage over the Turner et al. (2018) food environment model: it evaluates the food environment from a policy-making perspective. Not only does it assess direct policies affecting the food environment (policy domains) but it also evaluates the context of these policies and the attention granted to the food environment within all of the governments' activities (infrastructure support domains). This comprehensive framework enables the evaluation of the entire policy infrastructure and policy-making processes. Furthermore, it illustrates that governments need to consider more aspects than only the most evident policies to effectively change the food environment.

Most aspects of the food environment models described above are covered within Swinburn et al. 's (2013) Food-EPI tool, however, not necessarily with the same wording or categories. The aspects missing in the Food-EPI model relate to people's attitudes, knowledge, skills, and culture. Thus, for this thesis, the Food-EPI model used for evaluating the reports was adapted to consider recommendations for promoting not only healthy but also sustainable diets and expanded by a domain focused on food education. This domain was added to the model as none of its original domains addressed the aspect of nutrition education or knowledge, which were highlighted as important determinants of the food environment in the models described above (HLPE, 2017; Turner et al., 2018).

5. Problems with our Current Food Systems

Our global food system has undergone extensive changes in the last century. Nevertheless, it is failing to adequately feed millions of people worldwide, as both world hunger and diet-related NCDs rage. It has also become the largest cause of global environmental change. These crises have been traced back to the ongoing global nutrition transition, enabled by households' income rise, urbanization, and the wave of globalization in the food industry toward high-processed foods and – hardest on the environment – ASF. Diets are a major link between human health and environmental sustainability and are the factor that ultimately determines the nature of the foods being produced. The promotion of SHD, with significantly lower levels of ASF, is estimated to reduce global mortality by up to 23% (Willett et al.,

2019, p. 448) and reduce food-related GHG emissions by up to 70%, depending on intensity of adaptation (Springmann et al., 2016).

Despite the global food system successfully feeding more people worldwide than it has ever done before, more than 820 million people continue to be undernourished. As many as two billion people suffer from micronutrient deficiencies. Further, 2.1 billion people worldwide are currently overweight or obese– with rapidly growing tendencies (Willett et al., 2019, p. 449). Unhealthy diets are the largest global burden of disease and are the leading cause of morbidity worldwide, surpassing unsafe sex, alcohol, drug and tobacco use combined (GPAFSN, 2016, p. 114).

At the same time, our global food system is the largest cause of global environmental change. The global food system is already exceeding various planetary limits, thus already compromising the system's ability to produce food in the future (Springmann et al., 2016). Around 40% of the land used by humans is occupied by agriculture. At the same time, food production is responsible for 19-29% of all anthropogenic GHG emissions, with a rapidly increasing trend. Addressing the sector's GHG emissions is essential to meet the 1.5°C or even the 2°C climate goals of the Paris Agreement (Clark et al., 2020; Willett et al., 2019).

5.1. The impact of our food system on the environment

GHG emissions are only one factor among many regarding the environmental impact of food. The global food system also depletes and pollutes many of our natural resources: it is the source of 70% of global freshwater withdrawals (FAO, 2011) and 78% of global water eutrophication due to overuse and misuse of fertilizer (Poore & Nemecek, 2018). It is also the primary cause of biodiversity loss (Benton et al., 2021) and a leading risk for the development of antimicrobial resistant pathogens (Xiong et al., 2018) and zoonotic diseases worldwide (UN, 2020).

This overexploitation of the natural system also includes the marine systems, with around 60% of world fish stocks being fully fished and more than 30% overfished (FAO, 2016c). Moreover, the rapidly growing expansion of aquaculture – intensive fish and shellfish farming – is certainly not easier on the environment. It pollutes and destroys coastal habitats, consumes high amounts of freshwater, further depletes wild fish populations, which are used as feed for captive fish and is even causing chemical pollution due to the overuse of antibiotics (Klinger & Rosamond, 2012).

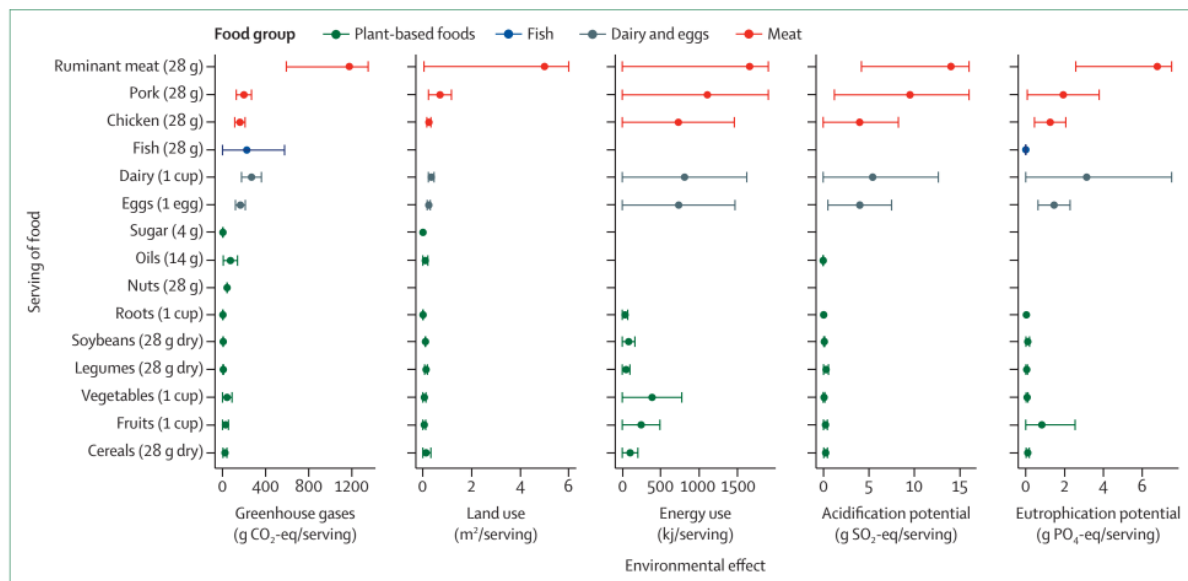
If things continue as they are, our food system, already transgressing several planetary boundaries (Conijn et al., 2018), will have unimaginable environmental consequences. Its environmental impact is expected to increase by a further 50-90% due to the growing and shifting demands toward ASF in a business-as-usual scenario (Springmann et al., 2018). GHG emissions alone could increase by much as 80% by 2050, comprising up to half of all emissions allowed by guidelines to maintain the global temperature rise below 2°C. By 2070, the food systems' emissions could even exceed total permissible emissions worldwide (Springmann et al., 2016). Other environmental factors, such as land and water use, eutrophication, and deforestation, are expected to continue sharpening.

At the same time, households are also increasingly consuming more foods high in sugar, salt, and saturated and trans fats, such as sugar-sweetened beverages (SSBs), highly-processed foods, and processed and red meats (HLPE, 2017, p. 13). This so-called *nutrition transition* describes the “[...] lifestyle and dietary patterns driven by urbanization, globalization and economic growth, and their resulting impacts on nutrition and health outcomes” (HLPE, 2017, p. 13). While higher rates of urbanization and wealth also bring higher rates of obesity, it is important to highlight that this statistic fails to reflect the diversity of diets that develops simultaneously within and across food systems (HLPE, 2017, p. 13).

A closer look at the environmental impact generated by the food systems reveals that not all foods are created equal. Despite methodological inconsistencies and apparent data gaps, the system has a clear pattern. There are considerable differences in the environmental footprint of various food types, with ASF tending to have a multiple times higher environmental impact than plant-based foods on all environmental criteria: carbon footprint, land and water use, and eutrophication (Poore & Nemecek, 2018; Sandström et al., 2018; Springmann et al., 2018; Willett et al., 2019). For example, the production of 100 grams of protein from beef requires 74 times more land than the same amount of protein from soybeans. Similarly, one kilogram of cheese requires 15 times and up to 37 times more water than one kilogram of peas and one kilogram of tofu, respectively. The production of 1000 kilocalories of prawns and beef emits 100 and 55 times more eutrophying emissions (PO₄eq), respectively, than the production of 1000 kilocalories of peas. These statistics illustrate the gigantic gap in the environmental footprint between ASF and plant-sourced foods (Poore & Nemecek, 2018). Figure 3 (Willett et al., 2019, p. 471) provides an overview of the estimated environmental effects of different food groups on five different environmental factors, also called impact categories: GHG, land use, energy use, acidification potential, and eutrophication potential.

Figure 3

Environmental effects per serving of food produced for the impact categories: greenhouse gas emissions, land use, energy use, acidification potential, and eutrophication potential



Note. Some results for the impact categories of fish are missing due to lack of data. CO₂ = carbon dioxide. Eq = equivalent. PO₄ = phosphate. SO₂ = sulphur dioxide. From „Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems” by W. Willet et al., 2019, *The Lancet*, 393(10170), p. 471 ([https://doi.org/10.1016/S0140-6736\(18\)31788-4](https://doi.org/10.1016/S0140-6736(18)31788-4)). Copyright 2019 by Elsevier. Reprinted with permission.

Regarding GHG emissions, direct emissions – those emitted at the farm level – from livestock and fisheries account for 31% of the food system’s emissions. However, the actual figure is 53%, as the emissions generated through feed crops and land use for livestock also need to be included in the equation. However, ASF account for only 18% of calories consumed worldwide and 37% of total protein consumed (Poore & Nemecek, 2018).

As Poore and Nemecek (2018) calculated, for most food, most GHG emissions result from land change and processes at the farm stages, but especially for the largest emitters – primarily animal-based foods. The emissions at the farm level include the use of fertilizers – both organic and synthetic, as well as enteric fermentation, the production of methane in ruminants, such as cows, sheep, and goats (Poore & Nemecek, 2018; Ritchie & Roser, 2020). In fact, while improvements in food production practices are estimated to potentially reduce agricultural GHG emissions in 2050 by ten%, shifting food consumption toward plant-based

diets could reduce the sector's GHG emissions by up to 80%. Halving food loss and waste would contribute a further five% less GHG emissions (Springmann et al., 2018).

As shown in Figure 4 (Ritchie, 2020), the main emission drivers of food production are intrinsic to their production. Improving production practices would only lead to small improvements. Similarly, promoting locally grown foods or avoiding plastic packaging would not address the main source of emissions either. It is thus essential that diets and food choices are understood for what they are: a major link between human health and environmental sustainability (Willett et al., 2019, p. 450).

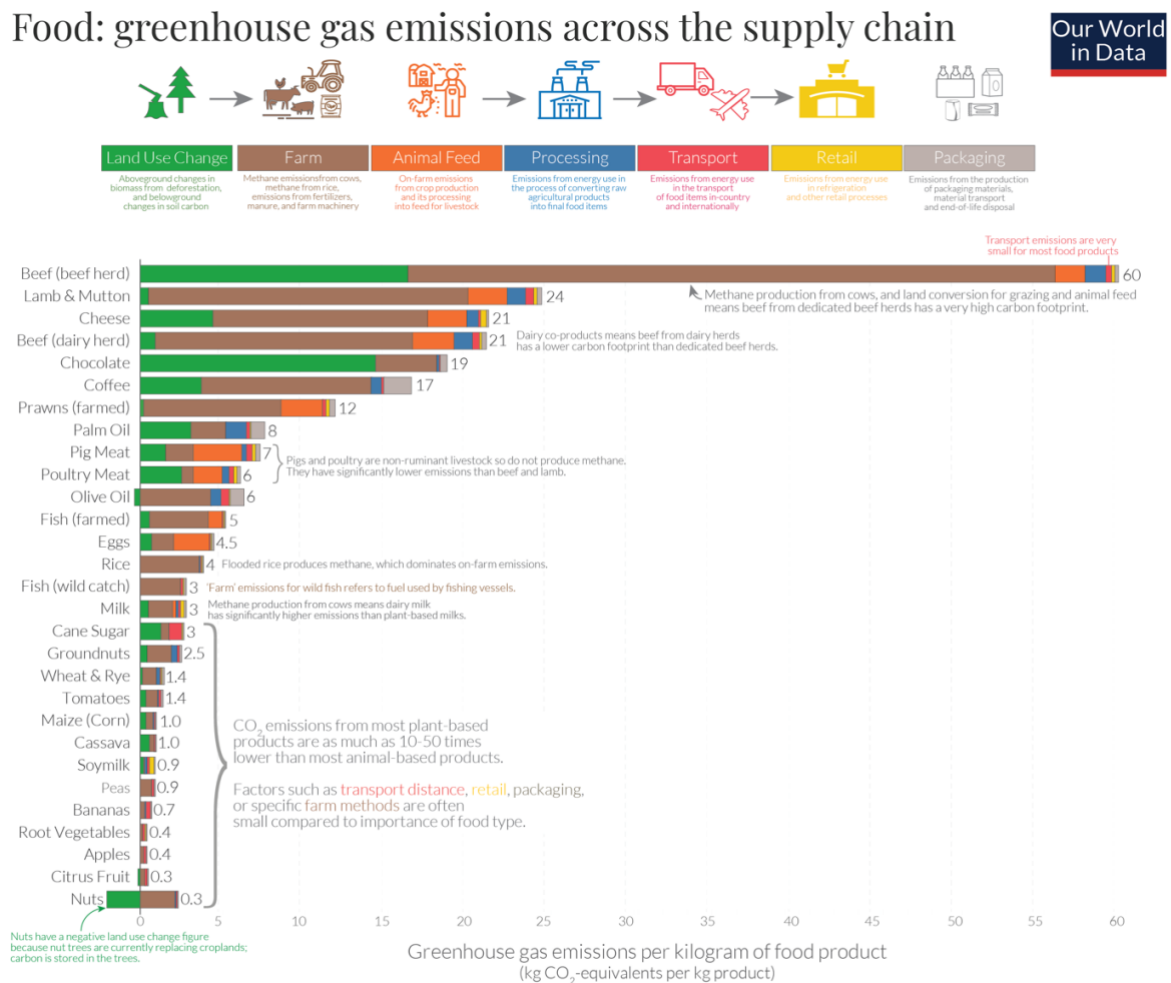
Greenhouse gas emissions are given as global average values based on data across 38.700 commercially viable farms in 119 countries. Data source: Poore and Menecek (2018). Illustration adopted from Ritchie and Roser (2021) through the Our World in Data Organization.

In comparing GHG emissions from average diets in the EU, Sandström et al. (2018) came to similar conclusions. After quantifying the emissions from food production, land-use change and trade, including transport, for each food group, they concluded that most emissions result from land use change and emissions at the farm level (Sandström et al., 2018). Meat, dairy, and eggs end up accounting for 83% of GHG emissions from the average EU diet, while only 17% stems from plant-derived foods. These results ultimately show that the most critical factor in reducing the environmental impact of people's diets is the type of food, not whether it has been grown locally (Sandström et al., 2018). Reducing people's consumption of ASF is the only way to reduce the food system's environmental footprint significantly.

The results of the studies described in this segment are only a small sample of the growing literature on the subject. Through the results, it becomes clear that for the food system to become environmentally sustainable, the production of those products with the largest environmental impact must be cut down. As elaborated above, the main potential to do so lies in changing people's purchasing behavior and dietary choices. Thus, it is governments' responsibility to make the adoption of SHDs as easy as possible and to shift the current heavy reliance on ASF toward plant-based foods.

Figure 4

Greenhouse gas emissions across the supply chain of different foods.



Note: Greenhouse gas emissions are given as global average values based on data across 38,700 commercially viable farms in 119 countries. Data source: Poore and Nemecek (2018). Reducing food's environmental impacts through producers and consumers. *Science*. Images sourced from the Noun Project. OurWorldinData.org - Research and data to make progress against the world's largest problems. Licensed under CC-BY by the author Hannah Ritchie.

Note in original. Greenhouse gas emissions are given as global average values based on data across 38,700 commercially viable farms in 119 countries.

Note. Figure from “You want to reduce the carbon footprint of your food? Focus on what you eat, not whether your food is local” by Ritchie, H., 2020, *Our World in Data* (<https://ourworldindata.org/food-choice-vs-eating-local>). CC BY-NC. Original data from “Reducing food’s environmental impacts through producers and consumers” by Poore, J., & Nemecek, T., 2018, *Science*, 360(6392), 987–992. (<https://doi.org/10.1126/science.aag0216>).

5.2. The impact of our food system on public health

The type and relative distribution of crops being produced in agriculture, are determined by a range of factors: “government subsidies, trade promotion and restrictions, technological developments, increasing scale and intensity of agriculture, population and income growth, changing dietary preferences and lifestyles, and more” (GPAFSN, 2020, p. 73). The supply of and demand for highly processed foods have shaped agricultural fields, producing ever-larger quantities of staple cereals, sugar, and oil crops. Some of the largest agricultural land expansions in the last decades have been for starchy grains, such as wheat and maize, and oil crops, including soy, sunflower, palm oil, rapeseed, and mustard, to produce food or livestock feed. The agricultural commodities with the largest relative and absolute abundance in national food supplies are the world’s major cereals: rice, wheat and maize (GPAFSN, 2020, p. 73). As the Global Panel on Agriculture and Food Security (GPAFSN, 2020, p. 73) put it, “[...] the global expansion of land area for farming was largely for commodities associated with diets that were calorically rich but relatively poor in micronutrients.”

Today’s diets, especially in developed countries but also increasingly in low- and middle-income countries with high intakes of meat, sugar, salt, and fat, have been identified as an important contributor to the growing global prevalence of NCDs (Denniss et al., 2021; Rohrmann et al., 2013; Zheng et al., 2019). Researchers thus consider current diet trends to be a major risk not only to environmental life-support systems but also to public health and thus ultimately to social systems as a whole (UNSCN, 2017).

NCDs have become the leading cause of death worldwide, and most saliently in low- and middle-income countries. At the same time, the number of people suffering from undernourishment, which had been falling for decades, has now been steadily increasing again since 2014. This number experienced a sharp increase from 2020 to 2021 due to the world economic stagnation induced by the COVID-19 pandemic. According to the latest estimates, as many as 828 million people are going hungry today, 46 million more than in 2020 and 150 million more than in 2019. This development represents an increase in world hunger from eight% of the world population in 2019 to 9.3% in 2020. The gender gap in food insecurity has also continued increasing, with 31.9% of women being in moderate or severe food insecurity, compared to 27.6% of men (WHO, 2022). Given the current trends, the world is far from achieving the goal of Zero Hunger by 2030.

Furthermore, in 2020, “[a]lmost 3.1 billion people could not afford a healthy diet, an increase of 112 million more people than in 2019” (FAO et al., 2022, p. xix). This increase is arguably due to the COVID-19-related inflation in consumer food prices and income losses. However, these numbers are expected to rise even further as the ongoing war in Ukraine is disrupting international supply chains and further destabilizing grain, fertilizer, and energy prices worldwide (FAO et al., 2022, p. vi). Even ready-to-use therapeutic food for children with severe malnutrition has been affected by the war between two of the largest global exporters of staple cereals, oil seeds and fertilizer (WHO, 2022). Meanwhile, climate change is already ravaging hectares of crops worldwide, reducing agricultural yields and disrupting food supply chains (IFRI, 2022, p. 6).

Across high- and upper-middle-income countries, the connection between food insecurity, undernutrition, and overweight and obesity is becoming more apparent. This growing understanding has put diet quality in the spotlight of the food security and nutrition policy debate. Today, the global community agrees that diets should meet not only people’s energy requirements but also their nutritional needs (FAO et al., 2020, p. 41). And while overweight and obesity are understood to be the result of various socio-economic factors and childhood nutrition, access to cheap, less nutritious foods and lack thereof to healthy foods are understood to be contributing factors. The effects are most substantial among people in low-income households. However, even with the highest affordability rates of healthy diets, high-income countries also have the highest rates of adult obesity (FAO et al., 2020, pp. 66–67). The FAO estimates that by 2030, the sum of the diet-related health costs linked to NCDs could reach USD 1.3 trillion per year, while the social costs of the system’s GHG emissions could amount to a further USD 1.7 trillion (FAO et al., 2020, p. 139). The GPAFSN (2020) stipulated even more drastic figures – and that before the impacts of the pandemic and the war in Ukraine materialized:

Estimates of the health and economic burdens likely to beset countries around the world by the escalation of diet-related problems (human diseases, nutritional deficiencies, GHGs, failing food production systems, and more) are estimated at US\$16 trillion per year by 2050. (p. 178)

Malnutrition has many forms: anemia, low birth weight, stunting and wasting, but also overweight; combined, it is estimated to cause 20% of disability-adjusted life years lost to ill health and possibly even responsible for 20% of premature deaths worldwide. Addressing these five forms of malnutrition and promoting exclusive breastfeeding for the first 6 months

of life was set as the goal of the UN's Sustainable Development Goal 2 (SDG2) to “end all forms of malnutrition by 2030” (GPAFSN, 2020, p. 41).

However, there is an additional dimension not fully captured by the SDG2: the growing rate of diet-related NCDs associated with adolescent and adult obesity. Since 1975, the rates of obesity have tripled worldwide and NCDs are now present in every country. The 2018 Nutrition Report revealed that 422 million people worldwide live with diabetes and 1.1 billion people suffer from high blood pressure. In 2016, 71% of deaths worldwide were caused by NCDs; diet being one of the four leading risk factors. The magnitude of the problem is not decreasing as risk factors for the world's disease burden, including most of those related to sub-optimal diets, such as high blood glucose, high cholesterol, and obesity, are expected to continue worsening in the next decades. (GPAFSN, 2020, pp. 39-42). According to the GPAFSN (2020, p. 42), Stanaway et al. (2018) concluded that “[m]ore than a quarter of preventable deaths worldwide have been attributed to imbalanced diets, mostly from diet-related, chronic diseases that also require costly treatments”. For example, the number of people with diabetes is expected to rise from 451 million globally in 2017 to 693 million by 2045. The associated global healthcare costs are expected to increase to almost USD 1 trillion annually. The “full economic cost” of diabetes – including indirect costs due to workforce productivity loss – are estimated to rise from US\$1.3 trillion in 2015 to US\$2.5 trillion in 2030 (GPAFSN, 2020, p. 43).

Populations in all countries worldwide fail to meet the WHO nutritional recommendations. This is not only the case in low- and middle-income countries but also in high-income countries such as the US, Canada, and European countries. Despite their wealth, people in these countries do not meet the recommended consumption levels for various food groups: nuts and seeds, calcium, whole grains, legumes, fruits and vegetables. Regarding legumes, fruits and vegetables, people in low-income and upper-middle-income countries have higher consumption rates. At the same time, high-income countries have excessively high consumption rates of processed meats, red meat, and salt. While sugar-sweetened beverages are overconsumed in all countries, this phenomenon is especially stark in upper-middle- and high-income countries (GPAFSN, 2020, pp. 39-47).

Furthermore, failing to meet dietary recommendations on fruits (>300g/day) and vegetables (>400g/day) leads to a range of NCDs, causing millions of preventable deaths globally from diseases such as coronary heart disease and stroke. High consumption levels of processed meat, primarily red meats, are also understood to contribute to higher rates of coronary heart

disease and diabetes. Furthermore, poor nutritional status is also understood to increase the risk of fatality from infectious diseases, visible during the peak of the COVID-19 pandemic in 2020. This observation has brought wider attention to the connection between diet quality, health, and disease resilience (GPAFSN, 2020, pp. 39-47).

The magnitude of the challenges policymakers worldwide face and the importance of the changes that need to be implemented to address them cannot be underestimated. These challenges will only become harder the longer we wait. Further crises, such as the COVID-19 pandemic, the ongoing war in Ukraine, international tensions, and climate change, are already exacerbating the situation. Addressing the food system's challenges and reaching the SDG2 requires international commitment and national willpower. The question is where precisely within the food systems governments could focus on to address these problems. This is where the food environment comes into play.

5.3. The importance of changing today's food environments

Food environments worldwide are highly dynamic and in constant development. Just half a century ago, most foods were produced by several smallholders living in rural areas and were to be purchased at small, local markets. Now, foods in high-income countries and increasingly across low- and middle-income countries are primarily conveniently found in supermarkets. Many of the foods accessible have travelled long distances to reach the shelves, giving consumers an immense amount of food options. Globalization, industrialization, market oligopolization, technological advancements, economic growth, and urbanization have shaped today's rapidly changing food systems and, with them, supply chains, food environments, lifestyle habits and dietary choices (FAO et al., 2020, p. 116; UNSCN, 2019, p. 5).

Today's food markets are "[...] outlets for mass-produced and highly processed foods, often energy-dense foods of minimal nutritional value that are high in fats, sugars and/or salt" (FAO et al., 2020, p. 116). Nutritious foods, such as vegetables, fruits, and healthy sources of proteins, including ASF in some world regions, are too expensive for or inaccessible to several households, especially low-income ones, leading to the dominant diets being of low nutritional quality (FAO et al., 2020, p. 116). In fact, 70% of the total food energy consumed worldwide comes from only three food groups: starchy staples, sugar, and oils and fats. This distribution is partly driven by food and agricultural policies implemented worldwide during the last 50 to 70 years, focused primarily on making calories accessible (GPAFSN, 2020, p.

73). Thus, many of today's food environments qualify as *unhealthy* ones, promoting unhealthy dietary choices for consumers with mostly calorie-dense, nutrient-poor foods, which are, however, more accessible and less perishable. Some have argued this to be a general conversion of traditional, healthy food environments into convenient but largely "unhealthy" ones where unhealthy – and, as elaborated above, unsustainable in the case of ASF – food decisions become the default, making healthy food choices increasingly difficult. This dietary shift is considered a relevant factor for the increasing rate of overweight, obesity and NCDs (FAO et al., 2020, p. 118; HLPE, 2017, p. 28), as described above.

