# EXAMINING SUSTAINABILITY IN FOOD-BASED DIETARY GUIDELINES: AN INTERNATIONAL COMPARISON AND SYSTEMS THINKING FRAMEWORK FOR SUSTAINABLE DIETARY GUIDELINE DEVELOPMENT

by

# RACHEL MAZAC

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The following individuals certify that they have read, and recommend to the Faculty of Graduate and Postdoctoral Studies for acceptance, the thesis entitled:

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submitted by	Rachel Mazac	in partial fulfillment of the requirements for	
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in	Integrated Studies in Land and Food Systems		

## **Examining Committee:**

Dr. Jennifer Black
Supervisor
Dr. Kerry Renwick
Supervisory Committee Member
Dr. Barbara Seed
Supervisory Committee Member
Additional Supervisory Committee Members:
Dr. Emily Huddart Kennedy

Supervisory Committee Member

#### Abstract

International appeals from the United Nations and a growing group of nutrition, policy, and environmental science experts have called for integration of sustainability into national food policies. As of 2018, at least fifteen countries had sustainability considerations in their foodbased dietary guidelines (FBDG) or supporting documentation, yet little scholarship has examined sustainability framing within these guidelines. This study therefore examined sustainability inclusion and framing in international FBDG. Qualitative content analysis was used to analyze FBDG distinguished by the UN as having considered sustainability. The aim of this study was to explore the sustainability inclusion process within international FBDG and to identify common elements regarding sustainability inclusion. Eleven documents used by 15 countries were analyzed. This content analysis revealed five main themes about the framing and inclusion of sustainability in international FBDG: i) explicit sustainability documents were recently published, and the process for inclusion varied with country context; ii) multiple sectors and myriad stakeholders contributed to guidelines, instilling broad interests and a wide conceptual framing; iii) sustainability was primarily framed through health and nutrition, yet other sustainability domains also emerged as salient; iv) the most explicit sustainability considerations were found in documents that are focused more on the context of eating, with less explicit focus on specific nutrients; and v) consistent main messages were revealed across explicit sustainability documents. Based on these analyses, a proposed framework was developed to examine how sustainability has been included in dietary guidelines. The analysis of FBDG documents informed the development of a framework adapted from existing literature on food policy. The resulting framework to assess the interconnected inclusion of sustainability concepts

in FBDG has five core domains: health and nutrition, food security and agriculture, markets and value chains, environment and ecosystems, and sociocultural and political. The framework developed can be used in future studies to compare and examine how sustainability considerations are integrated into emerging FBDG.

# Lay Summary

Sustainability in food policy and dietary guidelines is increasingly a focus of researchers, international organizations, and governments. Currently, there is limited attention by governments to integrate sustainability into their national food-based dietary guidelines (FBDG). To understand sustainability inclusion in dietary guidelines, this study assessed FBDG that have included sustainability. A framework is suggested to aid in the development of national FBDG with sustainability considerations. This study analyzed FBDG or supporting documents used by fifteen countries from four continents and examined how sustainability was included according to a framework of sustainability in food policy. Health and nutrition dominated the FBDG sustainability framing, however, health was included in interconnected and complex ways with other domains through simultaneous consideration of food security, agriculture, markets, or sociocultural and political contexts. This framework can serve as a tool for countries to interrogate ways to incorporate sustainable diet considerations in FBDG.

# Preface

This dissertation is original, unpublished, independent work by the author, R. Mazac. As a first year in the Integrated Studies in Land and Food Systems MSc program, I identified and designed the research program in collaboration with my supervisor, Dr. Jennifer Black, and committee members, Drs. Kerry Renwick and Barbara Seed. In the following year, I collected the documents for analysis, analyzed the data, synthesized the findings, and wrote the results into this thesis.

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# **List of Abbreviations**

- FBDG Food-based dietary guidelines
- GHG Greenhouse gases
- NNR Nordic Nutrition Recommendations
- SDGs United Nations Sustainable Development Goals
- UN FAO United Nations Food and Agriculture Organization
- UN WHO United Nations World Health Organization

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### **Chapter 1: Introduction**

#### 1.1 Why care about sustainability in diets?

The current condition of the global food system has serious implications for jeopardizing future agricultural production, poses wide-ranging detrimental impacts on ecosystems, and is failing to adequately nourish the global population (1-4). Worldwide, agriculture is facing cropland degradation from intensification and causing simultaneous biodiversity loss (1,2). Hunger and malnutrition afflict nations around the globe (4), yet obesity prevalence is also on the rise, associated with unhealthy transitions in diets towards market-driven, obesogenic foods (e.g. fast foods, sugar sweetened beverages) (3). According to the United Nations and nutrition and environment experts, in order to address the myriad environmental, social, and health challenges both caused by and affecting food systems, a shift towards healthy and environmentally responsible dietary patterns is needed within global populations (5-10).