In addition, the link between climate change and diet has not received the attention it deserves. To illustrate, according to the UNSCN (2017, p.7), governments continue to fail to recognize the importance of demand-side mitigation options (or rather necessities) of lifestyle changes, such as active transportation or a shift toward more sustainable and healthier diets. This is visible through the short falling of Nationally Appropriate Mitigation Actions (NAMAs) under the United Nations Framework Convention on Climate Change (UNFCCC) in recognizing the potential and importance of these solutions. According to the UNSCN, only about 1% of all financing destined for addressing the challenges of climate change was allocated to health, with an unknown proportion allocated to address nutritional issues. Since the start of the Nutrition Decade in 2016, governments have been called upon by the global community to make use of the time-specific window it offers and take the recommendations of the ICN2 Framework for Action and the Global Agenda seriously and turn their promises and commitment into actual policies and climate actions (UNSCN, 2017, pp. 7–8).

Many issues with today's food environments need to be addressed to enable people to adopt SHDs. Most subsidy schemes in place today prioritize quantity over quality, incentivizing the production of staple foods, sugar, and ASF over healthier crops, such as vegetables, fruits, and legumes. Moreover, while globalization has brought more choices and year-round accessibility to diverse sorts of food in more affluent markets worldwide, access to low-cost, calorie-dense and nutrition-poor foods has also increased, especially in underserved areas (HLPE, 2017, pp. 29–30). HSFs are neither available nor financially accessible to many people worldwide, especially for poorer households, who are also more vulnerable to food price increases and price volatility (FAO et al., 2022, p. 55). Addressing power imbalances between powerful and influential transnational food corporations and local stakeholders also plays a key role, given their stake and role in the current system (FAO et al., 2020, p. 137).

The transformation of the food environment to promote the adoption of SHDs will require an in-depth review of governments' regulations on food marketing and advertising (Cairns et al., 2013). This thesis provides a deep understanding of the barriers to SHDs and policies that international organizations and research associations recommend governments implement to address the barriers.

Understanding food environments is no easy task. Changing them will be even harder. As the UNSCN (2019) put it, the food environment touches upon all areas of society:

The food environment is highly dynamic, interactive and constantly evolving, which makes it difficult to grasp. It links people at the community level to the highest levels of decision-making and cuts across policy areas. It examines the specifics of local food environments against the backdrop of larger national and global environments and systems. Food environments are also the arena in which tensions lie and power politics play, sometimes with explicit rules and regulations, often with inequalities underlying the outcomes. (p. 4)

Nevertheless, as highlighted in the chapter above, the food system cannot continue as it is and needs reform. Stakeholders in the food supply chains are locked in as they directly respond to today's consumers demand for ever-growing quantities of low-cost foods, ASF included. As discussed in the chapters above, this demand is creating colossal public health, social and environmental problems, making it an issue that only governments can help to address. They are the ones with the greatest power to shape the food environment to the degree necessary to enable the adoption of SHDs. To illustrate the effects of governments' actions, relatively small interventions such as nutrition labels are not only designed to give consumers more agency over their consumption decisions. They are also known to positively affect the industry by inciting the reformulation of products (HLPE, 2017, p. 31). Fiscal policies such as the sugar tax scheme can also positively affect the whole industry. For example, the Soft Drinks Industry Levy in the United Kingdom has led several manufacturers to reduce the sugar content in their soft drinks below 5 grams to avoid a two-tiered tax (Scarborough et al., 2020).

These are only small interventions attempting to correct only a few aspects of the food environment that have led to the obesity and the food-related NCD-epidemic we are experiencing today, which is only expected to get worse. The changes required to make the food systems not only healthier but also more sustainable are immense and will require full

commitment from all branches of government and other stakeholders. As elaborated above, the primary source of environmental damage in the food system is the production and consumption of ASF and the only mitigation solution lies in shifting consumer demand away from ASF and toward plant-sourced foods, which are not only more sustainable by several factors of magnitude but also healthier, as elaborated in the next chapter. This approach of changing consumer demand for food products is generally understood as a *demand-side solution for mitigation of climate change* (Creutzig et al., 2022):

[D]emand-side solutions for mitigation of climate change modify demand for goods and services by targeting choices/adoption of technology, consumption, behavior, lifestyles, coupled production–consumption infrastructures and systems, service provision and associated socio-technical transitions, as exemplified by options to improve accessibility and living conditions and increase nutritional quality while decreasing energy input and emissions of greenhouse gases (GHG). (p. 37)

Given that consumer demand for resource-intensive foods, such as ASF, is already having significant effects on the environment and on public health, and the impacts of the global food system on the environment is forecasted to only continuing growing, the time to act is now. However, as the GPAFSN (2020, p. 160) put it: “There are many reasons for the lack of action around the globe, including absence of political consensus, institutional inertia, vested interests defending existing policies, the lack of coherent strategies which unite common interests across public sector and businesses, and the daunting complexity and assumed costs of the task”. While all actors across the food system play a key role in making it more sustainable and healthier, governments have the primary responsibility to design adequate public policy to address the system’s issues and develop the necessary frameworks for what the EAT-Lancet Commission called “The Great Food Transformation.” In this sense, the food environment should be considered to be “[...] the entry point for transforming food systems” (UNSCN, 2019, p. 5).

Governments are the only ones able to redesign food environments. They are thus the only ones capable of affecting societies’ capacity to successfully adopt the much needed shift toward SHDs; diets that have a low environmental impact, are accessible (both, in a physical as well as an economic sense) culturally acceptable, safe, and nutritionally adequate (HLPE, 2017, pp. 11–12).

6. The potential of sustainable and healthy diets

Despite the catastrophic impacts of our food system being known for years – at least since the FAO’s 2006 report on the environmental impact of the global food system (Steinfeld et al., 2006), individual calls to reduce the consumption of ASF in 2009 (Friel et al., 2009) remained largely ignored. Today, after considerate efforts by international organizations and the global scientific community, the topic is increasingly receiving international attention. Now, even the IPCC calls governments to implement policies to promote the adoption of SHDs, high in plant-sourced foods and especially low in ASF, due to their significant environmental impact, to reach the goals of the Paris Agreement. A diet shift toward more plant-based foods would not only reduce the food system’s environmental impact but also improve public health (IPCC, 2019, pp. 48–49) and, ultimately, human well-being (Creutzig et al., 2022).

The latest important steppingstone at the international level involves the FAO and the WHO. To help transform their food systems, the organizations held an international expert consultation on SHDs in July 2019. The experts’ summit resulted in the provision of guiding principles for what constitutes SHDs. These are proclaimed to “[...] take a holistic approach to diets; [and] consider international nutrition recommendations; the environmental cost of food production and consumption; and the adaptability to local social, cultural and economic contexts” (FAO & WHO, 2019, p. 6). This international expert consultation resulted in the following definition of sustainable healthy diets in their “*Guiding Principles on Sustainable Healthy Diets*” (FAO & WHO, 2019):

Sustainable Healthy Diets are dietary patterns that promote all dimensions of individuals’ health and wellbeing; have low environmental pressure and impact; are accessible, affordable, safe and equitable; and are culturally acceptable. The aims of Sustainable Healthy Diets are to achieve optimal growth and development of all individuals and support functioning and physical, mental, and social wellbeing at all life stages for present and future generations; contribute to preventing all forms of malnutrition (i.e. undernutrition, micronutrient deficiency, overweight and obesity); reduce the risk of diet-related NCDs; and support the preservation of biodiversity and planetary health. Sustainable healthy diets must combine all the dimensions of sustainability to avoid unintended consequences. (p. 9)

It is important to note that the definition of a SHD provided by the FAO and WHO (2019) is only one among many. However, the general theme across definitions from other authors entails an increase in the consumption of fruits and vegetables, legumes, nuts and seeds and a reduction in the consumption of highly processed foods, sugar, and saturated fats, and most importantly, for the environmental aspect of SHDs, a significant reduction in the consumption of ASF (FAO and WHO, 2019; HLPE, 2019; Swinburn et al., 2019; Willett et al., 2019).

Given the urgency to address the sustainability aspect of today's food system, some scholars warn that failing to do so could become the very cause of sharpened food insecurity in the future (Berry et al., 2015). As the HLPE put it in their report "*Nutrition and food systems*": "In the long term, there will be no food security or health without sustainability and no sustainability without food security and health" (HLPE, 2017, p. 34). The 2019 IPCC report on Climate Change and Land also highlights healthy sustainable diets to be the only diets to be truly globally equitable. A food system transformation toward SHDs would also help countries achieve several SDGs "[...] at country level, especially Goals 1 (No Poverty), 2 (Zero Hunger), 3 (Good Health and Well-Being), 4 (Quality Education), 5 (Gender Equality), 12 (Responsible Consumption and Production) and 13 (Climate Action)" (FAO & WHO, 2019, p. 6).

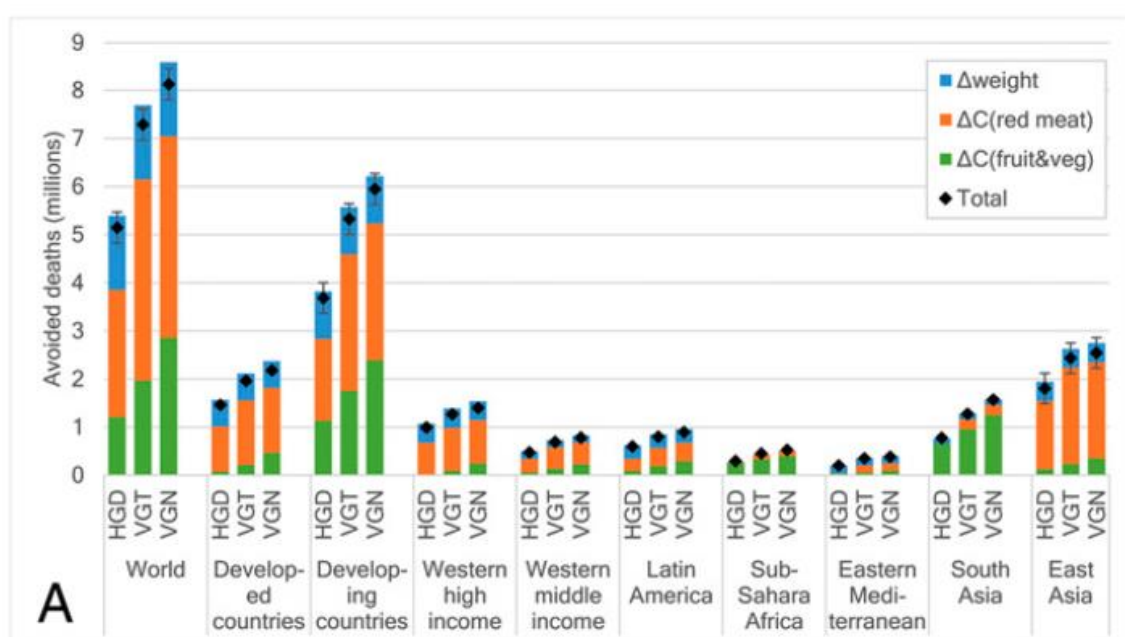
Other organizations included in the analysis use the term of *high-quality diets* instead of SHDs: "High-quality diets are those that eliminate hunger, are safe, reduce all forms of malnutrition, promote health and are produced sustainably i.e. without undermining the environmental basis to generate high-quality diets for future generations" (GPAFSN, 2016, p. 32). This aligns with the definition of SHDs, as only the global shift toward SHDs is estimated to allow the system to feed up to 10 billion people worldwide without overstepping any planetary boundary. However, as the Lancet Commission highlighted, even the slightest increase in the production of red meat or dairy products could put this balance at risk (Willett et al., 2019).

A transition toward more plant-based diets, in line with WHO recommendations for healthy eating (WHO, 2020), is estimated to potentially reduce global mortality rates: exact estimates vary between 6-10% (UNSCN, 2017, p. 14), and 19-23% (Willett et al., 2019, p. 448). Springmann et al. (2016) estimated that while adopting global dietary guidelines would already avoid 5.1 million deaths annually, vegetarian diets would avoid 7.3 million and vegan diets 8.1 million annual deaths by 2050. The avoided deaths would primarily be in

developing countries, especially in East and South Asia, but also in high-income countries. Reducing the consumption of red meats is expected to have the largest positive effect, followed by the higher consumption of fruits and vegetables, and finally, the reduced rates of overweight and obesity (Springmann et al., 2016). Springmann et al.'s (2016) calculated effects of diet shifts for each diet type (global dietary guidelines, vegetarian, and vegan diets) on global death rates are illustrated in Figure 5 (Springmann et al., 2016, p. 4148).

Figure 5

Avoided deaths through dietary change



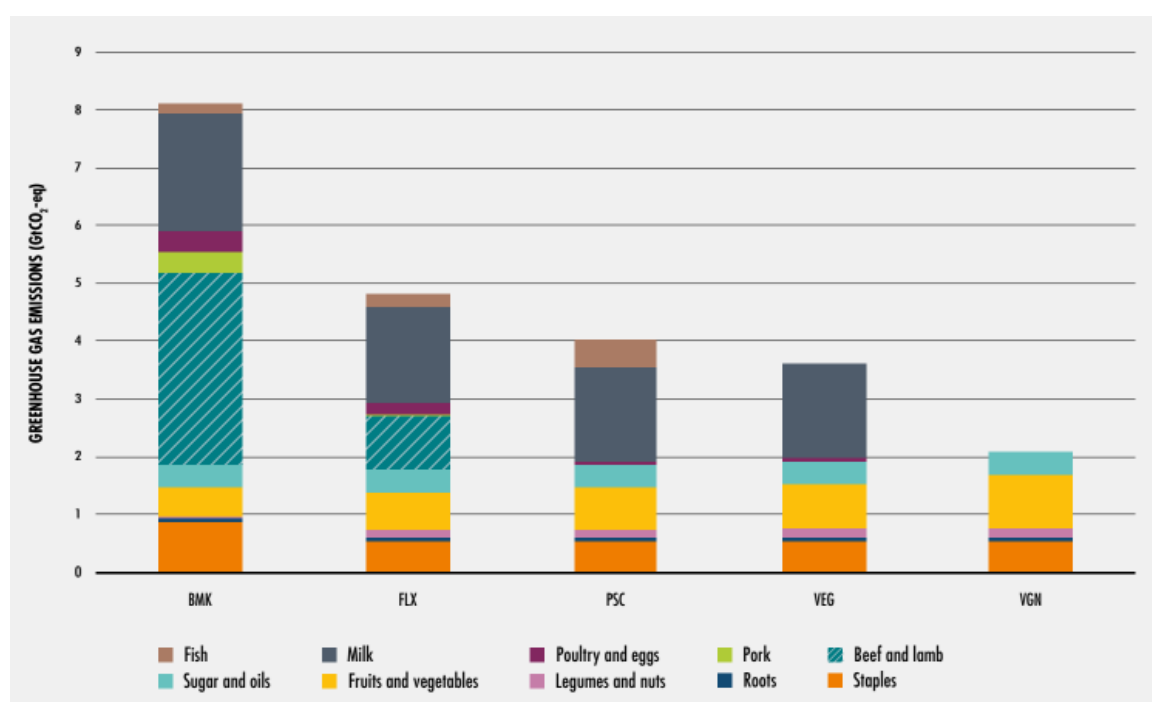
Note. Avoided deaths through dietary change from a reference scenario based on projections by the Food and Agriculture Organization, and three scenarios by 2050: global guidelines on healthy eating and energy intake (HGD), and scenarios based on vegetarian (VGT) and vegan (VGN) dietary patterns. Figure from “Analysis and valuation of the health and climate change cobenefits of dietary change” by M. Springmann, Godfray, H. C. J., Rayner, M., & Scarborough, P., 2016, *Proceedings of the National Academy of Sciences*, 113(15), p. p., 4148 (<https://doi.org/10.1073/pnas.1523119113>). ODC-By Springmann et al. (2016).

Reducing the consumption of ASF would not only avoid millions of preventable deaths worldwide but also reduce the food system’s environmental impact. Figure 6 (FAO et al., 2020, p. 106) illustrates Springmann et al.’s (2020) calculations of the projected global GHG

emissions of four diet types (flexitarian, pescetarian, vegetarian, and vegan) for 2030 compared to a benchmark based on current consumption patterns (BMK). According to their calculations, a flexitarian diet would almost cut food-related GHG emissions by half, with a vegan diet cutting them by one fourth (Springmann, 2020). The potential reductions in GHG emissions depend solely on the quantity and type of animal-sourced products consumed. This coincides with the results discussed in the 2019 IPCC report on Climate Change and Land: low-meat, vegetarian, or in the optimal case, vegan diets have a mitigation potential of 0.7–7.3, 4.3–6.4 and 7.8–8 GtCO₂e, respectively (IPCC, 2019, p. 60).

Figure 6

Diet-related GHG emissions in 2030 by diet type and food group



Note. Diet-related GHG emissions in 2030 by diet type and food group. Diet types include benchmark current food consumption patterns (BMK) and four alternative healthy diet patterns: flexitarian (FLX), pescetarian (PSC), vegetarian (VEG) and vegan (VGN). Figure from “The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets” by the FAO, IFAD, UNICEF, WFP and WHO, 2020, p. 106 (<https://doi.org/10.4060/ca9692en>). CC BY-NC-SA.

While 52% of food-related emissions stem from lower-middle-income countries, the highest per capita emissions come from upper-middle-income (1.6 MtCO₂-eq) and high-income countries (1.0 MtCO₂-eq). Adopting any of the four alternative dietary patterns would lead to a GHG emissions reduction of 45-78% in middle-income countries and up to 60-86% in high-middle-income countries, followed by 60-77% in high-income countries. Lower-middle income countries could reduce 31-70% of their food-related GHG emissions and low-income countries 27-68%. Nevertheless, it is important to note that GHG emissions in some regions, especially in those where high shares of the population suffer from undernourishment and other forms of malnutrition, might increase with a shift toward SHDs (FAO et al., 2020, pp. 106–107).

A shift toward SHDs would also lead to significant reductions of GHG emissions-related social costs. Even considering the wholesale costs of the four alternative healthy diet patterns evaluated in Springmann et al. (2020) (flexitarian, pescetarian, vegetarian, and vegan), the diet-related health and climate-change costs of the benchmark diet remain higher (FAO et al., 2020, pp. 109–110). The adoption of any of the four alternative dietary patterns would lead to reductions in the full cost of diets between 22-29% globally, and up to 52–58% in high-income countries (FAO et al., 2020, p. 110). SHDs would also reduce the need for additional land area for food production, thus positively impacting land use by reducing deforestation and associated food system vulnerabilities (IPCC, 2019, pp. 42, 55–57). This makes dietary shifts toward SHDs not only a mitigation but also an adaptation measure to climate change (IPCC, 2019, p. 60). SHDs could also improve public health, human well-being and society's resilience (Creutzig et al., 2022).

It is important to note that sustainability should not come at the cost of public health. There are also ultra-processed foods, high in sugars, fats and or salt, that have a lower environmental impact than the usually carbohydrate-rich staple foods they displace (UNSCN, 2017, p. 15). At the same time, certain foods considered to be especially healthy may be harmful for the environment in some respects and need to be better balanced against one another in each case. For example, nuts and fish are known to be beneficial for cardiovascular health. Both have a huge water footprint, even higher than that of cattle, but while nuts' emissions are relatively low, fish farming emits more GHG emissions than pig and poultry farming. Thus, it is necessary to evaluate the entirety of each food system to assess which healthy foods are the most sustainable in each case (Ritchie & Roser, 2020).

The estimates for the mitigation effects of diet shifts include both the reductions in GHG emissions from fewer livestock as well as soil carbon sequestration on spared land (Shukla et al., 2019, p. 58). Therefore, the 2019 IPCC report on Climate Change and Land calls for policy makers to implement policies that not only reduce food loss and waste but also to (IPCC, 2019):

[...] influence dietary choices, enable more sustainable land-use management, enhanced food security and low emissions trajectories (high confidence). Such policies can contribute to climate change adaptation and mitigation, reduce land degradation, desertification and poverty as well as improve public health (high confidence). (p. 27)

As for the exact definition, the FAO and WHO (2019, pp. 10-11) listed the following characteristics of SHDs (FAO & WHO, 2019, pp. 10–11):

Regarding the health aspect

1. ...start early in life with early initiation of breastfeeding, exclusive breastfeeding until six months of age, and continued breastfeeding until two years and beyond, combined with appropriate complementary feeding.
2. ... are based on a great variety of unprocessed or minimally processed foods, balanced across food groups, while restricting highly processed food and drink products.²
3. ... include wholegrain, legumes, nuts and an abundance and variety of fruits and vegetables.³
4. ... can include moderate amounts of eggs, dairy, poultry and fish; and small amounts of red meat.
5. ... include safe and clean drinking water as the fluid of choice.
6. ... are adequate (i.e. reaching but not exceeding needs) in energy and nutrition for growth and development, and to meet the needs for an active and healthy life across the lifecycle.

² *Original footnote in FAO & WHO (2019, pp. 10-11):* „Food processing can be beneficial for the promotion of high quality diets; it can make food more available as well as safer. However, some forms of processing can lead to very high densities of salt, added sugar and saturated fats and these products, when consumed in high amounts, can undermine diet quality. (Global Panel on Agriculture and Food Systems for Nutrition. 2016. Food systems and diets: Facing the challenges of the 21st century. London, UK. <http://ebrary.ifpri.org/utils/getfile/collection/p15738coll5/id/5516/filename/5517.pdf>)“

³ *Original footnote in FAO & WHO (2019, pp. 10-11):* “Potatoes, sweet potatoes, cassava and other starchy roots are not classified as fruits or vegetables.”

7. ... are consistent with WHO guidelines to reduce the risk of diet-related NCDs, and ensure health and wellbeing for the general population.⁴
8. ... contain minimal levels, or none, if possible, of pathogens, toxins and other agents that can cause foodborne disease.

Regarding environmental impact

9. ... maintain greenhouse gas emissions, water and land use, nitrogen and phosphorus application and chemical pollution within set targets.
10. ... preserve biodiversity, including that of crops, livestock, forest-derived foods and aquatic genetic resources, and avoid overfishing and overhunting.
11. ... minimize the use of antibiotics and hormones in food production.
12. ... minimize the use of plastics and derivatives in food packaging.
13. ... reduce food loss and waste.
14. ... are built on and respect local culture, culinary practices, knowledge and consumption patterns, and values on the way food is sourced, produced and consumed.

Regarding sociocultural aspects

15. ... are accessible and desirable.
16. ... avoid adverse gender-related impacts, especially with regard to time allocation (e.g., for buying and preparing food, water and fuel acquisition). (pp. 10-11)

The 2019 IPCC report gives a more nutrition-based description of what constitutes SHDs: “Examples of sustainable and healthy diets are high in coarse grains, pulses, fruits and vegetables, and nuts and seeds; low in energy-intensive animal-sourced and discretionary foods (such as sugary beverages); and with a carbohydrate threshold” (Shukla et al., 2019, p. 58). The report recognizes the potential and challenge of policies aiming for dietary shifts and even mentions technological developments as potential (but uncertain) solutions for a successful transition toward diets less reliant of ASF:

⁴ *Original footnote in FAO & WHO (2019, pp. 10-11):* “They include up to 30-35 percent of total energy intake from fats, with a shift in fat consumption away from saturated fats to unsaturated fats and towards the elimination of industrial trans fats; less than 10 percent of total energy intake from free sugars (possibly less than 5 percent) and not more than 5 g per day of salt (to be iodized). WHO. 2018. Healthy diet. WHO fact sheet No. 394 (updated August 2018). Geneva, World Health Organization, 2018. https://www.who.int/nutrition/publications/nutrientrequirements/healthydiet_factsheet/en/ “

Mitigation potential of dietary change may be higher, but achievement of this potential at broad scales depends on consumer choices and dietary preferences that are guided by social, cultural, environmental, and traditional factors, as well as income growth. Meat analogues such as imitation meat (from plant products), cultured meat, and insects may help in the transition to more sustainable and healthy diets, although their carbon footprints and acceptability are uncertain (Shukla et al., 2019, p. 58).

This coincides with the FAO and WHO (2019) recommendations and their background paper on healthy diets. “The evidence to date on dietary patterns and health suggests a need to focus on plant foods and degree of food processing, and is consistent with key elements of the WHO and GBD [Global Burden of Disease] findings” (WHO & FAO, 2019, p. 19). The implied dietary shifts toward plant-sourced foods and away from ASF and the changes in food production systems are directly pertinent for governments worldwide as they sharpen their sustainability agendas and policy programs to meet the ongoing sustainability crisis. The challenge governments face ties us back to the research question of this thesis: What policies can high-income countries implement to promote sustainable and healthy diets in their food environments?

7. Methods

To answer the research question, a structured literature review on policy recommendations for the promotion of SHDs in food environments was performed. These recommendations were collected from reports published by international organizations and research associations primarily for high-income countries with modern food systems. The evaluation of policy recommendations specifically for middle- and low-income countries is outside this study's scope.

The policy recommendations included in the analysis are limited to those affecting only the food environment and the impermanently connected consumer behavior. Thus, policy recommendations on the food supply chains that do not directly affect the food environment, including policies on use of agricultural land, fertilizer use, and other issues, were excluded from the analysis despite being critical for a successful transition to a sustainable food system. The reasons for this are multiple: On the one hand, policy recommendations on the food supply chains are so abundant that they could themselves be the material for a review on their own. On the other hand, despite the changes across the supply chains being important

for the transition to a sustainable food system and the estimate that optimizing the supply chains would lead to only a 10% reduction in emissions, the adoption of SHDs has the potential to reduce GHG emissions by up to 80% (Springmann et al., 2018). Thus, policy recommendations on food loss and food waste were not considered in the analysis. Only policy recommendations specifically for food environments and for the food supply chains that directly affect food environments were included in the analysis, such as fiscal policy and infrastructure aspects.