Human dietary practices impact the environment and have implications for food system sustainability (7,10). Trends in global food demand are estimated to increase by 100-110% by 2050 to keep up with predicted population growth and shifting consumption toward more animal products associated with increased wealth (2). Increased demand for crops could require one billion additional hectares of land cleared and emit greenhouse gas (GHG) equivalent levels exceeding three gigatons per year if land continues to be cleared in poor nations for agricultural expansion by rich nations (2). Reducing agricultural crop demand through sustainable dietary practices could reduce land clearing, water use, and associated species extinctions (7). Sustainable diets can offer health benefits while lowering global GHG emissions and excess nitrogen pollution in the environment (7,10). Diets, the environment, and health are a tightly linked 'trilemma' presenting a global challenge as well as an opportunity for improvements in environment and public health (7).

Dietary practices with low environmental impact have been associated with beneficial health outcomes (5-8). For example, diets lower in animal-based food products are linked with lower GHG emissions, less water and land use, and reduced all-cause mortality risk compared to high animal-based diets (6-8). Semi-vegetarian (less than one animal-based food consumed in a week) and vegetarian diets are lower in total emissions estimated through food product life cycle analysis of diets (including food production, processing, transportation, storage, retail, and consumption, and disposal) and are associated with a lower risk of all-cause mortality when compared to nonvegetarian diets (7,8). Though, an environmentally conscious diet does not necessarily mean it is also healthy (11).

One step that federal governments can take in shifting consumption and supporting sustainable, healthy futures is to produce and circulate food based dietary guidelines (FBDG) that include sustainability principles. Given the mounting evidence of the need for health- and environment-related changes in food and nutrition practices (8,10,12-14), the FAO has made international recommendations for governments to act by publishing FBDG that incorporate sustainability in 2016 (9). Many governments already create dietary guidelines that can be the basis for action in healthy eating and act as the foundation for policy and institutional change, yet their FBDG may be further employed to benefit the environment and greater sustainability concerns (9,10,15). The recent consensus of the global EAT-Lancet Commission is that "dietary guidelines that integrate health and environmental sustainability considerations could be one tool for nutrition education" and recommend that "relevant national bodies should implement guidelines for healthy diets from sustainable food systems" (10)p34. Yet few countries have

positioned sustainability in their food-related public polices (e.g. dietary guidelines) as a signal of their sustainability commitments (9).

#### 1.2 What are food-based dietary guidelines?

Countries develop FBDG to assist populations and industries in improving national public health outcomes and meeting international goals of preventing population-wide nutrient deficiencies (16). Internationally, early dietary guidelines were primarily developed for preventing nutrient deficiencies and focused their guidelines on specific nutrient intake recommendations for individuals, but implementation of nutrient-focused guidelines for inadequate nutrition and chronic disease prevention had limitations (16). A focus on absolute nutrient intake requirements is a paradigm dominant in nutrition science (termed 'nutritionism' by some scholars (17)) (18) and further frames dietary advice from professionals and governments (17). Nutrition recommendations of daily intakes alone cannot serve as dietary recommendations appropriate for general information about selecting healthful, culturally relevant, and nutritious diets (19). Some scholars suggest that dietary reference standards do not address the challenges individuals have in understanding nutrient-focused recommendations and making choices in contemporary obesogenic environments (20,21), therein need to be paired with other tools to serve public health goals for general nutrition education (19). It has been further asserted that nutrition science has a need to engage future global challenges, reconnecting with society and the environment, to be relevant to and inform policy (22).

Internationally, some countries' guidelines have transitioned from the nutrition focus to include the broader context of eating (e.g. the Canadian guideline transition from serving sizes in 2007 (23) to environmental and cultural considerations in 2019 (24)). The transition to a wider context of eating in FBDG has been spurred on as a result of the recognition that the

understanding and use of guidelines did not correlate to reductions in chronic disease (e.g. heart disease and obesity) (16). Mozaffarian and Ludwig (2010) claim that nutrient-focused guidelines provided little guidance for users to select healthier foods and make more nutritious food choices. Taking into account cultural and socioeconomic factors makes FBDG applicable in local food environments and meaningful in context of food preferences among the current glut of food options in hypermarkets (21,22). The transition to more food-based is only beginning, and further description of the transition to include the context of eating is represented in the findings of this thesis. A shift to food-based and food context-focused guidelines also provides the opportunity to incorporate sustainability principles as the UN FAO has brought biodiversity, natural resources, and ecosystems into the discussion of developing dietary recommendations (9).