The criteria for the reports included in the literature review were as follows: only reports by expert committees put forward by international organizations or research associations, including recommendations on policies to promote the adoption of both SHDs. Only documents entailing clearly formulated policy recommendations on SHDs were considered for this study. This included documents with lists but also recommendations directed at governments and policymakers within the documents' text field. The search was limited to English-language documents published between January 2015 – the adoption year of the 17 SDGs – and June 17, 2022. Only documents accessible online without cost barriers were included in the analysis. Reports focusing on specific geographic regions and/or populations, reviews of other documents, and old versions of newer reports were excluded from the analysis. Scholarly journal research articles were also excluded from the review.

The search took place on *Google* and *Google Scholar* search engines with the following search terms: “policy,” “recommendations,” “sustainable and healthy diets,” “healthy and sustainable diets,” “sustainable diets,” “sustainable food,” “food system,” “food environment,” and “nutrition.” Additionally, a snowball sampling method from the bibliography of the resulting documents from the search was performed to identify further relevant documents for the analysis. The resulting documents' abstracts and summaries were then screened as to whether they matched the criteria of the review described above. The final assessment included a more in-depth analysis of the documents to evaluate whether they matched all criteria. In this step, 20 documents were removed from the list; their recommendations were intended primarily or even exclusively for governments in low- and middle-income countries, only superficially related to environmental sustainability aspect of the food system or limited to the food supply chains. Figure 7 provides an overview of the methodology applied, and Table 2 lists the 13 documents included in this review.

Figure 7

Illustration of methodological proceeding of study based on the 2009 PRISMA Flow Diagram

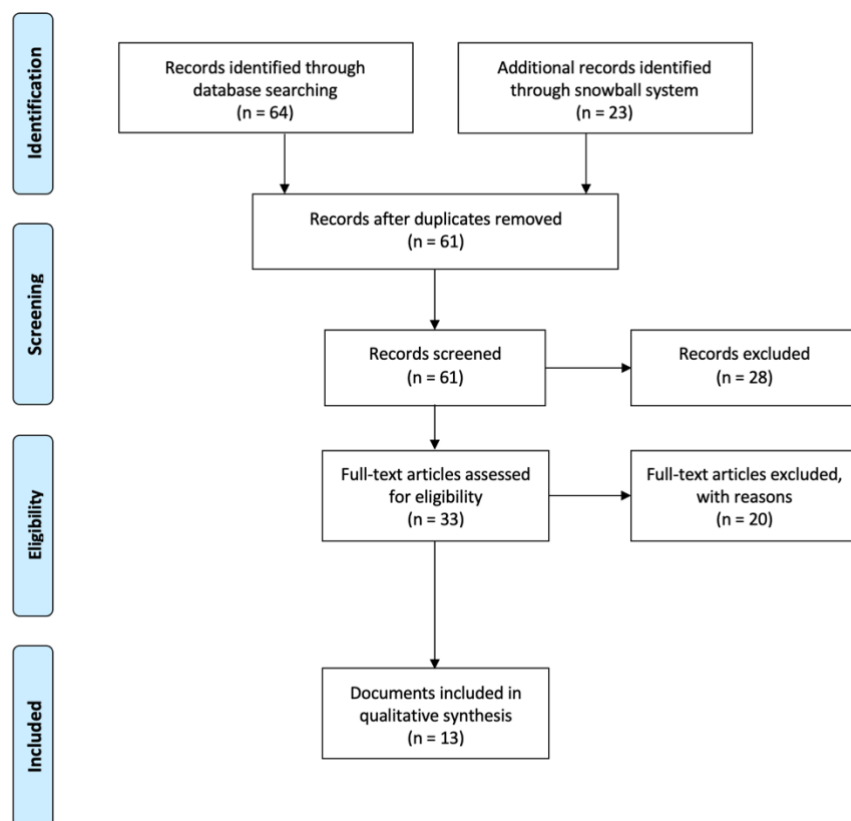


Table 2

List of policy recommendation reports from international organizations and research institutes included in the analysis of this thesis

Organization	Year	Title	Citation	Abbreviation
FAO	2016	Influencing food environments for healthy diets	FAO (2016a)	FAO-2016
FAO, FCRN	2016	Plates, pyramides, planet. Developments in national healthy and sustainable dietary guidelines: a state of play assessment	FAO (2016b)	PPP-2016
FAO, IFAD, UNICEF, WFP and WHO	2020	The State of Food Security and Nutrition in the World 2020 - Transforming food systems for affordable healthy diets	FAO et al. (2020)	SFSN-2020
FAO, WHO	2019	Sustainable Healthy Diets Guiding Principles	FAO and WHO (2019)	SHDGP-2019
GPAFSN	2020	Future Food systems: For people, our planet, and prosperity	GPAFSN (2020)	GPAFSN-2020
GPAFSN	2016	Food systems and diets: Facing the challenges of the 21st century	GPAFSN (2016)	GPAFSN-2016
HLPE	2017	Nutrition and food systems. High Level Panel of Experts on Food Security and Nutrition	HLPE (2017)	HLPE-2017
The Lancet Commission	2019	Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems	Willett et al. (2019)	EAT-2019
The Lancet Commission	2019	The global syndemic of obesity, undernutrition, and climate change: The Lancet Commission report	Swinburn et al. (2019)	SYN-2019
UN	2021	Science and Innovations for Food Systems Transformation and Summit Actions	UN (2021)	UN-2021
UNSCN	2017	Sustainable Diets for Healthy People and a Healthy Planet	UNSCN (2017)	UNSCN-2017
UNSCN	2019	Food Environments: Where People Meet the Food System	UNSCN (2019)	UNSCN-2019
WRI	2016	Shifting Diets for a Sustainable Food Future	WRI (2016)	WRI-2016

FAO, Food and Agriculture Organisation; FCRN, Food Climate Research Network; IFAD, International Fund for Agricultural Development; UNICEF, United Nations International Children's Emergency Fund; WFP, UN World Food Program; WHO, World Health Organisation; GPAFSN, Global Panel on Agriculture and Food Systems for Nutrition; HLPE, High-Level Panel of Experts on Food Security and Nutrition; UN, United Nations; UNSCN, United Nations Standing Committee on Nutrition; WRI, World Resource Institute.

The qualitative document analysis was performed in the program MAXQDA Plus 2022.2.1. The method of choice was a deductive coding mechanism based on an expanded version of the INFORMAS Government Food Environment Policy Index (Food-EPI) developed by Swinburn et al. (2013). The model's 14 policy domains were adopted as codes for the coding process of the policy recommendation reports. The definitions of the domains were expanded to include the environmental sustainability aspect. An eighth policy domain, "food education," was included by the author, based on the latest model of the food environment (Turner et al., 2018). The reasoning behind this was explained in Section 4.3. Table 3 provides an overview of the resulting coding categories used in the analysis, the ultimate categorization of the policy recommendations and a description of each domain.

Table 3

Overview of the 15 categories (eight policy and seven infrastructure support domains) used for the analysis of the policy recommendation reports for this thesis

Policy domains	Description
Food retail	Physical availability of food outlets in communities (outlet density and proximity) and in-store food availability (product density).
Food pricing	The price consumers pay when purchasing food products at a retail store.
Food composition	Ingredients and nutritional value of food.
Food labelling	Information printed or attached to the food packaging or the food product directly.
Food promotion	Marketing and advertising practices of food businesses, including food operators.
Food provision	The providing or supplying of meals in government-funded institutions (e.g., schools).
Food in trade and investment agreements	Border policy and other forms of domestic policy that affect trade flows and investment agreements.
<i>Food education</i>	<i>Information on nutrition and sustainability provided to the public.</i>
Infrastructure support domains	Description
Leadership	Political will to promote sustainable and healthy diets in policymaking.
Governance	Government structures that ensure transparency and accountability, and encourage stakeholder participation in policy-making on the food environment.
Monitoring and intelligence	Government's monitoring and intelligence systems (surveillance, evaluation, research and reporting) on the status of food environments, population nutrition and diet-related NCDs.
Platforms for interaction	Government mechanisms that enable and encourage exchange across government departments and with other stakeholders of the food environment.
Funding and resources	Funding and investment in efforts to promote sustainable and healthy diets in the food environment.
Workforce development	Training of certain groups of stakeholders (from doctors and nutritionists to chefs and policymakers) of food environments in their role to promote and enable the adoption of sustainable and healthy diets.
Health-in-all policies	Processes that ensure policies across government are coherent and aligned with the promotion of sustainable and healthy diets, including food-based dietary guidelines.

Note (Table 3). Fourteen of the categories are based on “Monitoring and benchmarking government policies and actions to improve the healthiness of food environments: A proposed Government Healthy Food Environment Policy Index” by B. Swinburn, Vandevijvere, S., Kraak, V., Sacks, G., Snowdon, W., Hawkes, C., Barquera, S., Friel, S., Kelly, B., Kumanyika, S., L’Abbé, M., Lee, A., Lobstein, T., Ma, J., Macmullan, J., Mohan, S., Monteiro, C., Neal, B., Rayner, M., ... Informas, 2013, *obesity reviews* (2013) 14 (S1) p. 14 (<https://doi.org/10.1111/obr.12073>). The policy domain “Food education” was added by the author based on “Concepts and critical perspectives for food environment research: A global framework with implications for action in low- and middle-income countries” by C. Turner, Aggarwal, A., Walls, H., Herforth, A., Drewnowski, A., Coates, J., Kalamatianou, S., & Kadiyala, S., 2018, *Global Food Security*, 18, 93–101

8. Results: Policy Recommendations to Promote the Adoption of Sustainable and Healthy diets

This section summarizes the results of the review (eight policy and seven infrastructure support domains) of the expanded Food-EPI model used during the analysis. Each domain begins with an overview of the main barriers to SHDs identified in the reports before describing the policy recommendations to address them. Appendix 2 provides an overview of all recommendations by policy and infrastructure support domains of the reports.

8.1. Policy domains

8.1.1. Food Retail

One of the most salient barriers to the adoption of SHDs is related to the inadequate (physical) availability of HSF. This is driven by several factors. At the macro-level, availability of HSFs depends on the agricultural production, as some types of crops are produced in especially high quantities compared to others (GPAFSN, 2020, p. 73). At the local level, people may lack access to vendors who offer HSFs near them. Physical inaccessibility to markets offering fresh fruits and vegetables constitutes a major barrier for many people, especially among poorer income groups (FAO et al., 2020, p. 127). In some cases, markets and food outlets in an area do not offer nutritious and healthy foods. The importance of physical access and availability to HSF cannot be understated: availability is the prerequisite for the adoption of SHDs (FAO et al., 2022, p. xxiii).

Regarding physical access and availability, underserved groups usually face higher opportunity costs in the form of greater physical distances and higher transport and time costs to access markets offering healthy foods. The aspect of financial costs as barriers is discussed in the food pricing domain. Physical inaccessibility of healthy foods leads people to opt for unhealthy foods as these are not only cheaper but also closer to home. Poor road networks and long distances between food production and consumption sites in some regions further exacerbate these physical barriers (FAO et al., 2020, pp. 127–128).

A critical aspect of physical availability is related to the markets in which people access foods. In 2000, supermarkets accounted for 70-80% of food retail sales in France and the US (Ranganathan et al., 2016, p. 52), making them the dominant point of access to food for a large share of the population in high-income countries (and increasingly in middle- and low-income countries as well). This phenomenon has been labelled the *supermarket revolution*, which took place around the 1990s as the food industry experienced a push in globalization. The supermarket revolution encompasses the growing prevalence of supermarkets as the primary food retail market worldwide (FAO et al., 2020, p. 137; Reardon & Gulati, 2008). Supermarkets in urban areas have a double-edged sword effect on the provision of access to SHDs. Their food supply model offers essential advantages for distributing nutritious perishable foods, such as fruits and vegetables, which help keep food prices stable and guarantee food safety. At the same time, supermarkets also provide access to a wide range of non-perishable, energy-dense foods with low nutritional value at lower prices than those of healthy foods (FAO et al., 2020, p. 128). Nearly 60% of processed food is distributed through supermarkets (GPAFSN, 2016, p. 92). This phenomenon is especially problematic in the case of low-income households, which are especially prone to regularly consume these foods compared to high-income households (GPAFSN, 2020, p. 108). It is nevertheless important to highlight that the results of the existing studies on the effects of supermarkets on people's diets hint toward complex and context-specific results, as people do not only rely on supermarkets for their food purchases (GPAFSN, 2020, p. 108).

High urbanization rates, lifestyle changes and women's increasing participation in the labor market have also affected another aspect of people's lifestyles across high-income countries: time constraints. Not only does purchasing nutritious foods require time, but healthy eating seems to also be determined by how much time people spend preparing their foods (Monsivais et al., 2014). These are time burdens that disproportionately affect women. In addition, due to the current availability of low-cost and energy-dense (but low nutritional

value) fast and easy-to-prepare foods, the opportunity costs of eating healthy are just too high for many households. As a result, more and more people are shifting away from home-cooked meals toward street foods and eating at fast food and full-service restaurants (GPAFSN, 2020, p. 152). Lack of time was identified as the leading barrier to implementing national dietary guidance across high-income countries. For example, the more hours people spend in paid employment in the USA, the likelier they are to purchase food at quick-service outlets (FAO et al., 2020, p. 130). Similarly, Europe's low- and middle-income working parents rely more on take-outs and restaurant meals and other quick options to cope with time constraints (Monsivais et al., 2014). However, there are other factors besides convenience and opportunity cost, such as the relative prices of different foods, taste, and peer pressure (GPAFSN, 2020, p. 152).

Policy recommendations

Most, if not all, of the domains of the food environment, depend on this domain. Food availability is a prerequisite for people to interact with food in the first place, which makes the availability of HSFs for everyone a priority for governments (FAO et al., 2020, p. 154). As the GPAFSN-2020 (p. 169) recognized, besides food processing and packaging, food wholesale and retail are the areas that will need to change the most to enable food environments to foster SHDs. The physical availability of HSFs is a domain within the food environment all reports touch upon, some with more thorough recommendations than others.

On the one hand, ensuring a good national road network, transport system, and market infrastructure is critical for the availability of HSFs in rural and urban areas (FAO et al., 2020, p. 149; HLPE, 2017, p. 19). The infrastructure improvement across food supply chains is necessary for making nutritious foods not only more physically accessible but also financially viable as food storage and distribution improve (FAO et al., 2020, p. 138). This task's magnitude will make public and private investments essential (FAO et al., 2020, p. 149; GPAFSN, 2020, p. 85). The goal is for this system to increase the year-round availability of nutrient-dense foods (GPAFSN, 2016, p. 99). Especially salient is the need for transport and cool chain infrastructure investment in poorly served communities (GPAFSN, 2016, p. 104). This goes hand in hand with calls by other organizations to invest in the development of packaging technologies for food (HLPE, 2017, p. 19), especially for vegetables and fruits, due to their much shorter shelf life than processed foods (Willett et al., 2019, p. 479).

On the other hand, there is the aspect of zoning regulation, already highlighted by Swinburn et al. (2013, p. 27-28). Zoning regulation defines the density and types of food outlets available within a community or in the proximity of schools. The HLPE-2017 and the SFSN-2020 recommend that governments design policies and regulations to shape the built environment into one that promotes the adoption of healthy diets via planning and zoning regulation and favorable tax regimes to reduce food deserts and swamps (HLPE, 2017, p. 19). This also includes passing zoning laws that incentivize retailers to open supermarkets in low-income areas and reduce the density of fast-food restaurants and food swamps, an initiative also supported in the SYN-2019 (Swinburn et al., 2019, p. 812). The EAT-2019 Lancet Commission argues that the decision power over zoning regulations should be decentralized and allocated to local authorities for it to be effective. These zoning regulations should help improve the types of food outlets available around schools (FAO et al., 2020, p. 158), and they are expected to be especially crucial in restricting unhealthy food outlets in low-income areas (Willett et al., 2019, p. 479). They also recommend incentivizing the establishment of farmers' markets and food trucks to sell nutritious foods in low-income areas (HLPE, 2017, p. 101). This would go hand in hand with the recommendation of the GPAFSN-2016 to restructure the supply chains into *local food systems* where farmers and customers interact directly with one another (GPAFSN, 2016, p. 106).

As the GPAFSN-2016 highlights, governments could also establish new retail hubs for nutritious foods at locations and times suitable for low-income populations (GPAFSN, 2016, p. 100). This could be done by changing the physical environment where people interact with food, such as putting healthy foods at eye level at the end of aisles or checkout lines in supermarkets (Ranganathan et al., 2016, p. 51). The availability of stores with accessible (and affordable) nutritious foods is especially important to ensure the effectiveness of other initiatives within these communities, such as cash transfers (FAO et al., 2020, p. 153).

Furthermore, the EAT-2019 also calls for urban planning interventions in low-income areas to consider the local context and how residents interact with the local food environment. These interventions should reflect their abilities and preferences for travel to purchase groceries (Willett et al., 2019, p. 479). Similarly, rural and urban planners are called upon to consider the distribution and trade of food in their designs in favor of local and fresh products (UNSCN, 2017, p. 21).

Given the relevance of supermarkets in shaping people's food choices, the GPAFSN-2020 calls for governments to partner with them and establish the goals of improving people's diet

quality. Examples of this type of partnership are community-focused supermarket chains promoting the consumption of perishable nutritious foods by offering free samples, lowering prices of blemished products, and improving the food's nutrition information (GPAFSN, 2020, p. 108). The GPAFSN-2016 recommends that governments implement incentives to retailers to improve the availability of nutritious diets and reduce the appeal of lower-quality ones (GPAFSN, 2016, p. 106). The HLPE-2017 recommends that governments restrict the in-store promotion of energy-dense foods of low nutritional value in all retail stores (HLPE, 2017, p. 101). However, as the GPAFSN-2020 recognizes, food allocation is usually part of the business model of many supermarkets, making it hard to implement the recommendation to persuade them to reposition the foods on display (GPAFSN, 2020, p. 145). Nonetheless, the FAO and WHO (2019) remind governments that they also ultimately have the option to restrict the sales of undesired food products (FAO & WHO, 2019, p. 26).

8.1.2. Food Pricing

The next aspect after ensuring physical access to food is economic accessibility. Three billion people globally, 18 million of them in North America and Europe, are unable to afford healthy diets, making this is a wide-ranging and pressing issue. As explained above, there are multiple reasons why the food systems are shaped as they are. Food prices are determined by multiple factors, including the traditional economic principles of food demand and production costs, but also by fiscal policy, technology, political stability, and corporate interests and market structures (FAO et al., 2022, p. xxiii).

Food prices in urban cities are especially prone to price increases ((FAO et al., 2020, pp. 127–128). Food price increases and price volatility affect households' purchasing power and, consequently, their nutrition and welfare. Poorer households are most strongly affected, as they spend a larger share of their income on food. While globalization has brought more choices and year-round accessibility to diverse sorts of food in more affluent markets around the world, access to low-cost, calories-dense and nutrition-poor foods has also increased, especially in underserved areas (HLPE, 2017, p. 30).

It is impossible to discuss the topic of food prices without addressing the main problem that cuts across today's food systems: its prioritization of quantity over quality (FAO, 2016b, p. 9; FAO et al., 2022, p. 55; GPAFSN, 2020, p. 72). So far, most agricultural policies around the world have had the primary goal of increasing food production, increasing people's energy intake to end hunger, and driving economic growth via trade (FAO, 2016b, p. 9; FAO et al.,

2022, p. 55; GPAFSN, 2020, p. 72). However, this development is not the result of the mechanisms of the free market alone. Between 2013 and 2018, the food and global agricultural sector obtained an average of almost USD 630 billion per year in financial support from national governments. Most of this (70%) reached farmers individually, mainly through trade and market policies and fiscal subsidies largely coupled to agricultural production (FAO et al., 2022, p. xiv). This support is primarily directed at staple foods, dairy, and other ASF, especially in high-income and upper-middle-income countries. These fiscal subsidies have contributed to the low prices of staple foods and their derivatives, including low-cost nutrition-poor foods. Rice, sugar, and meats are today's most incentivized foods worldwide, while vegetables and fruits often obtain less support or are even penalized. The lack of subsidies for fruits, vegetables, and pulses (i.e. legumes) has contributed to high prices and low consumption rates of HSFs (FAO et al., 2022, p. 55).

Higher diet quality comes with high additional costs, as the price of diets tends to increase with their nutritional quality. A healthy diet⁵ is (on the global average) 1.7 times more expensive than a nutrient-adequate diet⁶ and 5.4 times more expensive than an energy-sufficient diet⁷. Due to the lower costs of calorie-rich foods in most high-income countries, healthy diets in these countries cost as much as 7.4 times more than energy-sufficient diets (FAO et al., 2020, pp. 76–77). However, total costs on society – that is, the sum of the wholesale costs of the food, diet-related health, and climate-change social costs – make the adoption of SHDs the most price-sensitive choice overall. This is primarily due to the reduction in consumption of ASF; the lower it is, the higher will be the savings, with estimates between 52–58% in high-income countries (FAO et al., 2020, pp. 109–110).

People in low- and middle-income countries spend a greater share of their household budget on food than those in high-income countries. Even in high-income countries low-income households spend multiple times more of their income on food than high-income ones. To illustrate, the lowest 20% of households in the US spend 35% of their household budget on

⁵ “A *healthy diet* [emphasis added] ensures adequate calories and nutrients. It includes a balanced, diverse intake of foods from several different food groups. It is intended to meet all requirements of nutrient adequacy and help prevent malnutrition in all its forms, as well as NCDs” (FAO et al., 2020, p. 64).

⁶ A *nutrient-adequate diet* “meets required levels of all essential nutrients” (FAO et al., 2020, p. 73) by providing adequate calories and relevant nutrient intake values of 23 macro- and micronutrients and set up to prevent deficiencies and avoid toxicity. However, this diet is not set up to necessarily avoid diet-related non-communicable diseases, unlike the healthy diet (FAO et al., 2020, p. 73).

⁷ An *energy-sufficient diet* meets people's needs for short-term subsistence by providing them with adequate calories for daily energy balance using the basic starchy staple within the national context (e.g. rice, maize or wheat only) (FAO et al., 2020, p. 73).

food while the average American household spends around 6.4%. Thus, affording nutrition-rich foods is not only challenging for most people in low- and middle-income countries but also for vulnerable groups in high-income countries (HLPE, 2017, p. 29).

Besides agriculture subsidization schemes, governments throughout the world also use managed price policies. These are primarily implemented in low- and middle-income countries. These measures are set up to either incentivize domestic agriculture production or to protect consumers from high food prices. The latter include policies such as food price capping, reducing consumption taxes, or limiting monopolies or oligopolies in the market. In high-income countries, such as the US and within the EU, maintained price measures were implemented after the Second World War to support farmers and have been largely replaced by direct payments, which are coupled to neither price nor productivity (FAO et al., 2020, p. 135).

It is important to note that the subsidies food producers receive in high- (and middle-) income countries are not only affecting their national food systems. According to data provided by the International Consortium for Measuring the Policy Environment for Agriculture, agricultural production in low-income countries is, in contrast, under-protected. Agriculture subsidies in high-income countries, thus, distort not only national markets but also international ones. They harm the agriculture industry in countries with no such trade barriers, as national food production is discouraged due to the low prices of imported food from subsidized food systems in high-income countries. The subsidies affect not only the income of smallholders in low-income countries, and thus their ability to afford healthy diets but also the local agriculture industry. This reliance leads to high price volatility and dependence on food imports in low-income countries (FAO et al., 2020, p. 131).

Policy Recommendations

As the SFSN-2020 states, “[p]ublic expenditure is a powerful instrument by which governments can shape and develop their food systems” (FAO et al., 2020, p. 135). Public spending can correct market failures, reallocate resources to the poorest households, farmers, and smallholders, and provide public goods (FAO et al., 2020, p. 135; Mogues et al., 2012; UNSCN, 2017, p. 15). The barriers to SHDs, in the form of unavailability and financial inaccessibility of HSFs are highlighted across all analyzed documents. Both aspects could be considered the two most important domains of the food system. In general, all experts regard a restructuring of the food systems’ fiscal policy as critical for promoting SHDs.

International organizations, such as the FAO, IFAD, UNICEF, WFP⁸, UN, and WHO, as well as the UNSCN (2017; 2019) and the Global Panel on Agriculture and Food Systems for Nutrition (GPAFSN, 2020), call for a reorientation of agricultural priorities toward more nutritious foods from sustainable food systems. This reorientation is also a key priority highlighted in the Lancet Commission reports SYN-2019 and EAT-2019 (Swinburn et al., 2019, p. 837; Willett et al., 2019, p. 480). The current focus on staple foods, sugar, and ASF has significantly contributed to today's food systems' problems. Governments will need to reevaluate their current food and agriculture sector strategy and reallocate their resources to encourage agricultural productivity and diversification toward more nutrition-sensitive agricultural production. The strategy's goal should be to ensure that SHDs are financially accessible to everyone by incentivizing the agricultural sector to allocate resources toward healthy foods with small environmental footprints, such as vegetables, fruits, and pulses (FAO et al., 2020, p. 143; GPAFSN, 2020, p. 87; UNSCN, 2017, p. 15).