FBDG serve many purposes as national guidance on how citizens of that country can live well through choosing nutritionally balanced and adequate foods (25). FBDG have been found to impact individual diets. For example, in a nationally-representative sample of adults from the US, use of the MyPlate or MyPyramid FBDG was associated with more healthful dietary intakes on a self-reported 24-hour dietary recall after adjusting for several confounding variables (26). On a population-level, not following dietary guidelines can impose a high economic burden on a country (27). In Canada, not meeting 2007 food guide recommendations was estimated to contribute to CAD\$13.8 billion per year in both direct and indirect health care costs (27). Beyond economic sustainability, studies have associated increases in health of the environment following FBDG (5,11). Food guides are relevant through their provision of dietary guidance to the population, but guidelines can also be used as important comparison metrics to actual intake analyzing diet quality in individuals and the population, set terms for clinical assessments and

counselling, and support further practice and policy for improving diets (10). So, the definitions of healthy and sustainable diets espoused is important and can help increase dietary sustainability when populations follow federal dietary guidelines meant for steering public food choices (10,28). Through development of FBDG, federal governments can signal their commitment to and encourage dietary practices of their populations toward a more healthy and sustainable future (9).

#### **1.2.1** Food-based dietary guidelines internationally

FBDG are one component influencing population health and, potentially, sustainability in consumption patterns globally, yet the existence and emphases of FBDG vary widely. Not all countries have FBDG, official or not. The UN identified only 83 of the 215 (39%) countries worldwide as having FBDG, and the absence of FBDG is most conspicuous in low- and low-middle income countries (9). The aim of existing FBDG to improve or maintain health is consistent, but an evaluation of their inclusion of sustainability is lacking in the literature. Evaluation of FBDG is needed to understand how they were framed, in what ways has sustainability been considered, and the influence different groups of stakeholders had in incorporating sustainability.

Few countries discuss aspects of sustainability in their FBDG or in their supporting information available for food guidance as of 2018. According to a global review by the UN in 2016, only four countries include any explicit consideration of sustainability in their FBDG (Brazil, Germany, Qatar, and Sweden) (9). The United States and Australia have attempted to incorporate sustainability and environmental considerations into their official guidelines, but have failed to achieve sustained government support for full integration into guidelines (9). Resonating in their official FBDG, the United Kingdom, France, the Nordic countries (Estonia, Finland, Denmark, Norway, and Iceland), and the Netherlands have supporting dietary guideline documents with environmental considerations (9).

#### **1.3** What is a sustainable diet?

Sustainability is defined by the ability to meet the needs of the present without compromising the ability of future generations to meet their needs in a way that balances environmental, economic, and social aspects (29,30). The UN has also outlined a 2030 agenda for sustainable development in their 17 Sustainable Development Goals (SDGs) that present global goals for a thriving population and planet in peace and prosperity (31). Many definitions of sustainable diets have been put forward. According to Johnston et al.'s (2014) definition, a sustainable diet is one that "promote[s] environmental and economic stability through low-impact and affordable, accessible foods, while supporting public health through adequate nutrition" in a way that engenders "sovereignty and preserve[s] tradition involving culturally sensitive and acceptable foods" (13). For this thesis, the definition complied by the UN FAO and Biodiversity International will be used. They define sustainable diets as

"those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources" (9)p10.

Though early recommendations to include sustainability in nutrition guidelines had been made in the mid-1980s, according to Gussow (1999) there had been a "lukewarm response [to

that recommendation] not only from the public but from a large number of nutrition educators" more than a decade later (32). Recently, it has been more widely accepted that diets impact the environment and dietary change can be a main driver of the sustainability of the food system (5,7,10,11,28). Yet, despite the growing acknowledgement by public health scholars and practitioners of the need for changes in public health practice to include sustainability considerations (10,33,34), there is a lack of understanding of how public health policies include sustainability and how policy makers consider sustainability in FBDG development (35-37).

Note, the term 'eater' is used in this study, which was adopted from Dietitians of Canada's response to Health Canada's consultation on dietary guidance policy (38). 'Eater' is used as opposed to 'consumer,' as eater implies broader values of diets beyond physical (i.e. consumption of nutrients and foods) and economic health (i.e. buying, selling, livelihoods) to encompass the social and environmental health of sustaining people and the planet (38).

#### **1.4** What are policy considerations and why are they important?

Policy and guideline development involves decisions that emerge from political judgment and debate, as well as evidence valued through considerations, or lenses adopted, by policymakers (39). A lens is a critical and specifically adopted approach to policy and guideline development that addresses an issue valued by policymakers (40). An identified external influence, or viewpoint of the developer, a policy lens, or consideration, can explain why policies integrate certain aspects and the context for decisions made in the development of a policy or guideline (40). Since considerations are tightly bound to the values and ideological positions of political agents in policy and guideline development, they may act as a filter to either narrow or expand what 'evidence' is privileged or deemed irrelevant (39). Considerations and frames are distinct yet correlated parts of guideline and policy development. The framework is the structure that defines the problem and establishes the considerations with which a policy or guideline is developed (39). The framework is the driver that gives purpose to including a certain consideration. Without the problem defined, contextualized, and driven by the frame (41), a consideration would not be adopted through which to assess political judgment, professional practice, and scientific research each used in policy and guideline development (39). In the FBDG development process, the framing of sustainability as an important concern would guide the values of developers in adopting considerations of sustainability. Sustainability considerations can be used to incorporate specific professional and political judgments and evidence in the development process. A framework that articulates the full extent of a sustainable diet could guide developers in both narrowing in on salient evidence and broadening influences for consideration in FBDG development.

#### 1.5 What is framing and why is it significant?

To understand how the concept of sustainability has been framed in current FBDG, first an understanding of what framing is and why it is important is required. A theoretical and methodological tool for the study of problems and how they are discussed, framing has been described as a form of political influence (42). Framing and frame analysis stem from the tenets of social constructivism (41). Framing has roots in sociology and enables information processing allowing actors to define what an issue is and the course of action (41,42). Cognitively about making some aspect of reality more salient, framing plays many roles in different forms of communication from diagnosing causes, suggesting policy fixes, and even stating moral judgments (41,43). Frames are important since they not only describe an issue but also offer the author's description of the solution to readers interacting with that frame (43,44). Framing can impact users of FBDG by influencing attitudes and opinions of those who interact with the guide, which can impact the food choices made and may lead to other externalities (e.g. health, environmental, economic). To understand sustainability framing in FBDG is to work towards an understanding of the messages influencing FBDG users (44). Given the influential nature of the FBDG, an awareness of the way the concept of sustainability is framed and how this influences action, is a small step towards larger sustainable action among food system agents (e.g. as tools for transformation in how the public views and engages with food systems to "recognise the inextricable link between human health and environmental sustainability" (10)p5).

Understanding the framing of sustainability within current FBDG can direct future changes to the guidelines incorporating recommendations commensurate with international calls to integrate sustainability considerations in FBDG (5,9,10,45,46). Despite important implications of influencing action in eaters, little is known about the framing of sustainability in federal policy and guidelines, especially FBDG. Though sustainability has been discussed or considered in eleven global FBDG as of 2018 (9), there is still a gap in the literature when it comes to sustainability considerations in FBDG.

#### **1.6 Research Questions**

The purpose of this study is to investigate the consideration of sustainability in international FBDG, then adapt a framework through which to investigate the framing of sustainability in FBDG. This study aims to understand framing of sustainability in international FBDG through analysis of documents from 'early-adopter' countries that have considered sustainability in their guidelines or in supporting documents. Specifically, this study asked: i) what are the common elements and what differs in the development process of sustainability inclusion and how has sustainability been framed (included and considered) in international FBDG? ii) how are concepts framed and interconnected in current FBDG? and iii) how can the current sustainability framing be used to develop a framework for future integration of sustainability into FBDG?

#### **1.7 Study Objectives**

In order to address the gaps in articulating the understanding of how sustainability has been framed in international FBDG identified above, Chapter 2 will address the first objective and Chapter 3 will address objective number two:

- Explore: To examine how sustainability has been framed in international FBDG and compare across country contexts
- Apply: To adapt a framework through which to understand how sustainability has been framed in international FBDG

Note, this thesis was written with formatting for two publication-oriented papers (Chapters #2 and #3) with an additional Introduction (Chapter #1) and Conclusion (Chapter #3) to better frame the thesis as one coherent piece.

# Chapter 2: Sustainability inclusion in food-based dietary guidelines: an international analysis

#### 2.1 Introduction

This chapter, meant to stand alone and formatted to be a part of this full thesis, will take the reader through international sustainable dietary guidance, outline the methods used to understand the process of the sustainability inclusion and framing in FBDG, and present the findings of that objective through five main themes that emerged from this analysis. A concluding discussion invites readers to consider the implications and future directions of these findings for framing forthcoming dietary guidance.

#### 2.1.1 International action for sustainable diets

The UN FAO is placing increasing emphasis on establishing healthy and sustainable food systems catalyzed by changes in dietary patterns (9,45). The basis of many international sustainability initiatives, the UN released their Sustainable Development Goals in 2015, of which the majority of the goals can be tied to sustainable dietary consumption practices (31). The UN also declared the period between 2016 and 2025 the Decade of Action on Nutrition (47).