To improve the financial accessibility of HSFs, the SFSN-2020, the UN-2021, and the GPAFSN-2020 recommend that governments conduct an objective evaluation of their agricultural policies to assess how they support the production and consumption of nutritious food. This evaluation should cover all policy frameworks that directly and indirectly affect food production, with fiscal policy at the heart of the analysis. One of the most common recommendations is the direct reduction of prices of nutrient-rich non-staple foods via financial subsidies. Healthy foods from sustainable food systems should be subsidized instead of taxed, the latter being currently the case across many countries. This reorientation means avoiding taxing nutritious and sustainable foods and shifting subsidy schemes away from the current focus on staple foods, sugar, and animal-sourced foods toward fruits, vegetables, and legumes (FAO et al., 2020, p. 145; HLPE, 2017, p. 20; UNSCN, 2017, p. 15, 2019, p. 7; Willett et al., 2019, p. 479). This is often proposed in combination with the establishment of an evidence-based fiscal policy framework designed to incentivize or disincentivize the production and retail of certain foods, thus, implementing taxes and subsidies on foods based on their nutritional value (FAO et al., 2020, p. 155; GPAFSN, 2020, p. 179; HLPE, 2017, pp. 15, 20; UNSCN, 2019, p. 7) and sustainability (FAO & WHO, 2019, p. 12; Swinburn et al., 2019, p. 823; Willett et al., 2019, p. 479). It could also help reduce the perceived risks for companies to invest in these products (GPAFSN, 2020, p. 154). The main

⁸ IFAD: International Fund for Agricultural Development; UNICEF: United Nations International Children's Emergency Fund; WFP: World Food Programme

goal of all these recommendations is to reduce the price consumers pay for healthy foods from sustainable food systems. Additionally, the shift in policy focus should not negatively affect the quantity of food produced by the system but instead primarily improve the quality of the foods produced. The idea is for more nutrient-rich food to be produced sustainably and not necessarily to reduce the total amount produced (GPAFSN, 2020, p. 71). According to the GPAFSN (2020, p. 71), a relatively modest shift in subsidies in favor of nutrient-rich foods, such as 25% of current subsidy schemes, could already have major positive effects on the prices of these foods by promoting their production at the local and global level. Still, given the urgency, the GPAFSN (2020, p. 179) calls for the alignment of prices of HSFs with that of staple foods and even of ultra-processed foods, making sure that the latter are no cheaper than the nutrient-rich foods. According to a systemic review on primarily high-income countries cited in the SFSN-2020 (WHO et al., 2020, p. 155), a price decrease of 10% of healthy foods would increase the consumption of healthy foods by 12% (Afshin et al., 2017).

Further recommendations include implementing systems to reduce the volatility of food prices, such as the reevaluation of biofuel subsidies and tariffs to reduce the diversion of food to energy use and the removal of market barriers. Better access to price information and early warning systems and coordinative management of food stocks at the international level are also proposals from the EAT-2019 (Willett et al., 2019, p. 479). Several organizations also recognized the reduction of food waste and most importantly food loss, as one method to reduce food prices, such as through the recommendations for infrastructure investment detailed in the food retail domain above (FAO et al., 2020, p. 149) or through capacity building in the harvesting of nutritious crops (GPAFSN, 2016, p. 104). Financial (and promotional) incentives for retailers and food outlet owners to sell healthy foods were also among the options proposed to address the financial inaccessibility of SHDs (HLPE, 2017, p. 19).

Given the link between the SDG 1 of “Ending poverty in all its forms everywhere” and SDG 2 to achieve “Zero hunger,” a pivotal aspect to enable SHDs across all segments of the population is related to poverty alleviation (FAO et al., 2020, p. 151). Poverty reduction should be a priority as the consequences of the systemic problems of the food system disproportionately affect the poorest and most socially disadvantaged populations (Swinburn et al., 2019, p. 835). Households in lower socioeconomic brackets struggle with higher rates of NCDs (FAO et al., 2020, p. xxvii; Willett et al., 2019, p. 479). Since even energy-

sufficient diets are unaffordable for millions worldwide, raising the purchasing power of the poorest in society is crucial to ensure their access to SHDs. Social protection mechanisms are composed of diverse policies and programs designed to address the many barriers poorer people face at all levels: economic, environmental, and social vulnerabilities, food insecurity, and malnutrition (FAO et al., 2020, p. 153). Addressing the latter primarily includes reducing people's financial and social barriers to food while considering the relative prices of food to non-food essentials (FAO et al., 2020, p. 153; GPAFSN, 2020, p. 169). Nevertheless, policies designed to reduce poverty and income inequality in general, such as those set up to generate employment and income-generating activities, are essential as they raise people's incomes and make SHDs more affordable (FAO et al., 2020, p. 151; GPAFSN, 2020, p. 169).

Furthermore, the SFSN-2020 and the GPAFSN-2020 call for today's poverty lines, the basis for the social safety programs in place, to be redrawn. The current definition fails to take the higher prices of even nutrient-adequate diets, let alone the costs of healthy diets, into account and are thus not fit to support the adoption of SHDs. These *nutrition-sensitive poverty lines* need to go beyond today's "basic needs" calculating approach and include new food price metrics based on global nutritional and dietary goals (FAO et al., 2020, p. 82). They need to be, as their name indicates, nutrition-sensitive. Today's poverty lines are simply not high enough to cover nutrition needs in addition to food security (FAO et al., 2020, p. 82; GPAFSN, 2020, p. 121).

Nutrition-sensitive social protection policies could ensure access to HSFs for underserved low-income households. This point also includes financial support for adequate micronutrient supplementation for such households. These policies are especially crucial in the case of adversity, such as the COVID-19 pandemic. Policy tools include cash transfer programs, in-kind food transfers, and school feeding programs (described further in the next section) but also the aforementioned subsidization of nutritious foods (FAO et al., 2022, pp. xxvii; 151). The social protection policies should ensure access to foods that meet people's dietary energy requirements and that are also healthy and sustainable (FAO et al., 2020, p. 153). The main goal is to ensure that vulnerable and poor groups have financial access to SHDs by directly increasing their purchasing power through cash transfers, in-kind food transfers and school feeding programs or indirectly through subsidization. The latter would also benefit higher-income households.

Particularly important for the effectiveness of cash transfers is ensuring that people have easily accessible and affordable food stores and markets and the provision of nutrition

education, as discussed in the food retail domain (FAO et al., 2020, p. 153). In-kind transfers, primarily food distribution, are also a common tool to free up household income, allowing people to spend more money on other nutritious foods. The choice between cash-transfer programs or in-kind transfers depends on the respective opportunity costs in procurement and logistics in food distribution and households' access to food. The latter is most commonly implemented in remote areas with limited access to food markets (FAO et al., 2020, p. 154).

Along with the subsidization of SHDs, there is also broad agreement on the need to introduce taxes on highly processed, energy-dense foods with minimal nutritional value (FAO et al., 2020, p. 158; GPAFSN, 2016, 2020, p. 153; UNSCN, 2017, p. 15; Willett et al., 2019, p. 479). For example, a common fiscal policy already implemented in various countries is the taxation of sugar-sweetened beverages, which was implemented in Mexico in 2014. According to a study in the US cited in the SFSN-2020, a modest tax on sugar-sweetened beverages would not only generate USD 13 billion in annual revenue but also reduce the costs of adverse health costs by as much as USD 17 billion (FAO et al., 2020, p. 321).

Another proposal brought forward by the UNSCN (2017, p. 16), the EAT-2019 (Willett et al., 2019, p. 479), and SYN-2019 (Swinburn et al., 2019, p. 837) is to tax food-related GHG emissions. This would create an economic incentive toward more sustainable foods and is based on the publication by Springmann et al. (2017) on the "Mitigation potential and global health impacts from emissions pricing of food commodities" (Springmann et al., 2017). As the UNSCN (2017, p. 16) put it:

A GHG emissions tax on foods (corresponding to their emissions intensities), if properly designed, could be a powerful health-promoting climate policy affecting health improvements worldwide. Sparing food groups known to be beneficial for health – such as fruits and vegetables – from taxation, selectively compensating for income losses associated with tax-related price increases, and using a portion of tax revenues for health promotion are potential policy options that could help avert most of the negative health impacts experienced by vulnerable groups, whilst still promoting changes toward diets which are more environmentally sustainable.

Similarly, the UN-2021 also recommends integrating the externalities of the food system into the food prices through a *true cost accounting* (TCA) mechanism. Policies should encourage companies to internalize their externalities and take appropriate steps to reduce them while sanctioning those companies that fail to do so. This would clearly require various steps at

different societal levels: coordination for harmonized TCA principles at the international level, education and capacity building throughout the public and private sector, and the development and provision of concrete tools to facilitate TCA in business and governments. Further steps could include integrating TCA into product labelling, business sustainability reporting, controls, national accounts, and GDP measures (Braun et al., 2021, p. 370).

8.1.3. Food Composition

As can be expected from the problems of today's food systems, most specifically the raging obesity and NCD epidemic, an intuitive aspect of today's food environment that needs to be addressed is food composition. In high-income countries, the challenge is not related to food safety, which is ensured via comprehensive and strict control mechanisms. The problem lies instead in the composition of the food being consumed. The ongoing dietary shift toward energy-dense, nutrient-poor foods with high levels of salt, sugar, and saturated and trans fats is understood to be a leading cause of overweight, obesity, and NCDs (FAO et al., 2020, p. 118; HLPE, 2017, p. 28). By 2030, the FAO estimates that the diet-related health costs linked to NCDs could reach USD 1.3 trillion per year while the social costs of the system's GHG emissions could amount to a further USD 1.7 trillion annually (FAO et al., 2020, p. 139).

Policy recommendations

As Swinburn et al. (2013, p. 27) discussed in their Food-EPI model, governments can influence food composition despite being primarily within the domain of food manufacturers. Governments can set targets and strategies to reduce both the energy density of foods and the levels of concerning components (salt, added sugar, fat, and trans-fat). Improving the nutritional quality of processed foods is certainly an aspect most of the organizations whose documents were evaluated in this study also encourage governments to address (FAO et al., 2020, p. 158; GPAFSN, 2016, p. 99; HLPE, 2017, p. 19; UNSCN, 2017, p. 16).

The SFSN-2020 calls for governments to set stricter food industry regulations to reduce sugar and salt content in foods (FAO et al., 2020, p. 158). More specifically, the FAO, IFAD, UNICEF, WFP, and the WHO (2020) encourage governments to develop and implement programs that lead to a reformulation of food products toward healthier alternatives. This is especially important in the case of processed foods (FAO et al., 2020, p. 158). Furthermore, the UNSCN-2017 encourages governments to implement public-sector incentives not only for food manufacturers but also for food service companies, retailers, and distributors to develop and sell HSFs (UNSCN, 2017, p. 16). This way, food operators would also be

interested in selling foods with less salt and a higher proportion of healthy oils, vegetables, and fruits (HLPE, 2017, p. 19). In addition, the GPAFSN-2016 suggests that the banding of corporate tax rates to the production and processing of healthier foods could be used to incentivize their production (GPAFSN, 2016, p. 105).

The fortification of food with micronutrients is also commonly recommended (FAO et al., 2020, p. 158; GPAFSN, 2016, p. 104). The GPAFSN-2016 highlights public-private partnerships as enablers of food fortification, which is especially important for complementary infant food. The SFSN-2020 also calls for a general ban on the use of industrial trans-fats in the food chain and the implementation of fiscal policies to replace trans and saturated fats with unsaturated fats (FAO et al., 2020, p. 158). Equally important and already highlighted by Swinsburn et al. (2013, p. 27) is the implementation of policies limiting food portions and package sizes (FAO et al., 2020, p. 158). The reduction of food portions, choice and packaging is also highlighted in EAT-2019 as an important measure to nudge people into eating less (Willett et al., 2019, p. 479).

The FAO and WHO (2019) fully integrate the sustainability aspect into their recommendations regarding food composition in their "Sustainable and Healthy Diets: Guiding Principles". Here, they identify the production and processing of HSFs as the key to "[c]reate an enabling environment" (FAO & WHO, 2019, p. 12) and the first action to promote SHDs. Furthermore, the WRI-2016 encourages governments to set targets for the reduction of the population's consumption of animal-sourced protein in cooperation with companies in the food sector and to replace it with plant-based proteins (Ranganathan et al., 2016, p. 63).

8.1.4. Food Labelling

Ultimately interlinked with food composition is the aspect of food labelling, set up to inform consumers about the contents of the foods they are consuming. There are two types of food labelling, front-of-pack and back-of-pack labelling, with the former aimed at providing consumers with simplified nutritional information of the product at a glance.

Back-of-pack labelling usually entails more detailed nutritional information, including the energy content in kilojoules and kilocalories and the food's macronutrients content. While it would be assumed that food labelling affects consumer behavior, in reality food labelling seems to primarily affect food producers by encouraging them to reformulate their products (GPAFSN, 2016, p. 105). Swinsburn et al. (2013, p. 27) stated that "[f]ront-of-pack and back-

of-pack labelling, signage and claims on processed foods are thus an important area for government engagement and potential regulation." The domain of food labelling covers the labelling of packaged food products and of foods sold by food operators, such as restaurants, which are increasingly gaining in relevance across the world. More people than ever are eating outside their homes and purchasing fast foods to feed their families (GPAFSN, 2020, p. 152).

Policy recommendations

Most policy recommendations on food labelling focused on introducing and enforcing better and easy-to-interpret front-of-pack nutrition labels (Braun et al., 2021, p. 7; FAO et al., 2020, p. 158; GPAFSN, 2016, 2020, p. 149; HLPE, 2017, p. 19; Swinburn et al., 2019, p. 807; UNSCN, 2017, p. 105). The UNSCN-2019, for example, calls for better labelling practices and gives various examples of an easy to understand front-of-pack nutrition label, such as "[...] Chile's 'warning' labels on packaged foods high in fats, sugars and salt nutrition label, and [...] Ecuador's system of stoplight labels, with red indicating high levels of fats, sugars, and salt" (UNSCN, 2019, p. 7). The HLPE-2017 and the SYN-2019 also call for stronger regulation of the health and nutritional claims on food packaging (HLPE, 2017, p. 19; Swinburn et al., 2019, p. 807). Given the growing relevance of restaurants in people's diets, a few organizations recommend governments set up regulations that force not only fast-food but also full-service restaurants to disclose the nutritional information of their food on the menus (FAO & WHO, 2019, p. 26; GPAFSN, 2020, p. 149)

At a more international level, governments could also work on setting standards for understandable nutrition labelling through the Codex Alimentarius Commission for international guidelines, also known as the Food Code, as the GPAFSN-2016 recommends (GPAFSN, 2016, p. 104). The SYN-2019 also calls for the WTO to adopt the WHO's international standards and recommendations for labelling food targeted at children to standardize them internationally and thus avoid legal challenges based on restrictions on trade and investment when countries implement more robust regulatory measures (Swinburn et al., 2019, p. 821).

While most labelling recommendations focus on nutrition information, the UNSCN-2017, the SYN-2019, and the SHDGP-2019 by the FAO and WHO (2019) also recommend the introduction of food labelling for environmental sustainability markers. Labels on carbon and water footprints can support consumers in understanding not only the nutritional content of

their food choices but also their environmental impact (UNSCN, 2017, p. 16). The FAO and WHO (2019) state that the implementation of regulatory instruments that promote all aspects of SHDs, including the production and processing of HSFs, is key to “[c]reate an enabling environment” (FAO & WHO, 2019, p. 12).

8.1.5. Food Promotion

Consumers are constantly exposed to advertising, branding, and social marketing: signs, packaging, product placement, billboards, media advertisement, in-store displays, celebrity endorsements, sports sponsorships, price promotions – all with the goal of changing consumer acceptance, preferences and ultimately their purchasing behavior and consumption patterns (FAO et al., 2020, p. 158; HLPE, 2017, p. 30). The marketing of processed packaged foods is especially aggressive. One explanation for this could be these products’ higher profitability margin, given their longer shelf life, low-cost production and easier transportation (GPAFSN, 2020, p. 147). The marketing and consequent purchase of such low-quality foods reduces households’ budgets for nutritious foods, especially among low-income households (FAO et al., 2020, p. 159).

Food marketing affects everyone, but children seem to be especially vulnerable (HLPE, 2017, p. 30; UNSCN, 2019, p. 5). Cairns et al. 's (2013) systematic review concluded that children’s preferences, nutrition knowledge, consumption patterns and, ultimately, their nutrition and health are directly influenced by food promotion and advertising (Cairns et al., 2013; HLPE, 2017, p. 30). Children worldwide are exposed to television advertising deliberately using child-oriented persuasive techniques promoting unhealthy foods (FAO et al., 2020, p. 158; Kelly et al., 2010). The design of food packaging for food directed at children is also especially salient among energy-dense and nutrient-poor foods (FAO et al., 2020, p. 158). Since 2010, the WHO has recommended that governments reduce children’s exposure to the marketing of foods and non-alcoholic drinks. So far, more than 40 countries have implemented some restrictions, but it remains a problem that needs further attention (FAO et al., 2020, pp. 158–159).

Not only are small children affected by corporate marketing, but mothers of infants may also be exposed to misleading information on breastfeeding (FAO et al., 2020, p. 159). Today, only two in five infants under 6 months of age are exclusively breastfed. This is especially prevalent in low-income settings where the promotion of breast milk substitutes is widespread. Between 2008 and 2013, global sales of milk-based formula foods grew by 41%.

Even at an older age, many children (44%) aged between 6 and 23 months are not fed fruits or vegetables despite medical recommendations (GPAFSN, 2020, p. 156).

Policy recommendations

Given the significant impact marketing has on people's consumption behavior, all reports but the WRI-2016 entail the recommendation for governments to restrict companies' marketing for energy-dense foods with minimal nutritional value (Braun et al., 2021; FAO, 2016a, p. 24, 2016b, p. 56; FAO et al., 2020, pp. 158–159; GPAFSN, 2016, p. 105, 2020, p. 144; HLPE, 2017, p. 19; Swinburn et al., 2019, p. 479; UNSCN, 2017, p. 16, 2019, pp. 5–7; Willett et al., 2019, p. 479). Most reports highlighted the need for especially stricter regulation in the case of advertising and promotion of ultra-processed foods directed at children (Braun et al., 2021, p. 7; FAO et al., 2020, pp. 158–159; GPAFSN, 2020, p. 144; HLPE, 2017, p. 19). The HLPE-2017 also highlights the need to restrict these types of promotion toward adolescents (HLPE-2017a, p. 19).

The SFSN-2020 report's recommendations in this regard focus primarily on restricting the marketing of ultra-processed foods directed at children and served at fast food restaurants, thus recommending to restrict advertising of unhealthy foods not only by food retailers but also at restaurants (FAO et al., 2020, p. 158). Furthermore, the SFSN-2020 and the GPAFSN-2020 recommend implementing restrictions on the "[...] aggressive marketing of breastmilk substitutes [...]" (FAO et al., 2020, p. 159) to women of reproductive age, given the known benefits of breastfeeding for children (GPAFSN, 2020, p. 144). As the GPAFSN-2016 highlights, the value of restricting the advertising and marketing of unhealthy foods could materialize in two ways. It should reduce these foods' appeal to consumers; but it also incentivizes food manufacturers to reformulate their products, reduce their production or eventually even discontinue the products altogether (GPAFSN, 2016, p. 105).

While most of the recommendations outlined above focus primarily on the health aspect of diets, several of the reports analyzed also included a call for governments to restrict the advertising and marketing of unhealthy and unsustainable foods (GPAFSN, 2020, p. 143; HLPE, 2017, p. 19; UNSCN, 2017, p. 16; Willett et al., 2019, p. 479). For example, the GPAFSN-2020 recommends that governments restrict companies' marketing activities that might encourage people to make dietary choices that do not support SHDs (GPAFSN, 2020, p. 143). Willett et al. (2019, p. 479) go a step further and call for a "[...] positive discrimination of [marketing and advertising of] healthy diets from sustainable food

systems.” Similar recommendations are made in the HLPE-2017, where governments are called upon to provide financial and promotional incentives for food operators to sell foods with less salt and a higher proportion of healthy oils, vegetables, and fruits (HLPE, 2017, p. 19). Similarly, the GPAFSN-2016 recommends defining standards and providing marketing incentives for wholegrain processed food products (GPAFSN, 2016, p. 108). Moreover, the FAO and WHO first guiding principle for fostering a food environment that enables SHDs entails the implementation of regulatory instruments that promote the production, labelling and marketing of the consumption of foods that contribute to SHDs (FAO & WHO, 2019, p. 12).

Especially important for governments that do not yet plan to start monitoring or regulating the marketing practices of the food industry, the GPAFSN-2020 highlights the potential of the Nutrition for Growth (N4G) voluntary pledge for companies in the food sector to commit to the “Responsible Business Pledge for Better Nutrition at N4G”. Through the pledge, companies promise to integrate the SDGs 2 and 3 and broader food system concerns into their corporate strategies and make these aspects a long-term board-level priority. Given that companies also commit to regularly reporting on their progress in this regard, the GPAFSN-2020 calls for governments to establish or at least enable the establishment of consumer-focused watchdog organizations monitoring the marketing practices of those businesses that signed the N4G business pledge as well as those that did not (GPAFSN, 2020, p. 156).

As for the international level, the SYN-2019 recommendation to adopt the WHO’s international standards and recommendations on food labelling at the WTO level is also made to standardize marketing regulation. This standardization would improve the current situation of governments being required to address companies’ harmful marketing practices, each on their own, leaving countries with fewer resources exposed (Swinburn et al., 2019, p. 821).

8.1.6. Food Provision

Most people meet their food at the food retail and provisioning systems, the last stage of the food supply system after production, transportation, trade, and transformation. This domain focuses on the provisioning subsystem, which integrates food supply into places people work, learn, and recreate. Two aspects fall within this segment: food provision can take place at publicly funded institutions, such as government agencies, schools, universities, hospitals, the military, and prisons, but it also entails private food outlets, such as, fast food and full-service restaurants, and street vendors (GPAFSN, 2016, p. 92; Swinburn et al., 2013, p. 14).

The role of food outlets in people's diets is growing rapidly across the world as low- and middle-income countries are reaching similar levels of outside eating as high-income countries. In South Korea, for example, households already spend around 48% of their food budget eating out. Food outlets are especially important for working parents from low- and middle-income households in Europe and the USA, who usually face time constraints for preparing meals at home and thus rely on food take-outs and restaurants to feed their families (FAO et al., 2020, p. 130). The problem is that eating outside the home usually comes at the cost of diet quality, as many restaurants (not only fast-food outlets) fail to support SHDs (GPAFSN, 2020, p. 152). For example, in the USA, a study concluded that less than 0.1% of the meals sold in full-service restaurants met the American Heart Association's score for high-quality diets. Around half the meals sold were of either poor or intermediate quality. Popular cuisine meals in restaurants in Brazil, China, Finland, Ghana, and India were found to also have high energy content, with some offers even exceeding the calory content of fast-food meals by 33% on average, making them a relevant contributor to the obesity epidemic (GPAFSN, 2020, p. 152).

Governments are in a prime position to promote the adoption of SHDs through their government-funded food provision facilities across society. School feeding programs, for example, play a crucial role in low- and middle-income countries and across high-income countries. In the USA, for example, the federal government coordinates the school lunch program for nearly 100.000 schools across the nation. These programs are set up to ensure that children from low-income households meet their daily nutrient requirements (U.S. Department of Agriculture, 2022). Furthermore, the successful adoption of healthy meal provision at public institutions was highlighted by Swinsburn et al. (2013, p.14) as critical given that the governmental implementation of other health-related initiatives, such as smoke-free environments, is known to have led to their broader implementation in other areas.

Policy recommendations

The promotion of healthy (and sustainable) foods in publicly funded places, such as schools, hospitals, prisons, and the military, was often highlighted by various publications as an important step in transforming the food environment (FAO et al., 2020; GPAFSN, 2016, p. 107, 2020, p. 179; HLPE, 2017, p. 19; UNSCN, 2019, p. 7; Willett et al., 2019, p. 480). This is understood to be a *double-duty action*, addressing two facets of malnutrition, undernourishment and obesity, with one action (FAO et al., 2020, p. 39). Such a change

would also incentivize suppliers and contractors to sell more foods in line with SHDs (GPAFSN, 2016, p. 20). As the GPAFSN (2020, p. 179) described it, the goal of public procurement should be shifted from merely feeding people to nourishing them.

According to the SFSN-2020, school feeding programs should be expanded to provide not only nutritious food to children but also HSFs (FAO et al., 2020, p. 155). As the UNSCN (2019, p. 7) highlighted, these efforts should also include the foods available for purchase on the school premises. The GPAFSN (2016, p. 107) and the FAO (2016, p. 12) propose connecting food provisioning at schools with local farmers to establish stable markets for producers while providing adequate diets to children. This model could also be implemented in other public institutions. Furthermore, nutrition-sensitive school feeding programs ensuring children's access to SHDs during their childhood is also expected to shape their food preferences, ultimately positively influencing their consumption behavior in adulthood (GPAFSN, 2016, p. 83).

Regarding the provision of healthy diets in the private sector, some organizations call on governments to empower physicians and healthcare service workers to advise not only government-funded canteens but the food service industry as well (GPAFSN, 2016, p. 107; Swinburn et al., 2019, p. 810; Willett et al., 2019). This could take place in the form of partnership arrangements with the food industry. Such an example is provided in the SYN-2019 in the form of "The Partnership for Healthy America in the USA" which sets up targets for both the reduction of calories and the provision of healthier foods (Swinburn et al., 2019, p. 810).