International recommendations for country-level action towards sustainable dietary practices have centered around developing policies and guidelines. Prior to the Sustainable Development Goals, and as early as 1996, the UN and World Health Organization (WHO) suggested that countries consider the question "are the guidelines environmentally sustainable?" when preparing food-based dietary guidelines (45). In the 2014 Rome Declaration on Nutrition, UN member countries committed to "enhance sustainable food systems by developing public policies from production to consumption and across relevant sectors to provide year-round access to food that meets peoples' nutrition and promotes safe and diversified healthy diets" (48)p5. UN countries, as signatories of the Declaration, aim to move forward by producing and disseminating food policies that include health and sustainability considerations for producers and eaters. Countries party to the 2014 Rome Declaration have pledged to implement public policy with both sustainability and health considered, yet few countries have positioned sustainability in their food-related public polices (e.g. dietary guidelines) as a signal of their sustainability commitments (9).

#### 2.1.2 Food Guides: from nutrient-focused to food-based

Developing and publishing food based dietary guidelines (FBDG) that include sustainability principles is one step federal governments can take in shifting consumption and supporting sustainable, healthy futures. To assist populations and industries in meeting international commitments to public health and national goals of preventing and reducing nutrition-related public health challenges (e.g. nutrient deficiencies, nutrition-related chronic diseases, malnutrition), countries develop FBDG (16). Internationally, early dietary guidelines after the Second World War were primarily focused on addressing nutrient deficiencies, with an emphasis on recommendations pertaining to individual dietary components or micro and macronutrients [e.g. with advice in US food guides from the 1980's to "eat foods with adequate starch and fiber" and "avoid too much fat, saturated fat, and cholesterol (49)p1].

Implementation of guidelines focusing on specific nutrients has limitations (16,17). Mozaffarian and Ludwig (2010) assert that nutrient-focused FBDG are shifting from a focus on micronutrient deficiencies to an emphasis on chronic disease prevention since advances in nutrition science have found the significant connection between diet and cardiovascular disease, diabetes, and obesity. Expanding on the foundation of nutrition science, some countries have taken further steps to focus on foods, lifestyles, and the context of eating in FBDG to decrease

chronic disease risk by increasing the likelihood of consuming fewer calories and more healthy foods (16). A central feature of current FBDG is a focus on desirable food patterns and not specific nutrients, and guidelines must be supported by well-communicated, sound nutrition science (21).

The UN has recently promoted the inclusion of sustainability principles into FBDG. The UN FAO has brought biodiversity, natural resources, and ecosystems into the discussion of dietary recommendations and how to develop guides (9). Other food values, such as the social context of eating (50) and the economic incentives of eating a healthy diet (51) have been brought into FBDG. Given the mounting evidence of the need for health- and environment-related changes in food and nutrition practices (8,12-14), the UN FAO has created international recommendations for governments to act by publishing the FBDG that incorporate sustainability and focus on food values (9).

Rizvi et al. (2018) have asserted that we need to reformulate national dietary guidelines. Based on the findings of their study comparing what international populations currently consume with what would happen if they transitioned to the US Dietary Guidelines recommended diet, Rizvi et al. (2018) assert the need for FBDG to consider actual land use of the recommendations and the cultural and economic variation in the food system (52). Food, and the production, transport, and distribution systems that bring food to people's plates, can be an entry point for eaters to consider and begin to address sustainability challenges; FBDG can be a tool for translating ideas into meaningful policies and actions catered to a country's context and political will (10,53). Beyond individual education, food guides can also influence other polices and food production from industries who use FBDG to justify production and encourage consumption (10).

#### 2.1.3 How has sustainability been included in FBDG thus far?

Not all countries have FBDG, official or not, with any indication of sustainability orientation. The UN identified only 83 of the 215 countries worldwide (39%) as having FBDG, and the absence of FBDG is most conspicuous in low income and developing countries (9). The aim of existing FBDG to improve or maintain health is consistent but evidence-based understanding of their consideration of sustainability is lacking.

Several governments have already developed dietary guidelines that are the basis for action in healthy eating and act as the foundation for policy and institutional change (9). In addition, FBDG can be employed to benefit the environment and greater sustainability concerns (9,10,15). Growing acknowledgement by scholars indicate the need for change in public health practice to include sustainability considerations (33,34).

According to a global review by the UN in 2016, only four countries had included any explicit consideration of sustainability in their FBDG (Brazil, Germany, Qatar, and Sweden) (9). The United States, Australia, and China have attempted to incorporate sustainability and environmental considerations into their official guidelines, but have failed to achieve government support for comprehensive integration of sustainability in their FBDG (9). Though not explicitly identified in their official FBDG, the United Kingdom, France, the Nordic countries (Estonia, Finland, Denmark, Iceland, and Norway), and the Netherlands have supporting dietary guideline documents with environmental considerations (9).

#### 2.1.4 What is missing in current knowledge of how FBDG address sustainability?

Though sustainability has been discussed in eleven global FBDG (Brazil, Germany, Qatar, Sweden, the Netherlands, the UK, the Nordic Nutrition Recommendations, France, Australia, China, the US) (9), there is still a gap in the literature understanding the framing and inclusion of sustainability in FBDG. Cognitively about making some aspect of reality more salient, framing is a facet of communication that highlights what the authors are prioritizing (41,43). Frames are important since they not only describe an issue but also offer the author's description of the solution to readers interacting with that frame (43,44). Frames impact users of guides by influencing attitudes and opinions of those who interact with the FBDG, which can impact user food choices that have other externalities (e.g. health, social impacts, economic dynamics, ecosystem effects). To understand sustainability framing and inclusion FBDG is to work towards an understanding of the messages influencing FBDG users (44). Though there is a broad set of heterogeneous documents, there is a need to analyze FBDG to indicate a country's alignment with UN recommendations and other countries who have included sustainability in their FBDG (54).

Lang and Mason (2017) discuss policy development internationally between 2008 and 2017 around sustainable diets, yet they conclude that a common, overarching framework for sustainable diets is missing (54). Their article addresses food policy or guidelines from Australia, Brazil, France, the Netherlands, Qatar, Sweden, UK and USA. Lang and Mason (2017) examine what sustainability means in policy, how it was addressed in complex ways, and draw out emergent themes in development. The discussion is thorough and brings up lessons learned from examining food policy and guidelines and their development around the world, but they indicate there is a need for a larger framework to guide policy and guideline development (54). Further, their analysis leaves a future direction for understanding the interconnected and complex inclusion of sustainability concepts in a cross-country comparison (54).

Brazil, Sweden, and Qatar are three countries that have considered sustainability in their FBDG development. Brazil has broadened their FBDG to include consideration of the context

from which food and nutrition are derived (55). Sweden's FBDG has also implemented sustainability in their national FBDG (56). Yet, the literature thus far does not include an analysis of the sustainability framing within the Brazilian or Swedish FBDG documents. The unique cultural context of Qatar informed the development of their FBDG, and a policy analysis showed that Qatar considered sustainability in recommendations for their citizens (57). Yet, a further cross-country comparison of framing in FBDG internationally is missing.

Australian and Nepalese food policies have been analyzed for sustainability framing, but the literature is incomplete; description of the framing in their FBDG specifically is lacking. While a study of Australian food policy assessed sustainability framing from various food system actors in the country (44), this analysis did not consider the government food policy itself, just framing of stakeholder views on the importance and main drivers of sustainability concerns. Though the sustainability framing in Nepal's food policy identified where the policies, in contrast with the food guide, can broaden their views to incorporate more holistic food systems aspects (35), it was again only applied to food policy and not FBDG specifically.

#### 2.1.5 Theoretical Framework

In this study, the general theory used as the starting point for sustainability framing assessment was Downs et al.'s (2017) framework that was used for assessing Nepal's food policy. The domains, their concepts, and definitions in the sustainable food policy framework were used as the units of content analysis for this study. The text was interpreted, following the research question, through application of the framework and coding of text into domains and concepts (based on domains in Downs et al. 2017), which were re-visited and revised within the process of analysis (i.e. inductive and deductive process outlined below) (58). The full framework adapted for use from Downs et al. (2017) can be found in Table 1 (see page 21); the

original framework can be found in Appendix B (page 132). Permission has been granted from Downs for reproduction in this thesis.

#### 2.2 Study Objectives

The objective of this chapter was to examine how sustainability has been framed in international FBDG and compare the inclusion of sustainability considerations across country contexts in early-adopter countries. Tough there is a large amount of heterogeneity, specifically, this study asked what are the common elements and what differs in the development process of sustainability inclusion and how has sustainability been framed (included and considered) in international FBDG?

#### 2.3 Methods

#### 2.3.1 Document Sampling and Data Collection

International FBDG with consideration of sustainability were the sample of interest for this analysis. Documents were included if they were identified and categorized by a FBDG review from the UN FAO (9). In a 2016 global review intended to support countries in developing, implementing, and evaluating FBDG, the UN FAO highlighted several countries' FBDG and divided them into three categories related to the extent of integration of sustainability (9). The first category identified four countries (Brazil, Germany, Qatar, Sweden) that have official guidelines with explicit references to sustainability in their main messaging: "Official guidelines that include sustainability." The second category of FBDG described four documents (the Nordic Nutrition Recommendations, and United Kingdom, France, the Netherlands FBDG) with "Quasi-official guidance that combines health and sustainability messaging," with quasiofficial guidelines defined as "those that stem from government agencies or government funded entities" (9)p17. The final category defined consists of three countries (Australia, China, United States) with 'attempts' to include sustainability. Where the meaning of attempts equates with "environmental considerations reach[ed] an advanced stage but [did] not achieve government endorsement" (9)p3.