8.1.7. Food in Trade and Investment Agreements

Most people do not produce the food they eat. Local and global trade of food is crucial for feeding the world by moving food from where it is produced to where it can be consumed. Imported food provides almost 20% of all dietary energy supply worldwide, and trade policy on agricultural products is a critical factor in the food environment. Most of the expansion in the last decade has been driven by low- and middle-income countries, with only five countries (China, the Democratic People's Republic of Korea, Japan, the Russian Federation and Saudi Arabia) making up 40% of the global food imports and another seven countries (Argentina, Australia, Brazil, Canada, New Zealand, Thailand and the USA) accounting for 55% of the total food exports (FAO et al., 2020, p. 132).

The term trade policy usually entails both border policy and other forms of domestic policy that affect trade flows, such as fiscal policy discussed above. This section will primarily focus on border policies directly affecting food import, such as tariffs and non-tariff measures, and food export, such as export taxes and restrictions (FAO et al., 2020, p. 132). It also entails recommendations on investment agreements.

Despite a general commitment through the WTO (and the vast number of free-trade agreements) to free and fair trade between WTO members, export restrictions for certain foods are still widely implemented policy tools, especially in times of uncertainty. However, these often fail to meet the goal of reducing domestic food prices and seem to even have counterproductive effects in some cases, leading to price instability at the national and international level (FAO et al., 2020, p. 132). The government-induced restrictions on food exports at the start of the COVID-19 pandemic, for example, led to growing fears about the accessibility of food on global markets, increasing food prices and affecting low-income families the most (GPAFSN, 2020, p. 102).

At the same time, food trade is set to become more relevant than ever as the world population continues to grow, and people's incomes keep rising, but also due to climate change and growing environmental degradation. Trade is and will continue to be essential to ensure access to staple and nutrient-rich perishable foods worldwide, regardless of the season. Meeting the demand for healthy foods in many countries today already relies on importing these types of foods due to seasonality or geography unsuitable for agriculture. The food trade has an impact on the types of food available as well as their financial accessibility, thus, ultimately determining the quality of people's diets. However, most policymakers fail to recognize trade agreements' role in people's health and nutrition (GPAFSN, 2020, p. 102).

Import tariffs, bans and quotas were shown by the SFSN-2020 to negatively affect the food provision in low-income countries. Similarly, non-tariff measures, such as sanitary, phytosanitary, and other technical barriers to trade, were shown to negatively affect the affordability of diets as prices rise due to the need for regulatory compliance. Import barriers are to this day some of the most common policy instruments for protecting the domestic agriculture and food industries (FAO et al., 2020, pp. 132-133). Agriculture products have the highest import barriers among all product groups, which has led to higher food prices in the domestic markets and a misallocation of resources, including government funds (FAO et al., 2020, p. xxv). In combination with today's fiscal policy in most countries, protectionary trade measures have been determined to promote the domestic production of staple foods and

neglect the production of nutritious foods, such as fruits and vegetables. Non-tariff trade measures, while improving food safety, make imports more expensive and thus affect the affordability of healthy foods (FAO et al., 2020, pp. 115, 133).

Non-tariff measures form part of governments' regulation to ensure the imports fall within the national product quality, health, and safety standards. The number of registered non-tariff barriers at the WTO database for vegetables and ASF has increased to over 16.000 measures worldwide. Non-tariff measures are a double edged sword: they ensure adequate food safety and quality levels but also increase the costs for food exporters and importers, ultimately raising the food prices consumers pay (FAO et al., 2020, p. 133).

Policy recommendations:

While trade mechanisms are not set initially to improve nutrition, health, or environmental goals, various reports call for governments to recognize the importance of including these aspects from now on (FAO, 2016a, p. 13; GPAFSN, 2016, p. 104, 2020, p. 105). Governments' goal should be to enable everyone to adopt a SHD. To this end, they should recognize and increase the role of international trade in enabling SHDs, given the fact that not all countries can grow the food requirements of their population and are thus reliant on imports (FAO, 2016a, p. 8; GPAFSN, 2016, p. 99, 2020, p. 168-170; UNSCN, 2017, p. 5).

Some reports called for governments to ensure seamless food trade and cooperation, arguing that global food supply chains make systems more resilient to shocks (GPAFSN, 2020, p. 180) and reduce price volatility (GPAFSN, 2016, p. 99). However, the EAT-2019 highlights that the evidence so far indicates that policies for trade liberalization have not always been associated to increased food availability. The FAO-2016 emphasizes that current trade policies have tended to introduce more highly processed foods into the country at the expense of healthy locally produced grains (FAO, 2016a, p. 8). Nevertheless, the report recognizes the importance of trade policy for food security and the adoption of healthy diets. For this reason, the FAO-2016 recommends developing complementary policies to ensure that trade policies promote healthy food environments rather than unhealthy ones (FAO, 2016a, p. 13). As for food security, trade policy does mitigate food price volatility in times of crisis but fails to address it during import surges. Thus, considering the complexity of international policy, trade policy should be designed to match each country's situation and enable the adoption of healthy diets from sustainable food systems (Willett et al., 2019, p. 483).

Adequate trade policies aimed at reducing the financial costs of food for consumers are often hard to balance with a thriving local production of nutritious foods (FAO et al., 2022, p. xxvii). Nevertheless, governments are called upon by several organizations to reevaluate their trade policies, reconsider their tariffs on healthy foods and reduce their non-tariff measures for healthy foods (FAO et al., 2020; FAO & WHO, p. 12; GPAFSN 2016, 2020; HLPE, 2017, p.17; UNSCN, 2017, p. 18). Ensuring the availability and financial accessibility of healthy foods should be governments' priority, especially during (food) crises, such as the one caused during the COVID-19 pandemic (FAO et al., 2020, pp. 138–139, 151) and the current war in Ukraine. In such cases, non-tariff barriers to healthy foods should be as small as possible to avoid related food price increases (FAO et al., 2020, p. 151). Additionally, there could be lower barriers to entry for food companies that meet specific quality criteria for the food they produce (GPAFSN, 2016, p. 105). Governments are also encouraged to implement ex-ante assessments to ensure that trade and investment agreements do not negatively affect food environments or diets (HLPE, 2017, p. 17; Swinburn, 2019, p. 808).

At the international level, the goal should be to establish better trade practices for agricultural products via global supply chains, especially so during times of crisis. As the Deputy Director General of the WTO said, even the WTO Rulebook for Agriculture should be updated to enable the establishment of a more effective multilateral food trading system that supports waste reduction, improves productivity, and limits the systems' negative impacts on the environment (GPAFSN, 2020, p. 102). According to the GPAFSN-2020, these aspects should be integrated into WTO negotiations and should include agreement on viable solutions for future bilateral impediments to avoid trade disruptions (GPAFSN, 2020, p. 180). The SYN-2019 calls for the WTO to integrate WHO guidelines and standards on nutrient profiling, food product labelling, and restrictions on marketing practices of unhealthy food toward children to prevent trade and investment law challenges by companies fighting governments' efforts to protect children (Swinburn et al., 2019, p. 836). Effective trade policy can support the necessary shift toward SHDs when implemented correctly, especially for countries where HSFs are not produced nationally. This requires formal trade agreements, appropriate tariffs, and food safety regulations, especially in sharp food price spikes. Governments should resist the imposition of export restrictions when food prices spike and instead lower tariffs and value added tax to encourage trade flows (GPAFSN, 2020, pp. 99-100).

As for the governments' investment agreements, various reports entail at least one recommendation regarding investments into the food system to improve people's diets and nutrition. For example, the GPAFSN-2020 recommends using FBDGs (elaborated in detail in the respective domain below) for SHDs to define their investments' priorities (GPAFSN, 2020, p. 151). Taking SHDs into consideration would enable countries to set a different approach toward investment patterns and market agendas, redefining the policy priorities and their consequences on food production (GPAFSN, 2020, p. 71). The HLPE-2017 encourages governments to leverage their investment power (along with their regulatory power) as incentive for the private sector to integrate nutrition goals into their corporate targets (HLPE, 2017, p. 116). In addition, governments are also encouraged to consider co-investment as a form of incentivizing private sector actors to invest in a sustainable food system that provides healthy diets (FAO et al., 2020, p. 143). Similarly, the GPAFSN-2016 entails the recommendation to set targets on the sales reduction of foods that undermine healthy diets as investment conditionalities on food companies (GPAFSN, 2016, p. 105).

A general recommendation is for governments to encourage investment in innovation to address the multiple challenges of sustainable development (GPAFSN, 2016, p. 105, 2020, p. 106; Braun et al., 2021; Willett, 2019, p. 484). Regarding the food environment, governments are encouraged to provide finance for developing and implementing innovative technologies to reduce food losses, protect nutrients, and reduce emissions (Willett, 2019, p. 484; GPAFSN, 2020, p. 106). Moreover, targeted investments could support the growth of small and medium enterprises in ways that reinforce sustainable food production (GPAFSN, 2020, p. 106). These types of support could include investment funds for start-ups and small companies working on processing nutritious foods (GPAFSN, 2016, p. 105).

8.1.8. Food Education

Ensuring the physical availability and financial accessibility of HSF is not enough for people to adopt SHDs (GPAFSN, 2020, p. 165). As discussed above, food choices are also influenced by people's knowledge and access to information (Turner et al., 2018). For example, food labelling and promotion provide individuals with information. However, food desirability is also determined by individual preferences, knowledge, attitudes, food acceptability, skills, and culture (Turner et al., 2018, p. 96). Most of these aspects are formed within the social context, enabling governments to influence them and empower individuals to make better food choices. This is a key aspect that had not yet been addressed in Swinburn et al. 's (2013) Food-EPI model.

Today, we understand that consumer food preferences impact the food environment, as consumer demand shapes the offerings available. The rising demand for information about food characteristics in high-income countries, such as food quality, origin, and to some degree, the food's impact on the world has led to a growing supply of information about the products' origins and production methods. This development is also shaping production methods. The growing demand for organic products in high-income countries is such an example, which has led to increased production and certification of these products and thus to significant price decreases compared to conventionally produced ones (FAO et al., 2020, p. 130).

Policy recommendations

Education on nutrition and sustainability is considered to play a critical role in the transition toward a HSF environment. Almost all reports highlighted this aspect as essential for the adoption of SHDs within the food environment (Braun et al., 2021, pp. 7, 231; FAO, 2016b, p. 11, 2016a, p. 21; FAO et al., 2020; FAO & WHO, 2019, p. 13; GPAFSN, 2020, p. 143; Swinburn et al., 2019, p. 805; UNSCN, 2017, p. 15, 2019, p. 4; Willett et al., 2019, p. 480). The SFSN-2020 sees it as a key aspect for the successful adoption of SHDs in general, but also for the successful implementation of nutrition-sensitive social protection measures, such as cash transfers (FAO et al., 2020, p. 153). However, not everyone agrees about the relevance of education. The WRI-2016 makes the case that to shift people's diets, much more complex and comprehensive strategies that go well beyond information and education campaigns are required (Ranganathan et al., 2016, p. 50).

The goal, as the GPAFSN-2020 put it, is to “[i]ncentivize changes in people's demand for food so that it better matches what people need to eat for a healthy life and what can be sustainably produced” (GPAFSN, 2020, p. 84). Education is implied to empower citizens with knowledge about the implications of their dietary choices to enable them to make more informed decisions (GPAFSN, 2020, p. 143). The SFSN-2020 puts the goal of policy measures set to directly shape consumer's behavior, somewhat more bluntly: the goal is for individuals to change their dietary habit toward predominantly plant-based diets and reduce their consumption of animal-sourced and starchy staple foods (FAO et al., 2020, p. 159). The SFSN-2020 calls upon governments to develop policies tailored to raise awareness and influence consumer behavior toward SHDs (FAO et al., 2020, p. xxvii).

While some organizations give general recommendations to implement “popular education programs” (HLPE, 2017, p. 17), others provide governments with specific examples of good practices. Reports, such as the EAT-2019 and the GPAFSN-2020 argue that public sector campaigns for behavior change need to be more compelling and have more effective messages. Examples include public advertisement campaigns highlighting the dangers of obesity and encouraging less food waste and higher fruit and vegetable consumption, and initiatives regarding packaging labelling (GAPFSN, 2020, p. 149, 154). However, as highlighted in the SYN-2019, it is important to evaluate these social marketing campaigns carefully to avoid reinforcing discriminatory biases toward overweight people (Swinburn et al., 2019, p. 825).

Governments are encouraged to develop policies that support food and nutrition education, behavior change communication, and mass media campaigns (FAO et al., 2020, p. 159; FAO & WHO, 2019, p. 13; GFASN, 2020, p. 154; UNSCN, 2019, p. 7). The SFSN-2020 recommend that governments integrate food and nutrition education, including food budgeting, into the national school curriculum to foster nutritious food choices in children and adolescents. In combination with the school provision of healthy and nutritious foods, these programs are expected to help children develop the skills necessary to make better food choices (FAO et al., 2020, p. 159; UNSCN, 2017, p. 7, 15; Willett et al., 2019, p. 480). Furthermore, nutrition education and budgeting should also be part of social protection programs to empower the beneficiaries with the knowledge and skills to adopt healthy diets (FAO et al., 2020, p. 159; Willett et al., 2019, p. 480). This aspect is of such importance that the FAO et al. (2020, p. 159) call for integrating these initiatives into state laws and regulations to prevent them from shifting in the future. The EAT-2019 and the GPAFSN-2016 also recommend including these education efforts – which should not only entail health and nutrition but also public health and sustainability information – into all forms of national services, including social protection programs and schools. The reports also call upon governments to establish the topic of SHDs as a priority among peer groups, such as co-operatives (GAPFSN, 2016, p. 99; Willett et al., 2019, p. 480).

A critical aspect of the desirability of food is culture. It is key to take the cultural context of the population set to whom information campaign are addressed into account when designing them (GPAFSN, 2020, p. 165). However, none of the reports include specific recommendations on how exactly the cultural context could be accounted for in the development of such campaigns. It is also important to shape the culture by promoting food

cultures that enable SHDs, including cooking skills. These campaigns could entail the promotion of traditional food cultures, if they match the profile of SHDs, such as in the case of South Korea (HLPE, 2017, p. 105).

While most of the recommendations assessed focus primarily on nutrition and health education, various recommendations include the sustainability education aspect and ensuring citizens' access to information regarding the environmental sustainability of food choices in information campaigns (FAO et al., 2020, p. 139; FAO & WHO, 2019; p. 13; Ranganathan et al., 2016; Swinburn et al., 2019, p. 837; Willett et al., 2019, p. 449). The SYN-2019 gives the environmental footprints of food choices as an example of this type of information disclosure (Swinburn et al., 2019, p. 837).

However, not all organizations whose documents were analyzed agreed on the importance of education campaigns, or rather, on their effectiveness in shifting consumer behavior. The WRI-2016 argues that government strategies to shift people's diets effectively must go beyond information and education campaigns. The reason for their skepticism is the scarce evidence on information labels or education campaigns influencing consumers' purchase behaviour. The whole WRI-2016 report is precisely about the need to consider the following aspects within these types of campaigns: (i) minimize disruption, (ii) sell a compelling argument, (iii) maximize awareness, and (iv) evolve social norms. A few of the factors within the model proposed by the WRI-2016 are covered in other domains, such as improving the availability and affordability of the desired products. The main argument is that the provision of information is only one aspect among many to effectively enable the adoption of the desired behavior. This shift needs to be made as easy and compelling as possible for it to take place and ultimately be integrated into social norms (Ranganathan et al., 2016).

8.2. Infrastructure Support Domains

The seven infrastructure support domains discussed below are those developed by Swinburn et al. (2013) for the Food-EPI model. These are based on the WHO approach of “system building blocks” for health systems and a review of authoritative documents performed by Swinburn et al. (2013).

8.2.1. Leadership

As mentioned above, the different domains of the food environment are affected not only by food and agricultural policies but also by policies in other areas, such as health, trade and investment, infrastructure, and fiscal and environmental policies. All these policies are not developed with the goal of optimizing the food system alone but are instead the result of a complex decision-making process involving many stakeholders with varying and often conflicting objectives and interests (FAO et al., 2020, pp. 130–131). Thus, governments, and more specifically policymakers, play a crucial role in developing a food environment fit for SHDs. As Swinburn et al. (2013, p. 29) already recognized, political will is required to address the pressing problems of our food systems and lead the much-needed transformation of the food environments.

Policy recommendations

The importance of leadership within governments to transform food environments is a common theme across several of the reports analyzed in this study. Policymakers’ leadership initiatives and adequate strategies to address the food system issues are identified as playing a critical role in transforming food environments. Effective leadership is characterized by effective coordination and consultation across policy areas (HLPE, 2017, p. 72; UNSCN, 2017, p. 15; Willett et al., 2019, p. 484). It is essential that important policy actors are engaged and committed to facilitating the development of good policy (Willett et al., 2019, p. 484), especially as most of the (first) leadership efforts both at the national and international levels need to come from governments (HLPE, 2017, p. 119).

There are various aspects to consider when establishing the leadership necessary. A key recommendation is for governments to seek international and national commitments to shift toward SHDs (FAO et al., 2020, p. 143; GPAFSN, 2020, p. 187; Willett et al., 2019, p. 484). Leaders are called upon to build on today’s global development targets related to the goal of establishing SHDs and make use of global fora and international organizations to set up new commitments for resilient food systems that enable SHDs (GPAFSN, 2020, p. 187; UNSCN,

2017, p. 20). Initiatives should address both the sustainability and health aspects of the food system (GPAFSN, 2020, p. 187). They should be linked across political system levels, from the federal to the municipal governance levels and across all policy domains to foster systemic thinking and comprehensive solutions that simultaneously address multiple problems (FAO et al., 2020, p. 142; GPAFSN, 2020, p. 187; HLPE; 2017, p. 17; Swinburn et al., 2019, p. 835; Willett et al., p. 484). The key is establishing concerted and coherent policies characterized by good planning and coordination to transform food systems (FAO et al., 2020, p. 138; UNSCN, 2017, p. 4). In addition, the EAT-2019 entails a specific call to the authorities not to limit themselves to soft policy interventions but to use hard policies as well, some of which were discussed in the sections above (Willett et al., 2019, p. 478).

Ensuring the municipalities' power enables them to mobilize local resources and generate pressure for further national action (Swinburn et al., 2019, p. 836). Similarly, the UNSCN-2017 recommends strengthening institutions, policies, and programs in crisis-prone areas to enable quick action to change circumstances (UNSCN, 2017, p. 5). As highlighted by the WRI-2016, the development of quantifiable targets is essential for a good strategy. For example, for shifting people's diets toward SHDs, the WRI-2016 recommend specifying the targets as reductions in the populations' consumption of ASFs (Ranganathan et al., 2016, p. 63).

Concerning the vision to lead the transformation, most organizations included in this review highlight the importance of expanding the current focus on the short-term economic efficiency of food systems alone to a long-term perspective. This includes integrating the externalized costs of the current food system on the environment and society into the common understanding of an efficient food system (GPAFSN, 2020, pp. 82–84). As stated in the GPAFSN (2020):

Anything that improves the outputs (people fed) whilst reducing the inputs (including environmental impacts and the social costs of poor diets) improves food system efficiency. In other words, an efficient food system maximises the number of people nourished healthily and sustainably per unit of input. (p. 83)

For a food system to be truly sustainable, all stages of food production and processing need to be considered: the type and the way food is being produced and processed, sold, prepared, and ultimately, consumed. This transformation of food and agricultural priorities will require explicit acknowledgement from governments and actors in the sector that the goal of the food

system is to provide everyone with the diets they need to be healthy without the system overstepping environmental limits (GPAFSN, 2020, p. 84). Given the complexity and interconnectedness of the sectors that affect the food environment, the HLPE-2017 recommends that governments set up multi-sectoral teams to be trained in leadership development to effectively initiate and scale up programs for the promotion of SHDs (HLPE, 2017, p. 116). When necessary, the UNSCN-2017 encourages governments to evaluate the trade-offs between climate, health, nutrition, and the economy (or other sectors) from a human rights perspective (UNSCN, 2017, p. 18).

At the international level, the GPAFSN-2020 calls for national leaders to bring the topic of SHDs forward and use the international arena to enable international commitments (GPAFSN, 2020, pp. 164, 180, 187). Furthermore, the SYN-2019 puts forward the proposition for convening organizations such as the World Economic Forum to redefine today's business models to include broader societal aspects and make the models fit for addressing the challenges of the 21st century (Swinburn et al., 2019, p. 837). Furthermore, a dedicated Global Financial Facility could be set up to support the mobilization of resources and incentivize the effective allocation of domestic resources into the transformation of food systems (GPAFSN, 2020, p. 159).

The GPAFSN-2020 sees the need to establish an IPCC-equivalent organization dedicated to sustainable food systems: an “International Panel for Sustainable Food Systems.” According to the report, this institution should improve mechanisms for the assessment of new evidence and knowledge gaps, study the policy implications of key findings, and ensure a consensus around key actions, targets, and international initiatives, as the IPCC does for the topic of climate change (GPAFSN, 2020, pp. 162, 165). Similarly, the UNSCN-2017 calls for an integration of global initiatives, such as the Programme on Sustainable Food Systems of the 10-Year Framework of Programs on Sustainable Consumption and Production, the UN Decade of Action on Nutrition, and the SDGs agendas (UNSCN, 2017, p. 19).

However, given the absence of such an intergovernmental scientific panel, a comprehensive agreement on food, and clear scientific targets for the food system, the EAT-2019 developed a list of potential science-based targets to guide governments in their transformation efforts. These are based on the planetary boundaries framework and intertwined with all UN SDGs. The adoption of SHDs is essential for reducing the food systems' environmental footprint. Given today's lack of coherence across initiatives, the framework developed by the EAT-

2019 is proposed to be used as a basis to set national, sectoral, and sociopolitical targets for governments to transform their food systems (Willett et al., 2019, p. 448-453).

8.2.2. Governance

Closely linked to good leadership is good governance. The reason for the distinction between the terms is, as Swinburn et al. (2013, p. 29) put it: “[...] the increasing intrusion of commercial vested interests into policy development [...]”. This was also identified as a problem by the FAO, WHO, and the other international organizations in their SFSN-2020. On the one side, today’s government policies favor the production, trade, and consumption of staple foods, sugar, and ASFs over nutritious and sustainable foods. On the other side, “[...] globalized and local food value chains are driven almost exclusively by profit motives rather than the provision of foods that contribute to healthy diets and support sustainability” (FAO et al., 2020, p. 140).

This development was fueled by the transformation food systems worldwide have experienced during the last century, but especially since the 1990s, as globalization and urbanization hit the food industry, foreign investments of transnational food corporations skyrocketed, and the supermarket revolution began (FAO et al., 2020, p. 137; Reardon & Gulati, 2008). These developments have fundamentally shaped the political economy of the food systems and thus the food environments. As the FAO (2020, p. 137) points out, the concentration of economic power into a few transnational corporations in the food sector sharpens their lobby activities and influence over policymaking, resisting changes that might negatively affect them and keeping prices of highly processed foods low. This influence is an important aspect, as the former WHO Director General Margaret Chan said in 2013: “market power therefore readily translates into political power” (WHO, 2013).

Policy recommendation

Good governance was highlighted by various reports as essential for transforming food environments (HLPE, 2017; UNSCN, 2017; Swinburn et al., 2019). The goal should be to ensure that policies that incentivize the adoption of SHDs achieve equitable outcomes via participatory governance mechanisms and restrict certain industrial practices and powers that undermine SHDs (UNSCN, 2017, p. 18). Good governance is inclusive, transparent, verifiable, and accountable; independent bodies are set to monitor compliance and performance against predefined benchmarks, hold stakeholders accountable, identify and address conflicts of interest and settle disputes (HLPE, 2017, p. 115). The complexity of

today's food systems requires equivalently complex and multi-scale governance mechanisms, engaging different stakeholders across public, private, and civil society (HLPE, 2017, p. 128).

Enabling the widespread implementation of effective measures for the promotion of SHDs requires setting up cross-government, and inter-sectoral coordination and networking mechanisms for the development of policies from the regional and national to the global level (FAO et al., 2020, p. 172; GPAFSN, 2020, p. 159). According to EAT-2019, governments should ensure the municipal level has the means necessary to implement local measures to promote the adoption of SHDs and to create pressure for action at the national level. There are also calls for the empowerment of civil society and other stakeholders by making these accountability mechanisms transparent, ergo, open access (GPAFSN, 2020, pp. 168, 180; HLPE, 2017, p. 18; Swinburn et al., 2019, p. 836). Similarly, as the GPAFSN-2020 highlights, transparency of the governance mechanisms would enable citizens to understand the situation and empower them to act. The report encourages establishing data-driven accountability of SMART (specific, measurable, achievable, realistic, and time-bound) commitments made by actors within the food system, highlighting the need for greater investment in data collection and their transformation into valuable information on relevant food system-specific performance indicators (GPAFSN, 2020, pp. 168, 180). To reduce the influence of large commercial interests, governments are encouraged to develop and implement straightforward and transparent guidelines on conflicts of interest and clear and transparent processes of policy development and implementation (Swinburn et al., 2019, p. 836). In general, when involving the private sector, the SYN-2019 recommends that governments enforce democratic practices via freedom of information laws, transparency in political donations, and engagement with truly independent ombudsman and commissioner positions (Swinburn et al., 2019, p. 836).

At the international level, some reports entail the recommendation of international (e.g., UN), supranational (EU) and regional (e.g., Pacific Forum) bodies to set up legally binding agreements to promote the adoption of SHDs and establish and protect healthy food environments (HLPE, 2017, p. XX; FAO et al., 2020, p. 172), such as a Framework Convention on Food Systems (Swinburn et al., 2019, p. 836). For example, the SYN-2019 encourages the WTO to integrate WHO guidelines and standards on nutrient profiling, food product labelling, and restrictions on marketing practices of unhealthy food toward children (Swinburn et al., 2019, p. 836). However, as the HLPE-2017 highlights, the UNSCN calls for

a shift from global to intersectoral governance for nutrition, enabling better coherence across all policy areas that affect the food system (HLPE, 2017, p. 112). At the same time, governments are called upon to fulfil their commitments to the UN SDG agenda and the UN Decade of Action on Nutrition by setting targets and accountability mechanisms (Swinburn et al., 2019, p. 836). Furthermore, development agencies and other funders should encourage addressing the problems of the food system by integrating it as a requirement for technical assistance and loans (Swinburn et al., 2019, p. 836).

Given the prevalence of economic interests affecting food system policies in their favor, governance and accountability mechanisms are required to better identify, assess, prevent, and address conflicts of interests among stakeholders. In general, the HLPE-2017 calls for a rebalance of power across food systems as power struggles that ultimately end up affecting food governance are prevalent (HLPE, 2017, p. 113). This is one of the reasons why the HLPE-2017 sees the need to establish transparency and accountability mechanisms by assessing and evaluating performance indicators within political commitments through open access monitoring systems (HLPE, 2017, p. 18).

8.2.3. Monitoring and Intelligence

A key aspect of effective governance over food environments is good monitoring mechanisms to understand the food environment and the ways people interact with it. Monitoring is also essential to evaluate the effectiveness of policy interventions to promote SHDs within food environments (Swinburn et al., 2013, p. 29). Many of the reports identified a relevant monitoring and intelligence gap regarding the food environment in general but also specifically on people's dietary habits (FAO, 2016a, p. 12; FAO et al., 2020, pp. 40-41; FAO & WHO, 2019, p. 12; HLPE, 2017, p. 115; Swinburn et al., 2019, p. 833; Willett et al., 2019, p. 478).

Policy recommendations

The establishment of monitoring mechanisms to assess the status of the food environments was highlighted in various reports as essential for understanding the systems' situation, identifying points of action, and developing adequate policies to address the gaps and problems identified (FAO, 2016a, p. 12; FAO & WHO, 2019, p. 12; HLPE, 2017, p. 115; Ranganathan et al., 2016, p. 64; Swinburn et al., 2019, p. 833; Willett et al., 2019, p. 478). This collection of intelligence is highlighted as an essential part of the common policy

process of analysis, decision-making, implementation, and monitoring (FAO & WHO, 2019, p. 26).

Only through monitoring can governments truly understand the impact of their policy decisions on the food environment, identify gaps and progress or even recognize and correct unintended consequences (HLPE, 2017, pp. 115, 119; Willett et al., 2019, p. 480). Monitoring and keeping track of the latest scientific developments would enable governments to develop evidence-based policy actions (GPAFSN, 2016, p. 99; Ranganathan et al., 2016, p. 64) and evaluate the cost-effectiveness of different approaches regarding the transformation of the food system (GPAFSN, 2020, p. 162) and enable them to perform regular synthesis that could be disseminated internationally (Willett et al., 2019, p. 484). While most reports give general recommendations to improve governments' monitoring efforts, some give specific recommendations, such as the monitoring of public health and nutrition markers (HLPE, 2017, p. 74) and the progress toward SDG targets (FAO et al., 2020, pp. 40-41; UNSCN, 2017, p. 18). As a further step, the EAT-2019 calls for the development of a diet quality assessment tool as an SDG indicator (Willett et al., 2019, p. 480).

The FAO-2016 would also like governments to monitor the diversity of nutritious foods in the food environment to identify points for action in the availability, affordability and acceptability of fruits, vegetables, legumes, and nuts (FAO, 2016a, p. 12). Similarly, there is also the general need to monitor the compliance and performance of stakeholders within the food environment (GAPFSN, 2020, p. 143; HLPE, 2017, p. 115). The GPAFSN-2020 encourages governments to set up mechanisms and national bodies to monitor food companies' compliance with new regulations and initiatives that hold them accountable in case of breach (GAPFSN, 2020, p. 143). Regarding the implementation of these mechanisms, the SFSN-2020 offers a warning: given the novelty of diet-related metrics and lack of standardization, global monitoring of diet quality will face multiple challenges adding up to the data scarcity problem (FAO et al., 2020, pp. 40-41).

To address these data quality problems, the SYN-2019 encourages governments to engage public health experts in evaluating the food environment regarding SHDs through proprietary big data on the sales of food and beverage products, food marketing trends through social media, and geographic information systems. It is particularly important to evaluate the access to SHDs for low-income segments of the population (Swinburn et al., 2019, p. 833). Similarly, the UNSCN-2017 highlights the value of a global dataset on food consumption

patterns, food composition, life cycle assessment of global food supply, and health profiles to better assess and monitor sustainability and health outcomes (UNSCN, 2017, p. 17).

A concern mentioned in most of the reports evaluated is the need for more research funding to better understand the food environments and develop adequate policies (Braun et al., 2021; FAO, 2016b, p. 7; FAO et al., 2020, p. 160; GPAFSN, 2016, p. 99, 2020, p. 181; HLPE, 2017, p. 18; Ranganathan et al., 2016, p. 13; Swinburn et al., 2019, p. 837; UNSCN, 2017, p. 21, 2019, p. 9; Willett et al., 2019, p. 480). Some make general calls for more interdisciplinary research on HSF production and consumption (FAO 2016b, p. 7; HLPE, 2017, p. 18). Others list more specific areas they consider relevant for further research efforts, such as traditional and indigenous knowledge of SHDs (Swinburn et al., 2019, p. 837) or the effects of upstream policies, infrastructure, and zoning regulation on people's nutritional outcomes (Willett et al., 2019, p. 480). The goal is to develop an evidence base of systemic drivers and actions on the food environment's impacts on health and wellbeing. This would promote cooperation between scientists, policymakers, and practitioners to co-develop relevant empirical and modelling studies and, ultimately, policies that better address the issues and gaps of the system (GPAFSN, 2016, p. 99; Swinburn et al., 2019, p. 837; UNSCN, 2019, pp. 8-9).

The most frequently suggested research aim is for research agendas to identify and develop policy instruments and programs that improve multiple domains of the food environments simultaneously. Their cost-effectiveness should be evaluated throughout the years to identify the most effective and efficient policy instruments and propose alternatives for those with the worst results. To accomplish this, researchers should determine relevant performance indicators, obtain access to already available information (e.g., public health), and set up the infrastructure necessary for the other indicators. Research should also enable better contextualization and help develop climate modelling with food system scenarios. In a more general sense, governments are called upon to enable and promote research on system-wide investments and the cost-effectiveness of policy instruments across the food system with a sharp focus on SHDs. Keeping track of best practices and innovations and their potential wider implementation should also be part of the research efforts (GPAFSN, 2020, pp. 85, 181; UNSCN, 2017, p. 21). More specific recommendations entail the assessment of the environmental impact of SHDs to better understand its role in the mitigation and adaptation of climate change. This includes the development of metrics and indicators to evaluate the impact of SHDs (UNSCN, 2017, p. 18). The SFSN-2020 would also like to see more research

on the cost drivers of food and how these could be addressed through policy measures (FAO et al., 2020, p. 160). Given the vast role of the private sector, governments should encourage ways to cooperate with organizations within it (UNSCN, 2019, p. 9), such as through public-private research partnerships on ways to improve the availability of healthy foods within the food environment (GPAFSN, 2016, p. 99).

As for the reporting on the progress toward SHDs, the EAT-2019 entails various recommendations. Many reputable bodies already publish annual official reports on health-specific subjects and environmental and food security topics. While the former could be expanded to include the aspect of sustainability in nutrition, the latter could be broadened to include the nutritional dimension. Alternatively, new annual or biannual reports on the progress of SHDs could be developed. These should be standardized to make them replicable at all levels of governance and go beyond the mere listing of actions and statistics to illustrate and disseminate lessons learnt in policy development for the promotion of SHDs (Willett et al., 2019, p. 484).

As a further step, governments could consider the recommendation from the EAT-2019 and SYN-2019 to expand the responsibilities of existing international oversight bodies or set up new ones to oversee the food systems transformation (Swinburn et al., 2019, p. 836; Willett et al., 2019, p. 484). The SYN-2019 develops a four steps approach for the UN to take up the task of monitoring national progress on HSFTems around the world. The first step would be to define relevant metrics for monitoring policy implementation and evaluating the food environment to promote healthy diets and reduce GHG emissions. Governments are encouraged to report on a regular basis to both the UN agencies and civil society to increase their accountability toward the global community and their citizens. The second step involves state actions to protect and promote human rights regarding "The Global Syndemic" to be monitored by the UN human rights treaty bodies, Human Rights Council Special Procedures, and the UN Interagency Task Force on NCDs. Third, NGOs and academia should improve their monitoring of policies on food, physical activity, and climate change. Existing food monitoring platforms, such as INFORMAS, ATNI (short for Access to Nutrition Initiative) and NOURISHING, should cooperate with UN agencies and other monitoring platforms for these topics. Finally, the EAT-2019 calls for the topic of food transformation to be prioritized by regional and global political and economic platforms, such as the World Economic Forum (Swinburn et al., 2019, p. 836).

8.2.4. Platforms for Interaction

As can be expected from the complex and interconnected nature of the food environment, its transformation will require the involvement and engagement of stakeholders, from policymakers and the private sector to researchers, the public and NGOs. Governments play a key role in enabling these exchange platforms between different stakeholders, including cross-government coordination between departments and all levels of government to implement coherent and coordinated policies (Swinburn et al., 2013, p. 31).

Policy recommendations

The importance of platforms for interaction between stakeholders resonated across most of the reports evaluated (FAO et al., 2020, p. 142; GPAFSN, 2020 pp. 143, 168, 184; HLPE, 2017, pp. 18, 114; Swinburn et al., 2019, p. 826; UNSCN, 2017, pp. 21-22; Willett et al., 2019, p. 484). For this cooperation to be effective, the GPAFSN-2020 encourages governments to ensure that all stakeholders – in the public and private sectors, across the food value chains, and in the media, civil society, academia, and research institutions – understand the importance of the food environment and are committed to transforming it. There also needs to be clear ownership of goals and milestones along the way (FAO et al., 2020, p. 142; GPAFSN, 2020, p. 168; Willett et al., 2019, p. 480). The EAT-2019 specifically recommends involving physicians and healthcare service workers in redesigning public food provision programs (e.g., at schools and hospitals) and supporting them to advise the food service industries, as well (Willett et al., 2019, p. 480). EAT-2019 also recommend engaging NGOs in the development of FBDGs (Willett et al., 2019, p. 480). A very essential aspect that the GPAFSN-2020 highlights is to ensure that local dialogue on the implications of the latest science regarding the needed transformation of the food system takes place for this to shape the national vision (GPAFSN, 2020, p. 162). The goal is for scientific information to better inform policy decisions (GPAFSN, 2020, pp. 159, 162).

Governments are also encouraged to engage civil society in the development of public policy (GPAFSN, 2020, p. 154; Swinburn et al., 2019, p. 836; UNSCN, 2017, pp. 21-22; 2019, p. 4). This resonates with the recommendation of the GPAFSN-2020 to include civil society organizations that have developed promising accountability mechanisms like ATNI (GPAFSN, 2020, p. 154). In addition, it is important to ensure civil society engagement across multiple levels of policymaking for these processes to be as transparent and consensual as possible (UNSCN, 2017, p. 22; 2019, p. 4).

The importance of the involvement of the private sector was highlighted as a key aspect across reports, as the cooperation with agriculture and food companies of all sizes and transnational and local businesses, on a clear agenda for the delivery of SHDs was identified as indispensable (GPAFSN, 2020, p. 187; Ranganathan et al., 2016, p. 51). This could be achieved by defining responsibilities and setting clear goals for the private sector regarding SHDs (GPAFSN, 2020, p. 143), as well as principles of engagement with its representatives (GPAFSN, 2020, p. 184). However, as the SYN-2019 highlights, governments should be careful to work with big corporations, given their tendency to oppose public health policies to fight NCDs and their rather unpromising track record when involved in policy development on nutrition. Thus, the EAT-2019 recommend that governments engage with small and medium-sized food companies instead (Swinburn et al., 2019, pp. 822, 826).

8.2.5. Funding and Resources

The treatment of diet-related NCDs, primarily diabetes and cardiovascular diseases makes up a large and growing proportion of countries' health budgets around the world. Nevertheless, funding for the prevention of diet-related NCDs, such as via the promotion of SHDs is miniscule relative to the shares of the budget destined for improving the efficiency of food production (Ranganathan et al., 2016, p. 64).

Policy recommendations

This was one of the less prominent domains across the reports evaluated for this study. This is partly due to overlaps with some of the other domains, especially monitoring and intelligence, where the call for a larger budget for research on SHDs and the food environment was particularly strong (FAO et al., 2020, p. 135). Nevertheless, some of the reports encourage governments to increase their funding for evidence-based efforts to shift diets toward SHDs (HLPE, 2017, p. 17; Ranganathan et al., 2016, p. 13; Willett et al., 2019, p. 484).

The recommendation for governments to increase their nutrition spending in national budgets resonated across some of the reports. These reports also encourage policymakers to evaluate how synergies with existing spending for agriculture and food systems could be achieved (HLPE, 2017, p. 17; Ranganathan et al., 2016, p. 13; Willett et al., 2019, p. 484). The EAT-2019 calls for governments to define a domestic spending budget to support the transformation toward SHDs (Willett et al., 2019, p. 484). At a more international level, the EAT-2019 recommends leveraging investment flows from donors and multilateral

organizations into double- or triple-duty measures that address multiple sustainable development challenges simultaneously (Willett et al., 2019, p. 484). Similarly, the UNSCN-2017 entails the call to make SHDs a priority in climate finance (UNSCN, 2017, p. 21).

8.2.6. Workforce development

Governments are responsible for the development of workforce skills and capacity. They are not only providers of education and formation via public institutions, such as universities, professional bodies, and training organizations: they also influence the framework of workforce development in the private sector and NGOs. This aspect was already recognized by Swinburn et al. (2013, p. 31), who highlighted the need for further cross-sectoral professionals dedicated to improving food environments. Despite many advances in recent years, a lack of human capacity continues to limit the scalability of nutrition programs' coverage, impact, and sustainability, especially among nutrition and food systems actors (HLPE, 2017, p. 116).

Policy recommendations

This aspect of the food environment was not at the forefront of any of the policy recommendation reports but was nevertheless highlighted by some (HLPE, 2017; UNSCN, 2019) and especially by the EAT-2019 report (Willett et al., 2019). While most reports called for general training on the intersectionality of nutrition, health, and sustainability (among other topics), some highlighted specific professions for further training, such as doctors, nutritionists, chefs, and the food service sector.

The goal is to develop the capacities of the workforce within the food system to enable the adoption of SHDs by improving their nutrition literacy and, thus, their influence on the food environment (HLPE, 2017, p. 17; Swinburn et al., 2019, p. 807; UNSCN, 2019, p. 5; Willett et al., 2019, p. 480). One example from the EAT-2019 is the need for changes in the medical curricula, which fail to highlight the relevance of nutrition for health. The new training packages should teach future doctors to better understand the link between nutrition and people's social ecosystems and its effects on health. Especially crucial is the alignment of nutrition counselling for mothers-to-be within maternal and child-care programs with the WHO recommendations (i.e., breastfeeding, and appropriate complementary feeding) as food preferences develop very early in life and even during gestation (Willett et al., 2019, p. 480).

Furthermore, the HLPE-2017 emphasized the importance of workforce development inside governmental institutions. On the one hand, the report highlights the need to establish and

train multi-sectoral teams to develop and implement policy programs on SHDs. Policymakers and program managers should obtain appropriate training on SHDs, food environments, and the role policy has in shaping them. The HLPE-2017 also encourages to train nutrition professionals to understand their role within the whole system and their intersection with different fields, including agriculture, environment, social protection, and sanitation (HLPE 2017, p. 116).

However, one of the most important recommendations for transforming the food environment is the engagement of chefs and the food service sector to develop healthy and sustainable meals that are both culturally appropriate and palatable. These stakeholders play a key role within the food environment to enable the adoption of SHDs across the population, whether by designing new menus, engaging in national public campaigns about sustainability and health in the food sector, or further developing training and education opportunities aligned with SHDs. SHFs need to be appealing to enable the mass dietary change the system requires (Willett et al., 2019, p. 480).

Furthermore, the GPAFSN-2016 identified needs for workforce development upstream of the value chain as well. Better training (and technologies) could help reduce food loss and waste, which would further improve availability and affordability of perishable crops, especially fruits, vegetables, and legumes, within the food environment (GPAFSN, 2016, p. 102).

8.2.7. Health-and-sustainability-in-all Policies

As illustrated throughout the policy domains, the food environment is shaped by a variety of policies from multiple sectors. However, many of these policies are developed and implemented without considering their impacts on public health and the environment (Swinburn et al., 2019, p. 835).

Policy recommendations

One key aspect highlighted by all reports was the necessary alignment across policy fields on the promotion of SHDs. In essence, governments are called upon to recognize that the problems, malnutrition in all its forms, and the food system's environmental sustainability crisis are *syndemic*: interconnected and of systemic origins. This will enable the development of synergistic policies across fields and stakeholders (Swinburn et al., 2019, p. 835). The first step is for governments to agree on the importance of enabling the adoption of SHDs across relevant parts of government and establishing a common policy agenda (GPAFSN, 2020, p.

149). All organizations identified developing FBDGs for SHDs and granting them more political relevance as playing a key role here, if used correctly.

The call for coherence across policy areas is unanimous across the evaluated reports. This is understandable, as a coherent bundle of measures toward a shared goal is expected to be more effective than single unaligned actions. This coordination across sectors would enable the development of double- or even triple-duty policies that address more than one problem at a time (Swinburn et al., 2019, p. 835), or what the GPAFSN-2020 called “multiple wins” (GPAFSN, 2020, p. 168). The GPAFSN-2020 recommends tailoring every new policy and investment decision to have multiple beneficial outcomes across the food system (GPAFSN, 2020, p. 162). Similarly important is policy cohesion across all levels of government (local, national, and international) (Swinburn et al., 2019, p. 814; UNSCN, 2017, p. 18).

Given the difficulties of coordinating efforts across different policy areas, the WRI-2016 recommends that governments set up a multidisciplinary cross-agency task force to evaluate current policies and regulations affecting diet choice. For example, in the case of trade policy, the EAT-2019 recommends bringing policymakers, public health professionals, nutritionists, environmental scientists, and trade bodies together to agree on policy objectives that support trade to achieve SHDs (Willett et al., 2019, p. 483). The need for cross-sectoral coherence and alignment was highlighted for the following sectors: agriculture, environment, fiscal policy, public health and nutrition, education, trade and marketing, retail, finance and development, transportation, and infrastructure (FAO, 2016a, p. 13; FAO et al., 2020, p. 142; HLPE, 2017, p. 17; UNSCN, 2017, p. 18; Willett et al., 2019, p. 483).

The goal is to integrate the subject of SHDs across policy areas to avoid cross-purposes, such as the intensively discussed case of the heavy subsidization of ASF (Ranganathan et al., 2016, p. 64). Governments are encouraged to set commitments to more fundamental changes across the food system, backed up by new national policies that are coherent with SHDs (UNSCN, 2017, p. 21). Additionally, a coherent policy scheme might positively shape company investment strategies across the food system (GPAFSN, 2020, p. 164). During the process of aligning policies, governments are also advised to evaluate the impact of potential food policies on their most vulnerable populations (Willett et al., 2019, p. 483) as well as their unintended external impacts in low-income countries and to pursue a “do-no-harm” principle (GAPFSN, 2020, p. 180).

A key aspect all reports repeatedly mentioned as one of the most important tools was the adoption of national FBDGs. While many countries have not yet set national FBDGs – especially low-income countries – those that have usually fall short in taking the food's environmental impact into account and thus disregard their recommendations' hidden effects on society and the environment. Despite FBDGs being viewed as the softest form of social marketing, they are, nevertheless, considered to have the potential to align policies across society to enable the adoption of SHDs (FAO, 2016b, 2016b, 2016a; GPAFSN, 2020; Willett et al., 2019).

The EAT-2019 states that, if taken seriously by policymakers, national FBDGs could play a key role in policymaking and society in general. If well implemented, they could serve not only serve as the first policy step toward a context-appropriate guide on dietary choices for SHDs but also as the basis for the development of aligned policies across fields that enable and promote the shift toward SHDs (FAO 2016a, p. 128-129; 2016b, p. 57; Willett, 2019, p. 480). FBDGs should, according to the GPAFSN-2020, also be integrated into the national food system action plans (GPAFSN, 2020, p. 151). To give FBDGs more saliency, many of the reports encourage governments to consider national FBDGs when developing policies in different sectors, such as nutrition, health, agriculture, education, fiscal, and trade (FAO, 2016b, p. 15; FAO et al., 2020, p. 157). This would involve the alignment of policies affecting all the policy domains discussed above, from the macro-level of trade agreements, through the meso-level of zoning regulation to the micro-level of food labelling and composition. FBDGs should also serve as the basis for food procurement and social security support, such as food distribution programs. Ideally, FBDGs should also influence the food offers across the private sector, regarding food composition, labelling and promotion, thus promoting the adoption of SHDs (FAO, 2016a, p. 129; GPAFSN, 2020, p. 151). National FBDGs could serve as the groundwork for a coherent policy system that enables the adoption of SHDs. For this to be possible, the FBDGs should also be embraced across governmental sectors and withstand lobbying from interest groups (FAO, 2016a, pp. 128–129).

On the development of national FBDGs themselves, the FAO (2016a) has concrete recommendations: The guidelines should be frequently updated to reflect the latest nutrition evidence, and the changing public health landscape, and as described above, to consider environmental sustainability. While the FAO-2016 recommends FBDGs to be developed by

professionals and scientists from the fields of health, environment, and socio-economy (FAO, 2016a, p. 128), the EAT-2019 also calls for governments to engage NGOs in the process (Willett et al., 2019, p. 480). The relevance of the cultural contextualization of the guidelines was also highlighted by the FAO-2016 (FAO, 2016a, p. 128), however, the UNSCN-2017 recommends aligning them to international guidelines where appropriate (UNSCN, 2017, p. 5)

FBDGs should provide citizens with official, accessible and easy-to-understand, science-based dietary recommendations based on the latest evidence regarding nutrition and health (FAO, 2016a, p. 129; GPAFSN, 2020, p. 143). They should be widely communicated to the public and promoted by health professionals. Not only will this enable the adoption of SHDs, but it will also counteract inaccurate diet-related information from other sources, such as fad diets. The effectiveness of the marketing strategy should be evaluated by monitoring public awareness of the guidelines and the issues they raise (FAO, 2016a, p. 129). Ideally, the communication of the FBDGs should be optimized for different audiences: the general public, health professionals, and those working in government procurement and the food sector. At the same time, the guidelines should be ambitious without being unrealistic and communicate a series of achievable steps for change (FAO, 2016a, p. 129). The FAO-2016 also recommends that governments develop FBDGs for specific population segments, including those who decide not to eat meat or animal products altogether. It was also recommended that the guidelines help redefine our relationship with food by including not only recommendations for cooking and food preparation but also information on the environmental impact of different food types (FAO, 2016a, p. 129).

While not all reports included specific recommendations to integrate the aspect of sustainability into FBDGs, some did (FAO, 2016a, p. 129; GPAFSN, 2020, p. 184; Willett et al., 2019, p. 480). Furthermore, the GPAFSN-2020 advocates for the next generation of FBDGs, an upgrade of the standard FBDGs to science-based FBDGs that induce a better understanding of the implications of dietary choice. They need to include more information and evidence on the impacts of food choices on human health and the environment, including the climate (GPAFSN, 2020, p. 151, 184).

Regarding breastfeeding, the FSNE-2020 and SHDGP-2019 recommend governments to ensure that women can follow the WHO and UNICEF recommendations of exclusively breastfeeding children during their first 6 months of life and continuing to breastfeed for the next 2 years or longer in combination with appropriate complementary feeding (FAO &

WHO, 2019; FAO et al., 2020, p. 159). This requires governments' support for breastfeeding during these crucial years, including the alignment of labor policies that provide maternity leave and continued income during that time (FAO et al., 2020, p. 159).

9. Discussion

Global nutrition initiatives have identified several promising actions to address the multiple problems of today's food systems. While transformation efforts at the production level are important to make food systems more sustainable, the greatest potential for reducing the food system's environmental impact is on the demand side, with the end consumers. Shifting people's dietary habits toward a more plant-based diet with higher vegetable, fruit, and legume intakes and a significant reduction in their meat consumption would massively reduce the food system's environmental footprint (including its GHG emissions). A shift toward SHDs would also address the latent public health crisis caused by the increasing rates of obesity and diet-related NCDs worldwide. This review provides an overview of the most relevant recommendations from different international organizations and research associations on where and how governments need to act within the food environment to promote and enable the adoption of SHDs.

The high consumption rates of low-cost, calorie-dense and nutrition-poor foods and ASF is creating colossal hidden costs in the form of public health, social and environmental problems. Governments have the responsibility and the power to shape the food environment to the degree necessary to enable a shift toward diets that are not only healthy but also more environmentally sustainable. For people to adopt SHDs, food systems and environments worldwide must undergo large transformations at all levels. Policies promoting SHDs in food environments must be comprehensive and multi-purposed, as they must cut across various policy areas and sectors. Given the diversity of food systems and food environments across countries and the different challenges and trade-offs they face, the ideal set of policy interventions for promoting SHDs will vary between countries and regions. A context-specific evaluation is crucial for identifying current barriers, potential trade-offs, and potential synergies to be exploited (FAO et al., 2020; 2022; HLPE, 2017).