International documents were sourced from the FAO database (59) and included in this analysis if the document was highlighted by the FAO review in one of the three above described categories (9). A review of the FAO database revealed no other FBDG published between 2016 and 2018 with sustainability explicitly placed in their guide. Three other FBDG (Korea, Belgium and Uruguay), published since the FAO review in 2016, had been published with recommendations that could suggest sustainability inclusion (i.e. "enjoy foods prepared with local produce" from Korea; "limit animal products" in Belgium; "cook traditional foods…be critical of information about diets" and "eat natural foods…avoid ultra-processed" in Uruguay), but these were not available in English and no explicit environmental considerations were indicated (59). Documents were excluded if not available in English and if the document had no connection to sustainability integration.

#### 2.3.2 Document Analysis

Documents were downloaded and filed in QSR International's NVivo12 Software. Using NVivo12 to record information, documents were reviewed. To collect background information to understand document framing (i.e. who has input, what they included, and document development process), the UN FAO database website (59) and UN FAO global review (9) were consulted. Literature was reviewed on the development of dietary policy for background information on the countries and documents in this study (54,60). An initial read of each document was completed to extract sample description data: development stakeholders, key

messages, general document description, authors or publishers, publication year, target audience, and evidence cited.

This study employed a qualitative content analysis of FBDG and supporting documents as the unit of analysis (n=11). Qualitative content analysis is the empirical, methodological, controlled analysis of texts within their context of communication (58). Qualitative content analysis was used to systematically examine of how sustainability has been included and framed in the texts. Framing here meaning the domains and concepts included in the document; inclusion meaning: the document development process of sustainability inclusion efforts and the sources (both stakeholders and literature cited) of sustainability inclusion. To evaluate the common elements and what differs in the development process of sustainability inclusion, data were collected from the FBDG and the UN FAO database (59) regarding stakeholders and their contributions, and, where available in the literature (54,55,57,61,62), the weight given to stakeholder input and evidence cited to support recommendations. To assess the sustainability framing, this analysis addressed not only contextual information but also the themes and core ideas found in the texts as primary content (i.e. key messages of the published text). 'Contextual information' here refers to how the texts were formatted and developed, including stakeholders and processes (63).

The qualitative content analysis procedure used here was adapted from Mayring (2000). First, to examine common elements in the development process of sustainability inclusion across documents, individual document data was collected then analyzed collectively. Within each document, development process data was defined as and collected on i) the aspects of the communicator: author, government, year; ii) the situation of dietary guideline production: what evidence was cited, who were the stakeholders and contributors; iii) the socio-cultural

background: history of the FBDG in country, where available; and iv) the text itself: what are the main messages, how is sustainability framed. Second, the content analysis categories were formed. Domains for this analysis were based on the theoretical foundations of the Downs et al. (2017) sustainable food policy framework (outlined above). The five domains were: nutrition and health, food security and agriculture, environments and ecosystems, markets and value chains, and sociocultural and political (see Table 1 on page 21 for the adapted framework). Next, in the qualitative content analysis, the material was analyzed step-by-step, document-by-document, coding for the content in the FBDG by the domains and their sub-concepts.

Domain	Concepts	Domain	Concepts
	agricultural inputs		adequate infrastructure and access to
stems		ts and Value Chains	markets
	air quality		employment in value chain
	biodiversity		food avail. and afford.
	conservation		food distribution and transport
sysc	ecosystem Services		food marketing
l Eco	fossil fuel use		food waste
anc	greenhouse gas emissions		Gross Domestic Product (GDP)
ent	land use	rke	incentives or disincentives for production
uu	resilience	Ma	incomes and livelihoods
viro	soil degradation		rural-urban migration
En	stability		supply chain dynamics
	sustainable technologies		animal welfare
	Waste	_	conflict
	water quality	tica	consumer demand
	agricultural productivity	Sociocultural and Polit	cultural acceptability
re	diverse production systems		equity Issues
ultu	food security		food consciousness
gric	food system		food literacy
d Ag	intra-household food distribution		food sovereignty
an	nutritional quality		labor conditions
urity	on farm food loss		land tenure
Secu	seasonal, local, indigenous crops		policy
po	soil health and fertility		communicable disease
Fo	sustainable agriculture and intensification		dietary diversity
	water use for agricultural/food production		population disease burden
		ç	educational benefits of diet
		itio	energy and caloric intake
		lutr	food safety
		l pu	health influence of agriculture
		Health ar	healthy weight
			malnutrition
			non-communicable disease
			physical activity
			sanitation and hygiene