The INFORMAS' Government Food Environment Policy Index (Food-EPI) tool (Swinburn et al., 2013), the most comprehensive framework for evaluating food environments to date, was used as the primary tool to assess the policy recommendations included in this review. In

this context, it is important to highlight that the Food-EPI model is primarily designed to evaluate how well national food environments enabled the adoption of healthy diets and does not originally take the sustainability aspects of people's dietary habits into consideration. The original model also fails to cover one determinant of the food environment considered important in today's models: people's knowledge (Turner et al., 2018). This aspect entails people's individual food preferences and tastes, their acceptability and desires, and their attitudes, knowledge, and skills, which are also shaped by culture. Despite our current understanding that information and knowledge do not have much influence on human behavior (Ranganathan et al., 2016), they were still highlighted as an important aspect of the food environment by the most recent models of the food environment (HLPE, 2017; Turner et al., 2018), and by almost all reports evaluated in this analysis. Thus, the model used in this thesis was an expanded version of the Food-EPI model to include an additional policy domain on governments' efforts to educate their population on nutrition, health, and sustainability (food education). The expanded framework helped differentiate which aspects of the food environment the policy recommendations of the reports were set to address and to categorize the recommendations into 15 domains: eight policy and seven infrastructure support domains. This categorization highlights the complexity of the food environment and the variety of factors that need to be considered to effectively transform it. The eight policy domains entail a wide variety of policy recommendations for governments to implement, while the seven infrastructure support domains highlight the context (national and international) in which these changes need to take place to transform the food environments. This review also provides an overview of each domain's barriers to SHDs that the policy recommendations are set to address.

So far, Reyes et al. (2021) had represented the only review of policy recommendations from international organizations and research associations for the promotion of SHDs. This thesis goes a step further by synthesizing available policy recommendations on improving food environments to promote the adoption of SHDs in high-income countries into an expanded Food-EPI framework that could be further developed into a Food-EPI model for SHDs. As a result, this thesis is, to the best of the author's knowledge, the first work to not only provide a review of these policy recommendations but to do so in a way that enables the further use of the results for the evaluation of food environments in high-income countries. Further steps would include a review of policy recommendations in other types of literature, primarily in academic literature where more innovative and potentially promising policy

recommendations for SHDs could be expected and could potentially complement the recommendations elaborated in this thesis.

As for the results of this review, there are various aspects to discuss. First, some domains are more extensively discussed across reports than others. This has also affected the extent to and depth with which each domain is covered in this review. One potential explanation for this phenomenon, is that some domains may be more complex and determined by a higher diversity of factors. This is the case, for example, in the food price domain, which addresses the deep structural issues that ultimately determine the price of food. The food retail domain is similarly complex, as it covers many factors affecting people's physical access to HSF. In contrast, the food composition and promotion domains are relatively simpler and cover very specific aspects of food policy. Similarly, there are vast differences in relevance between the infrastructure support domains. For example, the aspects of leadership and governance received much more attention across reports. They are thus more extensively covered in this thesis than is the funding and resources domain, which only a few reports addressed. Nevertheless, it is important to note that this unequal distribution in attention could also indicate the reports' authors having a potentially biased judgement and focus. While some domains are certainly more complex than others, the scarcity of recommendations on funding and resources and, to a lesser extent for workforce development, might also be a result of the authors' blind spots. These are aspects of the food environment that might be particularly hard to grasp or potentially even to recognize as key aspects of the food environment by the experts formulating the policy recommendations. More research is needed to assess the importance of the different policy and infrastructure domains and develop adequate recommendations for policymakers.

At the same time, there are also major differences in the resonance of certain recommendations within each domain across reports. Many recommendations appeared in several reports, others in fewer, and a few in only a single report. This observation is partly explained by the nature of the reports, as some focus much more on some domains of the food environments than others. For example, the PPP-2016 almost exclusively covers the topic of FBDGs. Similarly, some reports were much more extensive than others, covered more aspects of the food environment, and, thus, entailed many more recommendations than shorter reports. The SFSN-2020 is a prime example of a long report with 320 pages. In contrast, the HLPE-2017 has only 36 pages and cannot cover the aspects the SFSN-2020 does to the same extent. For this reason, some reports are cited more often than others. It is also

important to note that despite the reports having been selected for making policy recommendations promoting the adoption of SHDs, not all reports covered the sustainability dimension to the same extent as the health dimension (e.g., FAO-2016 and UN-2021). Reyes et al.(2021, pp. 8-9) also made this observation.

Similarly, many of the policy recommendations could be considered rather broad and unspecific. This is especially the case regarding the recommendations on the infrastructure support domains of the food environment: for example, the call for more accountability through regular reporting to the UN and to the public. None of the reports specified what the exact manner of implementation, frequency, or content of this reporting should be. The reasons for this can be multifold. On the one hand, the topic of sustainability in food systems has only recently started to gain ground in academia and at international organizations, so there are still many aspects to be determined. At the same time, political attention on the topic has been even slower to catch up, and drafting relevant policy recommendations requires more time given the importance of policymakers in the development of relevant policy recommendations. On the other hand, food systems are very diverse, so the authors of the policy recommendations may be particularly careful to formulate recommendations that may be relevant for all policymakers and give them enough material to work with without excluding anyone. This generalization, however, could potentially be a double-edged sword, supporting those policymakers who already have some preconceived ideas for policy development but falling short on specificity for those who have a harder time developing effective solutions.

Furthermore, as Reyes et al. (2021, p. 8) highlighted, the reports' shared mission of making food systems more sustainable by promoting the adoption of SHDs can create an illusion of convergence and agreement between initiatives. They cautioned that the different stakeholders behind reports like those evaluated in this thesis might have very different and potentially contradicting understandings of what constitutes "healthy" and "unhealthy" foods and even more so on the matter of the environmental sustainability of food (Reyes et al., 2021). Coherence and standardization of basic concepts, such as the definition of SHDs, are important for the development of comprehensive and coherent policy reforms on the food systems, as has been highlighted across all reports evaluated and by various academics (Gillespie & van den Bold, 2017; Reyes et al., 2021). Coherence is also important for other stakeholders, such as NGOs and the public. Thus, the GPAFSN-2020 recommendation to establish an IPCC-equivalent institution that determines the standards for sustainable food

systems should be a priority of stakeholders worldwide (GPAFSN, 2020, pp. 162, 165). This would align research and policy initiatives on the food systems globally and enable governments to develop science-based policies and formulate science-based targets on SHDs. Coherence in the definitions of the problems, goals, and recommended pathways would ideally trickle down to all levels of the political system – from the federal to the municipal governance levels, and across all policy domains. This would enable governments to develop adequate solutions to the systemic problems within the food systems and support researchers' efforts in evaluating the policies' effectiveness. The development of science-based FBDGs for SHDs was repeatedly emphasized across reports to potentially enable the levels of cross-sectoral coordination across policy domains needed. For FBDGs to be effective, however, policymakers need to grant them much more political relevance than they have to this day and reinforce their application and consideration at all policy levels.

Food systems are complex. Academics dedicated to understanding them and working on developing solutions to their massive issues know this better than anyone (Gillespie & van den Bold, 2017; Reyes et al., 2021; Swinburn et al., 2019; Willett et al., 2019). However, as the results of this review indicate some aspects of the food environment could be easier to address than others. For example, policy recommendations for food composition, labeling, and promotion, entail rather direct instructions for very specific aspects of food policy and regulation. The other policy domains, particularly those regarding food price and retail, and trade policy and investment agreements, require much more complex and cross-sectoral policy interventions and coordination as several of the policy recommendations for these domains affect the food system as a whole or the intersection between food environments and food supply chains (FAO et al., 2022; UNSCN, 2019). For example, the widely supported call to shift the agriculture production priorities toward more nutritious and sustainable foods is set to transform food systems completely to enable the demand and supply of SHDs. More specifically, governments are encouraged to reform their fiscal policy on agricultural products to favor SHDs. Such an action would reshape the whole food system and potentially have ripple effects across policy domains. This level of interdependency within food systems requires policymakers to address the problems systematically and consider how actions targeting a single aspect of the food system may affect other elements of the system as well. Other less wide-ranging examples, that would nevertheless cut across policy domains, include recommendations to invest in the national road network and the market infrastructure to improve the access to and affordability of healthier but more perishable foods, such as

fruits and vegetables. Such upstream investments would improve these aspects of the food environment by reducing food loss across the value chains (e.g., FAO et al., 2022, p. xxvi; Willett et al., 2019, p. 449).

The complexity of the challenges the food systems face requires governments to develop a comprehensive strategy that addresses (at least) all domains elaborated in this thesis and to ensure that policies in other areas are consistent with or do not harm the goal of promoting SHDs. Governments at national, regional, and local levels are thus encouraged to first assess the context-specific barriers and enablers and identify and exploit potential synergies within the system (FAO et al., 2020, p. 26). Policymakers need to develop a clear and proportionate plan that is feasible and comprehensive but also aligned with and adaptable to the latest scientific standards, all while considering that the food environment cuts across society and will thus require rethinking multiple policy fields, such as trade and zoning policy and investment agreements. At the same time, policymakers also should ensure the promotion and adoption of SHDs among vulnerable population segments, who suffer the worst consequences of today's obesity epidemic.

All but one report stressed the importance of educating consumers about nutrition and sustainability to promote the adoption of SHDs. The general idea is to shift consumers' preferences by empowering them with information on the impacts of dietary habits on their health and the environment. The relevance of food education was also highlighted in the policy recommendations review by Reyes et al. (2021, p. 8). However, the authors consider the aspect of individual agency and the importance of consumer education to have been underrated across the reports they evaluated. Building consumer knowledge and skills to adopt SHDs has also been highlighted as an important enabler by other researchers evaluating the barriers to a shift toward predominantly plant-based diets (Graça et al., 2019). As the WRI-2016 highlighted, however, our current understanding of human behavior indicates that people require more than just information to effectively change their behavior (Ranganathan et al., 2016). Thus, food education should take place within a comprehensive policy program covering all other domains of the food environment.

Despite international organizations (e.g., the WHO and FAO), academics (Creutzig et al., 2022; Denniss et al., 2021; Reyes et al., 2021; Rose et al., 2022; Springmann, 2020), and even the IPCC, stressing the urgent need to address the problems of the food system, this sense of urgency is still not fully reflected at the policy level. This lack of action from policymakers has not remained unnoticed in academia (Denniss et al., 2021; Rose et al.,

2022). Denniss and colleagues (2021) identified five barriers to the formulation and adoption of policies enabling SHDs in Australia: the complexity of the food system, stakeholders' competing interests, pressure from industry and policymakers' focus on economic benefits, government silos and a lack of political will to address the issues (Denniss et al., 2021). This coincides with the conclusion of Rose and colleagues (2022), who evaluated how local governments have taken action to advance public health and environmental goals in the context of today's food systems in Australia. They concluded that, despite local government's small successes against corporate practices that promote unhealthy food choices, such as the "sugar tax" and a few successful urban planning initiatives restricting fast-food restaurants around schools, substantive reform at all levels of government is necessary to solve the systems' problems. However, political reform requires political will, which according to Denniss et al. (2021) is exactly what is lacking among Australian policymakers. As the results of this thesis highlight, the context in which policymaking takes place (infrastructure support domains), including the political will and therefore leadership to address the challenges of the food system is essential for the food systems' transformation.

Nevertheless, there are some governments that are taking the first steps toward more sustainable food systems. In the EU, the *Farm to Fork Strategy* (F2FS) has been brought forward by the European Commission as the blueprint for a legislative framework addressing all issues of its food systems, including the adoption of SHDs: (i) ensuring sustainable food production, (ii) ensuring food security, (iii) stimulating sustainable food processing, wholesale, retail, hospitality and food services practices, (iv) promoting sustainable food consumption and facilitating the shift to healthy, sustainable diets, (v) reducing food loss and waste, and (vi) combating food fraud along the food supply chain (European Commission, 2020, p. 4). The EU's F2FS is a significant step in the right direction and will provide researchers with a wide array of policies on sustainable and healthy food systems to evaluate. Its adoption into national policy across member states will also provide enough material for comparative politics and establish best practice benchmarks. Having a well-developed framework for the evaluation of policies on SHDs by the time the F2FS is implemented into law by the end of 2023, would enable researchers and policymakers alike to assess the strategy's transformative potential and identify potential gaps in advance. This thesis provides the first step toward such a benchmarking framework for SHDs by laying out a review of policy recommendations from international organizations and research associations to transform food environments into enablers of SHDs and presenting them in line with the

original Food-EPI model's structure. Further research could focus on reviewing current academic literature on policy recommendations and searching for already existing best practice examples worldwide. These combined efforts could serve as the groundwork for the development of a comprehensive Food-EPI model to evaluate food environments on SHDs.

10. Limitations of this study

Due to the large diversity of food systems and environments worldwide and even within countries, there is no one-size-fits-all solution to making food environments enablers of SHDs. It is crucial for national, regional, and local governments to address the context-specific barriers and capitalize on identified enablers within the system (FAO et al., 2020, p. 26). Thus, these recommendations provide only a “buffet” of options and ideas policymakers could consider when drafting new policies for their respective food environments. At the same time, the list of recommendations provided in this thesis is non-exhaustive as there are certainly not only relevant reports missed in the search but also journal papers that might provide innovative insights and solutions to solving the food system's problems. Given the rapidly growing body of academic literature on climate change, a more comprehensive review of its latest results is undoubtedly required.

The transformation needed at the production level for everyone to be able to adopt a SHDs requires a shift toward what the GPAFSN (2020, p. 81) called *sustainable intensification* of agriculture, aimed at keeping and improving crop yield while reducing their environmental impacts through three stages: efficiency improvements, substitution, and systemic redesign. This is especially salient as today's food systems would be unable to bear everyone shifting to SHDs overnight. The systems rely on cereals, starches, oils, sugar, and ASF and fall short of producing nutrient-rich and sustainable foods. The policies within which the systems exist are set to produce as much food as possible at a minimum (short-term) financial cost, both for consumers and producers (GPAFSN, 2020, p. 74). As the GPAFSN (2020, p. 74) put it: “existing agriculture and related food policies, including those that influence food markets, are not supporting healthy diets at the most basic level, i.e., production”. Similarly, the topic of food loss and food waste was also outside of the scope of this study, despite it being an important factor in various aspects of the food environment, such as the accessibility and availability of nutritious foods that tend to be much more prone to spoilage. Thus, further

studies on policy recommendations for food supply chains, as well as food waste and food loss, are certainly to be encouraged.

Another limitation of the study is its focus on recommendations relevant to high-income countries' modern food systems. Despite some of the results of the analysis also being applicable to a growing number of middle-income countries that are increasingly experiencing a shift toward mixed and modern food systems, the results apply primarily to high-income countries. The key differences in the food systems and food environments between high-income and low- and middle-income countries (Turner et al., 2018) are simply too stark to enable extrapolation of the results to their situations. For this reason, researchers are also encouraged to focus on policy recommendations made explicitly for low- and middle-income countries. Moreover, it might also be the case that the Food-EPI model used in this thesis, even though expanded, fails to identify all relevant domains of food environments. Thus, more research on the determinants of food environments worldwide is to be strongly encouraged.

Nevertheless, this study should be regarded as the first step toward further developing a truly comprehensive Food-EPI model that evaluates how well food environments enable SHDs. This new model could evaluate food environments worldwide, understand their status quo, and identify their gaps and problems to determine which policy recommendations would fit their needs. For this to occur, the pool of policy recommendations would need to be developed further to include aspects this thesis might have missed and to be valid for any country no matter its income status.

11. Literature

- Afshin, A., Peñalvo, J. L., Del Gobbo, L., Silva, J., Michaelson, M., O’Flaherty, M., Capewell, S., Spiegelman, D., Danaei, G., & Mozaffarian, D. (2017). The prospective impact of food pricing on improving dietary consumption: A systematic review and meta-analysis. *PloS One*, 12(3), e0172277. <https://doi.org/10.1371/journal.pone.0172277>
- Benton, T. G., Bieg, C., Harwatt, H., Pudasaini, R., & Wellesley, L. (2021). *Food system impacts on biodiversity loss. Three levers for food system transformation in support of nature* (ISBN 978 1 78413 433 4). The Royal Institute of International Affairs Chatham House. https://www.chathamhouse.org/sites/default/files/2021-02/2021-02-03-food-system-biodiversity-loss-benton-et-al_0.pdf
- Berry, E. M., Dernini, S., Burlingame, B., Meybeck, A., & Conforti, P. (2015). Food security and sustainability: Can one exist without the other? *Public Health Nutrition*, 18(13), 2293–2302. <https://doi.org/10.1017/S136898001500021X>
- Braun, J., Afsana, K., Fresco, L. O., & Hassan, M. (2021). *Science and Innovation for Food Systems Transformation and Summit Actions, Papers by the Scientific Group and its partners in support of the UN Food Systems Summit*. ScGroup of the UNFSS. https://sc-fss2021.org/wp-content/uploads/2021/09/ScGroup_Reader_UNFSS2021.pdf
- Cairns, G., Angus, K., Hastings, G., & Caraher, M. (2013). Systematic reviews of the evidence on the nature, extent and effects of food marketing to children. A retrospective summary. *Appetite*, 62, 209–215. <https://doi.org/10.1016/j.appet.2012.04.017>
- Caspi, C. E., Sorensen, G., Subramanian, S. V., & Kawachi, I. (2012). The local food environment and diet: A systematic review. *Health & Place*, 18(5), 1172–1187. <https://doi.org/10.1016/j.healthplace.2012.05.006>
- Clark, M. A., Domingo, N. G. G., Colgan, K., Thakrar, S. K., Tilman, D., Lynch, J., Azevedo, I. L., & Hill, J. D. (2020). Global food system emissions could preclude achieving the 1.5° and 2°C climate change targets. *Science*, 370(6517), 705–708. <https://doi.org/10.1126/science.aba7357>

- Conijn, J. G., Bindraban, P. S., Schröder, J. J., & Jongschaap, R. E. E. (2018). Can our global food system meet food demand within planetary boundaries? *Agriculture, Ecosystems & Environment*, 251, 244–256. <https://doi.org/10.1016/j.agee.2017.06.001>
- Creutzig, F., Niamir, L., Bai, X., Callaghan, M., Cullen, J., Díaz-José, J., Figueroa, M., Grubler, A., Lamb, W. F., Leip, A., Masanet, E., Mata, É., Mattauch, L., Minx, J. C., Mirasgedis, S., Mulugetta, Y., Nugroho, S. B., Pathak, M., Perkins, P., ... Ürge-Vorsatz, D. (2022). Demand-side solutions to climate change mitigation consistent with high levels of well-being. *Nature Climate Change*, 12(1), Article 1. <https://doi.org/10.1038/s41558-021-01219-y>
- Denniss, E., Woods, J., & Lawrence, M. (2021). Promoting healthy and sustainable diets: Barriers and enablers for successful policy activities in Australia. *Health Promotion International*, 36(6), 1633–1643. <https://doi.org/10.1093/heapro/daab013>
- European Commission. (2020). *Farm to Fork Strategy. For a fair, healthy and environmentally-friendly food system*. European Commission. https://ec.europa.eu/food/system/files/2020-05/f2f_action-plan_2020_strategy-info_en.pdf
- FAO. (2011). *The state of the world's land and water resources for food and agriculture (SOLAW) – Managing systems at risk*. Food and Agriculture Organization of the United Nations. <http://www.fao.org/3/a-i1688e.pdf>
- FAO. (2016a). *Influencing food environments for healthy diets* (ISBN 978-92-5-109518-8). Food and Agriculture Organization of the United Nations. <https://www.fao.org/3/i6484e/i6484e.pdf>
- FAO. (2016b). *Plates, pyramids and planets. Developments in national healthy and sustainable dietary guidelines: A state of play assessment* (ISBN 978-92-5-109222-4). Food and Agriculture Organization of the United Nations and the University of Oxford. <https://www.fao.org/documents/card/en/c/d8dfeaf1-f859-4191-954f-e8e1388cd0b7/>
- FAO. (2016c). *The state of world fisheries and aquaculture 2016. Contributing to food security and nutrition for all*. (ISBN 978-92-5-109185-2; p. 200). Food and Agriculture Organization of the United Nations. <https://www.fao.org/3/i5555e/i5555e.pdf>

- FAO, IFAD, UNICEF, WFP, & WHO. (2020). *The State of Food Security and Nutrition in the World 2020—Transforming food systems for affordable healthy diets*. Food and Agriculture Organization of the United Nations. <https://www.fao.org/3/ca9692en/ca9692en.pdf>
- FAO, IFAD, UNICEF, WFP, & WHO. (2022). *The State of Food Security and Nutrition in the World 2020—Repurposing food and agricultural policies to make healthy diets more affordable*. Food and Agriculture Organization of the United Nations. <https://www.fao.org/3/ca9692en/ca9692en.pdf>
- FAO & WHO. (2019). *Sustainable healthy diets: Guiding principles*. Food and Agriculture Organization of the United Nations. <https://www.who.int/publications-detail-redirect/9789241516648>
- Friel, S., Dangour, A. D., Garnett, T., Lock, K., Chalabi, Z., Roberts, I., Butler, A., Butler, C. D., Waage, J., McMichael, A. J., & Haines, A. (2009). Public health benefits of strategies to reduce greenhouse-gas emissions: Food and agriculture. *Lancet (London, England)*, 374(9706), 2016–2025. [https://doi.org/10.1016/S0140-6736\(09\)61753-0](https://doi.org/10.1016/S0140-6736(09)61753-0)
- Gillespie, S., & van den Bold, M. (2017). Agriculture, Food Systems, and Nutrition: Meeting the Challenge. *Global Challenges*, 1(3), 1600002. <https://doi.org/10.1002/gch2.201600002>
- GPAFSN. (2016). *Food systems and diets: Facing the challenges of the 21st century* (ISBN 978-0-9956228-0-7). Global Panel on Agriculture and Food Systems for Nutrition. <https://glopan.org/sites/default/files/ForesightReport.pdf>
- GPAFSN. (2020). *Future Food systems: For people, our planet, and prosperity*. Global Panel on Agriculture and Food Systems for Nutrition. https://www.glopan.org/wp-content/uploads/2020/09/Foresight-2.0_Future-Food-Systems_For-people-our-planet-and-prosperity.pdf
- Graça, J., Godinho, C. A., & Truninger, M. (2019). Reducing meat consumption and following plant-based diets: Current evidence and future directions to inform integrated transitions. *Trends in Food Science & Technology*, 91, 380–390. <https://doi.org/10.1016/j.tifs.2019.07.046>

- Herforth, A., & Ahmed, S. (2015). The food environment, its effects on dietary consumption, and potential for measurement within agriculture-nutrition interventions. *Food Security*, 7(3), 505–520. <https://doi.org/10.1007/s12571-015-0455-8>
- HLPE. (2017). *Nutrition and food systems. High Level Panel of Experts on Food Security and Nutrition*. High Level Panel of Experts on Food Security and Nutrition on the Committee on World Food Security. http://www.fao.org/fileadmin/user_upload/hlpe/hlpe_documents/HLPE_Reports/HLPE-Report-12_EN.pdf
- IFRI. (2022). *2022 Global food policy report: Climate change and food systems* [ISBN 978-0-89629-425-7]. International Food Policy Research Institute. <https://doi.org/10.2499/9780896294257>
- IPCC. (2019). *Climate Change and Land: An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*. By P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.). Intergovernmental Panel on Climate Change.
- Kelly, B., Halford, J. C. G., Boyland, E. J., Chapman, K., Bautista-Castaño, I., Berg, C., Caroli, M., Cook, B., Coutinho, J. G., Effertz, T., Grammatikaki, E., Keller, K., Leung, R., Manios, Y., Monteiro, R., Pedley, C., Prell, H., Raine, K., Recine, E., ... Summerbell, C. (2010). Television Food Advertising to Children: A Global Perspective. *American Journal of Public Health*, 100(9), 1730–1736. <https://doi.org/10.2105/AJPH.2009.179267>
- Klinger, D., & Rosamond, N. (2012). Searching for Solutions in Aquaculture: Charting a Sustainable Course. *Annual Review of Environment and Resources*, 37, 247–276. <https://doi.org/10.1146/annurev-environ-021111-161531>

- Mogues, T., Yu, B., & Fan, S. (2012). *The impacts of public investment in and for agriculture. Synthesis of the existing evidence* (No. 12–07; p. 80). Food and Agriculture Organization of the United Nations.
- Monsivais, P., Aggarwal, A., & Drewnowski, A. (2014). Time Spent on Home Food Preparation and Indicators of Healthy Eating. *American Journal of Preventive Medicine*, 47(6), 796–802. <https://doi.org/10.1016/j.amepre.2014.07.033>
- Poore, J., & Nemecek, T. (2018). Reducing food’s environmental impacts through producers and consumers. *Science*, 360(6392), 987–992. <https://doi.org/10.1126/science.aag0216>
- Ranganathan, J., Vennard, D., Waite, R., Lipinski, B., Searchinger, T., & Dumas, P. (2016). Shifting Diets for a Sustainable Food Future. *Working Paper. Installment 11 of Creating a Sustainable Food Future*. <https://www.wri.org/research/shifting-diets-sustainable-food-future>
- Reardon, T. A., & Gulati, A. (2008). *The supermarket revolution in developing countries*. International Food Policy Research Institute. <https://www.ifpri.org/publication/supermarket-revolution-developing-countries>
- Reyes, L. I., Constantinides, S. V., Bhandari, S., Frongillo, E. A., Schreinemachers, P., Wertheim-Heck, S., Walls, H., Holdsworth, M., Laar, A., Nguyen, T., Turner, C., Wellard, K., & Blake, C. E. (2021). Actions in global nutrition initiatives to promote sustainable healthy diets. *Global Food Security*, 31, 100585. <https://doi.org/10.1016/j.gfs.2021.100585>
- Ritchie, H. (2020). *You want to reduce the carbon footprint of your food? Focus on what you eat, not whether your food is local*. Our World in Data. <https://ourworldindata.org/food-choice-vs-eating-local>
- Ritchie, H., & Roser, M. (2019). *Causes of Death*. Our World in Data. <https://ourworldindata.org/causes-of-death>
- Ritchie, H., & Roser, M. (2020). *Environmental Impacts of Food Production*. Our World in Data. <https://ourworldindata.org/environmental-impacts-of-food>

- Rohrmann, S., Overvad, K., Bueno-de-Mesquita, H. B., Jakobsen, M. U., Egeberg, R., Tjønneland, A., Nailler, L., Boutron-Ruault, M.-C., Clavel-Chapelon, F., Krogh, V., Palli, D., Panico, S., Tumino, R., Ricceri, F., Bergmann, M. M., Boeing, H., Li, K., Kaaks, R., Khaw, K.-T., ... Linseisen, J. (2013). Meat consumption and mortality—Results from the European Prospective Investigation into Cancer and Nutrition. *BMC Medicine*, 11(1), 63. <https://doi.org/10.1186/1741-7015-11-63>
- Rose, N., Reeve, B., & Karen Charlton. (2022). Barriers and Enablers for Healthy Food Systems and Environments: The Role of Local Governments. *Current Nutrition Reports*. <https://doi.org/10.1007/s13668-022-00393-5>
- Sandström, V., Valin, H., Krisztin, T., Havlík, P., Herrero, M., & Kastner, T. (2018). The role of trade in the greenhouse gas footprints of EU diets. *Global Food Security*, 19, 48–55. <https://doi.org/10.1016/j.gfs.2018.08.007>
- Scarborough, P., Adhikari, V., Harrington, R. A., Elhussein, A., Briggs, A., Rayner, M., Adams, J., Cummins, S., Penney, T., & White, M. (2020). Impact of the announcement and implementation of the UK Soft Drinks Industry Levy on sugar content, price, product size and number of available soft drinks in the UK, 2015-19: A controlled interrupted time series analysis. *PLOS Medicine*, 17(2), e1003025. <https://doi.org/10.1371/journal.pmed.1003025>
- Shukla, P. R. (2019). *Special Report on Climate Change and Land—IPCC site* (ISBN 978-92-9169-154-8). IPCC. <https://www.ipcc.ch/srccl/>
- Springmann, M. (2020). *Valuation of the health and climate-change benefits of healthy diets: Background paper for The State of Food Security and Nutrition in the World 2020*. FAO. <https://doi.org/10.4060/cb1699en>
- Springmann, M., Clark, M., Mason-D'Croz, D., Wiebe, K., Bodirsky, B. L., Lassaletta, L., de Vries, W., Vermeulen, S. J., Herrero, M., Carlson, K. M., Jonell, M., Troell, M., DeClerck, F., Gordon, L. J., Zurayk, R., Scarborough, P., Rayner, M., Loken, B., Fanzo, J., ... Willett, W.

- (2018). Options for keeping the food system within environmental limits. *Nature*, 562(7728), Article 7728. <https://doi.org/10.1038/s41586-018-0594-0>
- Springmann, M., Godfray, H. C. J., Rayner, M., & Scarborough, P. (2016). Analysis and valuation of the health and climate change cobenefits of dietary change. *Proceedings of the National Academy of Sciences*, 113(15), 4146–4151. <https://doi.org/10.1073/pnas.1523119113>
- Springmann, M., Mason-D'Croz, D., Robinson, S., Wiebe, K., Godfray, H. C. J., Rayner, M., & Scarborough, P. (2017). Mitigation potential and global health impacts from emissions pricing of food commodities. *Nature Climate Change*, 7(1), Article 1. <https://doi.org/10.1038/nclimate3155>
- Steinfeld, H., Gerber, P., Wassenaar, T. D., Nations, F. and A. O. of the U., Castel, V., Rosales, M., M, M. R., & Haan, C. de. (2006). *Livestock's Long Shadow: Environmental Issues and Options*. Food and Agriculture Organization. <http://www.fao.org/3/a0701e/a0701e04.pdf>
- Swinburn, B., Kraak, V. I., Allender, S., Atkins, V. J., Baker, P. I., Bogard, J. R., Brinsden, H., Calvillo, A., Schutter, O. D., Devarajan, R., Ezzati, M., Friel, S., Goenka, S., Hammond, R. A., Hastings, G., Hawkes, C., Herrero, M., Hovmand, P. S., Howden, M., ... Dietz, W. H. (2019). The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission report. *The Lancet*, 393(10173), 791–846. [https://doi.org/10.1016/S0140-6736\(18\)32822-8](https://doi.org/10.1016/S0140-6736(18)32822-8)
- Swinburn, B., Vandevijvere, S., Kraak, V., Sacks, G., Snowdon, W., Hawkes, C., Barquera, S., Friel, S., Kelly, B., Kumanyika, S., L'Abbé, M., Lee, A., Lobstein, T., Ma, J., Macmullan, J., Mohan, S., Monteiro, C., Neal, B., Rayner, M., ... Informas. (2013). Monitoring and benchmarking government policies and actions to improve the healthiness of food environments: A proposed Government Healthy Food Environment Policy Index. *Obesity Reviews*, 14(S1), 24–37. <https://doi.org/10.1111/obr.12073>
- Turner, C., Aggarwal, A., Walls, H., Herforth, A., Drewnowski, A., Coates, J., Kalamatianou, S., & Kadiyala, S. (2018). Concepts and critical perspectives for food environment research: A

- global framework with implications for action in low- and middle-income countries. *Global Food Security*, 18, 93–101. <https://doi.org/10.1016/j.gfs.2018.08.003>
- UN. (2020). *Preventing the next pandemic—Zoonotic diseases and how to break the chain of transmission* (ISBN No: 978-92-807-3792-9). United Nations Environment Programme. <http://www.unep.org/resources/report/preventing-future-zoonotic-disease-outbreaks-protecting-environment-animals-and>
- UNSCN. (2017). *Sustainable Diets for Healthy People and a Healthy Planet* (No. 00153). United Nations System Standing Committee on Nutrition. <https://www.unscn.org/uploads/web/news/document/Climate-Nutrition-Paper-EN-WEB.pdf>
- UNSCN. (2019). *Food Environments: Where People Meet the Food System*. United Nations System Standing Committee on Nutrition. <https://www.unscn.org/uploads/web/news/UNSCN-Nutrition44-WEB.pdf>
- U.S. Department of Agriculture. (2022, August 3). *National School Lunch Program*. Economic Research Service. U.S. Department of Agriculture. <https://www.ers.usda.gov/topics/food-nutrition-assistance/child-nutrition-programs/national-school-lunch-program>
- Walker, R. E., Keane, C. R., & Burke, J. G. (2010). Disparities and access to healthy food in the United States: A review of food deserts literature. *Health & Place*, 16(5), 876–884. <https://doi.org/10.1016/j.healthplace.2010.04.013>
- WHO. (2013, June 10). *WHO Director-General addresses health promotion conference*. World Health Organization. <https://www.who.int/director-general/speeches/detail/who-director-general-addresses-health-promotion-conference>
- WHO. (2020, April 29). *Healthy diet*. World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/healthy-diet>
- WHO. (2022, July 6). *UN Report: Global hunger numbers rose to as many as 828 million in 2021*. World Health Organization. <https://www.who.int/news/item/06-07-2022-un-report--global-hunger-numbers-rose-to-as-many-as-828-million-in-2021>

- Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., Vries, W. D., Sibanda, L. M., ... Murray, C. J. L. (2019). Food in the Anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, 393(10170), 447–492. [https://doi.org/10.1016/S0140-6736\(18\)31788-4](https://doi.org/10.1016/S0140-6736(18)31788-4)
- World Bank. (n.d.). *Prevalence of undernourishment (% of population) | Data*. The World Bank. Retrieved November 27, 2022, from <https://data.worldbank.org/indicator/SN.ITK.DEFC.ZS>
- Xiong, W., Sun, Y., & Zeng, Z. (2018). Antimicrobial use and antimicrobial resistance in food animals. *Environmental Science and Pollution Research*, 25(19), 18377–18384. <https://doi.org/10.1007/s11356-018-1852-2>
- Zheng, Y., Li, Y., Satija, A., Pan, A., Sotos-Prieto, M., Rimm, E., Willett, W. C., & Hu, F. B. (2019). Association of changes in red meat consumption with total and cause specific mortality among US women and men: Two prospective cohort studies. *BMJ*, 365, l2110. <https://doi.org/10.1136/bmj.l2110>

Appendix 1: Abstracts

Today's food systems are more efficient and productive than ever and while food hunger has been dramatically reduced, it has also contributed to a worldwide epidemic of obesity and non-communicable diseases. The latter has been caused partly by an increasing overconsumption of low-cost, calories-dense, and nutrition-poor foods. Additionally, current food systems are causing colossal environmental damages and contributing to climate change, primarily due to the overconsumption of animal-sourced foods. Governments have the primary responsibility to transformation of food systems to enable the adoption of diets that are not only healthier but also more environmentally sustainable. This thesis presents the results of a structured literature review of policy recommendations from international organizations and research associations for promoting sustainable and healthy diets (SHDs) in food environments – the context in which people meet the food systems – for high-income countries. The analysis was performed deductively, using an adapted version of the Government Healthy Food Environment Policy Index (Food-EPI) tool by Swinburn et al. (2013) as the main framework. The results entail a comprehensive overview of policy recommendations from 13 reports covering eight policy domains and seven “infrastructure support” domains within the food environment and that policymakers could consider when promoting and enabling the adoption of SHDs.

Die gegenwärtigen Lebensmittelsysteme sind effizienter und produktiver als je zuvor. Gleichzeitig tragen diese in ihrer aktuellen Form jedoch auch zur weltweiten Epidemie von Fettleibigkeit und anderen Krankheiten bei, die zum Teil auf den übermäßigen Verzehr von billigen, kalorienreichen und nährstoffarmen Lebensmitteln zurückzuführen sind, sowie zu massiven Umweltauswirkungen, welche primär durch den übermäßigen Verzehr von tierischen Lebensmitteln begünstigt werden. Regierungen spielen eine essenzielle Rolle die dringend erforderlichen strukturellen Veränderungen in den Lebensmittelsystemen vorzunehmen, um eine gesündere und ökologisch nachhaltigere Ernährung zu ermöglichen. Die vorliegende Arbeit befasst sich anhand einer Literaturanalyse mit politischen Empfehlungen von internationalen Organisationen und Forschungsverbänden für die Förderung einer nachhaltigen und gesunden Ernährung an der Schnittstelle zwischen Konsumenten und Lebensmittelsystemen (engl. food environment) in einkommensstarken Staaten. Methodisch wurde deduktiv vorgegangen. Grundlage hierfür war eine angepasste Version des Government Healthy Food Environment Policy Index (Food-EPI) von Swinburn et al. (2013). Die Ergebnisse bieten einen umfassenden Überblick über politische Empfehlungen, die acht Politikbereiche und sieben „Bereiche der Infrastrukturunterstützung“ abdecken, und als Grundlage für politische Entscheidungsträger dienen könnten, um eine gesunde und nachhaltige Ernährung der Bevölkerung zu ermöglichen und zu fördern.

Appendix 2: Overview of all policy recommendations

Overview of all policy recommendations from the 13 global nutrition initiatives included in the analysis													
Domains	Reports												
	FAO-2016	PPP-2016	SFSN-2020	SHDGP-2019	GPAFSN-2020	GPAFSN-2016	HLPE-2017	EAT-2019	SYN-2019	UN-2021	UNSCN-2017	UNSCN-2019	WRI-2016
Policy domains													
Food Retail													
Ensure a good national road and market infrastructure			I		I	I	I						
Invest in R&D of packaging technologies							I	I					
Consider the distribution and trade of HSFs in urban planning												I	
Align zoning laws to the promotion of SHDs							I	I					
Implement zoning laws that incentivize the opening of supermarkets in low-income areas							I	I					
Implement zoning laws that reduce the density of fast-food restaurants and food swamps							I	I					
Decentralize decision power over zoning regulation to local								I					

authorities													
Incentivize the establishment of farmers' markets and food trucks with SHFs in low-income areas						I	I						
Establish partnerships with supermarkets to improve people's diet quality					I								
Incentivize retailers to improve the availability of HSDs and reduce the appeal of lower-quality diets						I							
Restrict retailers' in-store promotion of energy-dense foods of low nutritional value				I			I						
Food Pricing													
Reorient agricultural priorities away from staple foods, sugar, and ASFs toward more HSFs			I		I			I	I		I	I	
Assess how current policies affect the production and consumption of HSFs			I		I					I			
Align fiscal policy to the promotion of HSDs by subsidizing HSFs and taxing unhealthy and unsustainable foods			I		I		I	I	I	I	I	I	
Implement systems to reduce the volatility of food prices, such as the reevaluation of biofuel subsidies and tariffs								I					
Implement better access to price								I					

information and early warning systems													
Coordinate management of food stocks at the international level								I					
Implement measures to reduce food waste and loss, such as investing in infrastructure								I					
Implement financial incentives for retailers and food outlets to sell HSFs							I						
Integrate considerations of SHDs into social protection programs			I		I			I					
Redraw poverty lines to take the higher prices of SHDs into account			I		I								
Ensure people have access to affordable food stores and markets selling SHFs			I										
Implement taxes for food-related GHG emissions								I	I		I		
Establish a true cost accounting mechanism for food prices that internalizes the external costs of food										I			
Food Composition													
Set targets and strategies to reduce the energy density of foods and the levels of concerning components, such as added sugar, salt, and fat								I					
Set stricter food industry			I										

regulations to reduce sugar and salt content in foods													
Incentivize the reformulation of food products toward healthier alternatives						I	I				I		
Enhance the fortification of food with micronutrients			I			I							
Implement a general ban of industrial trans-fats and implement fiscal policies that incentivize the use of unsaturated fats			I										
Banding of corporate tax rates to the production of SHFs						I							
Establish public-private partnerships for food fortification						I							
Incentivize the fortification of food with micronutrients					I	I							
Implement policies limiting food portions and package sizes			I					I					
Set targets for the reduction of the population's consumption of ASF by replacing them with plant-based proteins													I
Food Labelling													
Introduce and enforce better and easy-to-interpret front- of-pack nutrition labels			I		I	I	I		I		I		
Establish stronger regulation of the health and nutritional claims on							I		I				

food packaging													
Set up regulations that force restaurants to disclose the nutritional information of their food				I	I								
Introduce food labelling for environmental sustainability markers, such as carbon and water footprint				I					I		I		
<i>Set standards for understandable nutrition labelling through the Codex Alimentarius Commission for international guidelines</i>						I							
<i>Adopt the WHO's international standards and recommendations for labelling food targeted at children at the WTO</i>									I				
Food Promotion													
Restrict marketing for energy-dense foods with minimal nutritional value	I	I	I	I	I	I	I	I	I	I	I	I	
Restrict the "aggressive" marketing of breastmilk substitutes			I										
Restrict the advertising of unhealthy and unsustainable foods					I		I	I			I		
Positively discriminate the marketing and advertisement of HSFs								I					
Define standards and provide marketing incentives for						I							

wholegrain processed food products													
Draw on the potential of voluntary international initiatives, such as the Nutrition for Growth for companies in the food sector					I								
Food Provision													
Promote healthy (and sustainable) foods in publicly funded places, such as schools, hospitals, prisons, and the military			I		I	I	I	I				I	
Connect food provisioning at schools with local farmers to establish stable markets	I							I	I				
Empower physicians and healthcare service workers to advise public and private food service operators						I		I	I				
Food in Trade and Investment Agreements													
Recognize the importance of consider SHDs in trade and investment policy	I				I	I							
Ensure seamless food trade and cooperation ¹					I	I							
Develop complementary policies to ensure that trade policies promote healthy food environments	I							I					
Reevaluate trade policies, reconsider tariffs on and reduce non- tariff measures for healthy			I	I	I	I	I				I		

foods													
Lower entry barriers for food companies that meet specific quality criteria for their food production						I							
Implement ex-ante assessments to ensure that trade and investment agreements do not negatively affect food environments or diets							I		I				
Resist the imposition of export restrictions when food prices spike, and instead lower tariffs and value added tax							I						
<i>Update the WTO Rulebook for Agriculture to enable the establishment of a more sustainable multilateral food trading system</i>					I								
<i>Integrate the WHO guidelines and standards on nutrient profiling, food product labelling, and restrictions on marketing practices of unhealthy food toward children at the WTO</i>									I				
Use FBDGs for SHDs to define governments' investments' priorities					I								
Incentivize the private sector actors to invest in a sustainable food system by co-investment			I				I						
Set targets on the sales reduction of						I							

foods that undermine healthy diets as investment conditionalities on food companies													
Encourage investments in innovative technologies that make the food system more sustainable					I	I		I					
Food education													
Develop policies that support food and nutrition education, behavior change communication, and mass media campaigns			I	I	I		I	I		I		I	
Integrate food and nutrition education, including food budgeting, into the national school curriculum			I										
Integrate nutrition education and budgeting into all forms of national services, such as social protection program			I					I					
Integrate initiatives on food and nutrition education into state law and regulations			I										
Establish the topic of SHDs as a priority among peer groups, such as co-operatives						I		I					
Promote food cultures that enable SHDs, including cooking skills							I						
Implement education campaigns on the environmental sustainability of food choices			I	I				I	I				I

Ensure that education campaigns on SHDs are supported by a comprehensive strategy to shift people's diets													I
Infrastructure Support Domains													
Leadership													
Effective leadership is characterized by effective coordination and consultation across policy areas							I	I			I		
Policy actors need to be engaged and committed to facilitating the development of good policy							I	I					
Seek international and national commitments to shift diets toward SHDs			I		I								
Build on today's global development targets related to the goal of establishing SHDs					I						I		
Make use of global fora and international organizations					I						I		
Link initiatives across the international, national, and local levels and across different policy areas			I		I		I	I					
Strengthen institutions, policies, and programs on SHDs in crisis-prone areas to enable quick action											I		
Develop quantifiable targets on													I

SHDs, such as reductions in the populations' consumption of animal-sourced foods													
Integrate the externalized environmental and societal costs of the current food system into the common understanding of an efficient food system					I								
Set up multi-sectoral teams to be trained in leadership development to effectively initiate and scale up programs for the promotion of SHDs							I						
Evaluate the trade-offs between climate, health, nutrition, and the economy (or other sectors) from a human rights perspective											I		
<i>Bring the topic of SHDs forward and use the international arena to enable international commitments</i>					I								
<i>Set up a Global Financial Facility to support governments in the effective mobilization and allocation of resources into the transformation of food systems</i>					I								
<i>Establish an IPCC-equivalent organization dedicated to sustainable food systems</i>					I								
<i>Integrate today's various global nutrition initiatives into one</i>											I		
<i>Use the EAT-2019 framework as a</i>								I					

<i>basis to set targets on the food system transformation while more comprehensive frameworks are developed</i>													
Governance													
Ensure that policies that incentivize the adoption of SHDs achieve equitable outcomes via participatory governance mechanisms											I		
Restrict certain industrial practices and powers that undermine SHDs											I		
Establish independent bodies to monitor compliance and performance against predefined benchmarks, hold stakeholders accountable, identify and address conflicts of interest and settle disputes							I						
Set multi-scale governance mechanisms and engage different stakeholders across public, private, and civil society							I						
Set up cross- government, and inter-sectoral coordination and networking mechanisms for the development of policies from the regional and national to the global level			I		I								
Ensure the municipal level has the means necessary to implement local													

measures to promote the adoption of SHDs and to create pressure for action at the national level													
Empower civil society and other stakeholders by making the accountability mechanisms transparent					I		I		I				
Establish data-driven accountability of SMART (specific, measurable, achievable, realistic, and time-bound) commitments made by actors within the food system					I								
Invest in data collection and their transformation into valuable information on relevant food system-specific performance indicators					I								
Implement straightforward and transparent guidelines on handling with the private sector, including straightforward and transparent guidelines on conflicts of interest and clear and transparent processes of policy development and implementation									I				
Set up legally binding international agreements to promote SHDs, such as a Framework Convention on Food Systems and the adoption of WHO standards at the WTO level			I				I		I				
Set up targets and accountability mechanisms on SHDs									I				

<i>Development agencies and other funders should encourage addressing the problems of the food system by integrating it as a requirement for technical assistance and loans</i>													
Monitoring and Intelligence													
Establish monitoring mechanisms to assess the status and development of the food environments, such as on markers on nutrition and public health	I			I			I	I	I	I			I
Collect information on cost-effectiveness of policy measures on the food environment and disseminate it internationally								I					
Develop a diet quality assessment tool as an SDG indicator								I					
Monitor the diversity of nutritious foods in the food environment to identify points for action in the availability, affordability and acceptability of fruits, vegetables, legumes, and nuts	I												
Monitor the compliance and performance of stakeholders within the food environment							I						
Engage public health experts in evaluating the food environment regarding SHDs through proprietary big data on the sales of									I				

food and beverage products, food marketing trends through social media, and geographic information systems													
Evaluate the access to SHDs for low-income segments of the population									I				
Participate in the development of a global dataset on food consumption patterns, food composition, life cycle assessment of global food supply, and health profiles											I		
Provide research funding to better understand the food environments and policy development		I	I		I	I	I	I	I	I	I		I
Encourage research cooperation with the private sector, such as through public-private research partnerships						I						I	
Report on the progress toward SHDs by either expanding current annual official reports or develop new ones and standardize the reporting across all levels of governance								I					
Expand the responsibilities of existing international oversight bodies, such as the UN, or set up new ones to oversee the food systems transformation								I	I				
Platforms for Interaction													

Establish platforms for interaction between stakeholders of food environments			I		I		I	I	I		I		
Ensure that all stakeholders understand the importance of the food environment transformation					I								
Engage stakeholders in the process of redesigning the policy framework around food environments, such as physicians in the redesign of public food provision programs			I		I			I					
Ensure that local dialogue on the implications of the latest science regarding the needed transformation of the food system takes place					I								
Engage civil society (organizations) in the development of public policy					I				I		I	I	
Engage agriculture and food companies in the development of a clear agenda for the delivery of SHDs ²					I			I					I
Funding and Resources													
Increase public funding for evidence-based efforts to shift diets toward SHDs							I	I					I
Evaluate how synergies with existing spending for agriculture and food systems could be achieved							I	I					I

<i>Leverage investment flows from donors and multilateral organizations into double- or triple-duty measures that address multiple sustainable development challenges simultaneously</i>								I					
<i>Make SHDs a priority in climate finance</i>											I		
Workforce Development													
Develop workforce capacities within the food system to enable the adoption of SHDs by improving their nutrition literacy							I		I			I	
Establish and properly train multi-sectoral teams to develop and implement policy programs on SHDs							I						
Train nutrition professionals to understand their role within the whole system and their intersection with different fields							I						
Engage chefs and the food service sector in the development of healthy and sustainable meals that are both culturally appropriate and palatable								I					
Improve workforce development upstream the food value chains to reduce food loss and waste						I							
Health-and-sustainability-in-all													

Policies													
Ensure alignment on the promotion of SHDs across policy fields	I	I	I	I	I	I	I	I	I	I	I	I	I
Agree on the importance of enabling the adoption of SHDs across relevant parts of government and establishing a common policy agenda					I								
Tailor every new policy and investment decision to have multiple beneficial outcomes across the food system					I								
Ensure alignment on the promotion of SHDs across all levels of government								I			I		
Set up a multidisciplinary cross-agency task force to evaluate current policies and regulations affecting diet choice													I
Evaluate the impact of potential food policies on their most vulnerable populations								I					
Assess potential unintended external impacts of new policies in low-income countries and pursue a "do-no-harm" principle					I								
Grant FBDGs more political relevance and consider them when developing policies across society to enable the adoption of SHDs	I	I	I	I	I	I	I	I	I	I	I	I	I

Use FBDGs for SHDs as the basis for food procurement and social security support, such as food distribution programs	I				I								
Ensure the FBDGs reflect the latest nutritional and environmental sustainability evidence, and the changing public health landscape by updating them regularly	I												
Engage professionals and scientists from the fields of health, environment, and socio-economy in the development of the FBDGs	I												
Engage NGOs in the development of the FBDGs								I					
Ensure the cultural contextualization of the FBDGs	I												
Aligning FBDGs to international guidelines where appropriate											I		
Provide citizens with official, accessible and easy-to-understand, science-based FBDGs	I				I								
Ensure FBDGs are widely communicated to the public and promoted by health professionals	I												
Adapt the communication of the FBDGs to different audiences: he general public, health professionals, and those working in government procurement and the food sector	I												

Develop FBDGs for specific population segments, including those who decide not to eat meat or animal products altogether	I												
Ensure FBDGs include recommendations for cooking and food preparation	I												
Ensure FBDGs include information on the environmental impact of different foods	I				I			I					
Upgrade the standard FBDGs to science-based FBDGs that induce a better understanding of the implications of dietary choice on the environment					I								
Ensure that women can follow the WHO and UNICEF recommendations on breastfeeding			I	I									
Comments: 1 The FAO-2016 warns that current trade policies have tended to introduce more highly processed foods into food environments. 2 warning by SYN-2019: engage with small and medium-sized food companies instead of big ones due to the latter's track record of opposing public health policies Italic: recommendations for governments to implement at the international level through international organizations FBDG: food-based dietary guideline; HSF: healthy and sustainable food; IPCC: Intergovernmental Panel on Climate Change; SHD: sustainable and healthy diet													