 Table 1. Sustainable diets framework with the five domains and their sub-concepts, adapted from Downs et

 al. (2017) used in the international FBDG analysis.

water consumption

To meet criteria of reliability and validity, during and after the analysis, the adapted framework was compared with other studies' sustainable diet concepts and considerations.
Further, checks were made for validity and reliability in formative and summative feedback processes by triangulation of domains and concepts by comparison to the following studies (60), (46), (64), (35), (65), (9), (13), (54), and (66). Two reliability checks were made: a formative and summative check. The formative reliability check was made to assess how reliably the concepts fit in their domains and was made while formulating the framework for ongoing improvement. More specifically, formative reliability checks were employed for identifying domain and concept comprehensiveness (i.e. were the domains too broad or too narrow to cover each subconcept). Decisions for when concepts might be moved, cut, or added were made based first on where they fit in the theoretical framework, then on the background literature for that framework (outlined above), then through discussion with a convenience sample of sustainability educators. Feedback was incorporated from twelve food system sustainability professionals from Minneapolis, Minnesota in the formative reliability check. Further, a summative reliability check of the final framework compared and contrasted concepts included through the matrix coding query of all documents. Matrix coding compares the codes across different sets of documents and domains, showing the similarities and differences among the sample. One coder completed all reading and coding; four readings of each document were employed with reformulating or recoding each time.

To check for content validity, interrogating the extent to which the framework covers the content, or concepts, of interest to sustainable food guides, this study made use of general theory in previous literature and the emergent data. A combination of deductive and indicative coding was used in qualitative content analysis checking for content validity (58). A deductive approach was used to base the analysis on previously-tested theory from the literature. However, deductive coding is limited to the point of view and directions set by general theories or laws. Texts or

newly collected data might contain novel, important ideas or perspectives not previously identified in the conceptual framework and research literature. To address the rigid structure of the deductive method, an inductive method was applied in unison. Through the inductive method, new domains and sub-concept definitions were drawn from the documents and added to the framework adapted from Downs et al. (2017). As text was encountered that did not fit into an existing concept, the text was added to a separate list, then each piece of text was grouped by type once all documents were reviewed, the literature was referenced for what domain each new concept could fit in, and the cycle of formative assessment repeated through the four readings of each document. Inductive analysis was used to allow the data to bring emergent concepts pertaining to food guides into the analysis.

### 2.3.3 International Comparison

Food guides and support documents were compared from countries highlighted by the UN FAO. A systematic examination of the three categories of FBDG was completed to compare the common elements in the development process of sustainability inclusion and how sustainability has been framed in international FBDG (9,54,60). Data were analyzed by examining key emergent themes across the three categories and the full data set. Comparisons were undertaken by identifying the similarities and differences in how the sustainability inclusion occurred based on the stakeholders consulted, evidence cited, and final manifestation of sustainability inclusion in each document. An individual category comparison was made, then an overall sample comparison of how sustainability has been included and framed in the international FBDG. The official FBDG documents of the four countries with sustainability explicitly incorporated into their FBDG (Brazil, Sweden, Qatar, and Germany) were analyzed first. Then, the several other countries with supporting documents, or quasi-official documents

(the Netherlands, the United Kingdom, France, and The Nordic Nutrition Recommendations) were examined. Finally, countries with attempts (United States, Australia, and China) at incorporating sustainability into their FBDG were reviewed. The findings will be organized by the key themes that emerged from this analysis.

#### 2.4 Results

Fifteen countries represented in eleven total documents were analyzed. Countries included and the type of sustainability inclusion category (as outlined by the UN FAO (9)) are shown in Figure 1 (page 26). Five themes emerged from the comparison of the development process, the stakeholders, and consideration of sustainability in the respective document by domain. Across documents analyzed, each domain covers 10-13 concepts. The number of concepts represented (i.e. coded for at least once) in each document is the measure of the inclusion, or amount of coverage, of each domain. The documents collected and analyzed in this study are described briefly in Table 2 (page 28). Extensive individual country profiles and their inclusion and framing of sustainability, concepts included, and document development context, can be found in Appendix A (page 96). The consistent messages across the guides with explicit sustainability considerations can also be seen in Table 3 (page 37). Further country-specific details can found in the individual country profiles in the International Country Vignettes in Appendix A (page 96).

#### 2.4.1 Main Themes

To address objective number one, this study set out to explore how sustainability has been framed in international FBDG, and specifically compared how sustainability has been included in international FBDG. To answer the research question "what are the common elements and what differs in the development process of sustainability inclusion and how has

sustainability been framed (included and considered) in international FBDG?", the cross-country comparison revealed five major themes:

- i. explicit sustainability documents were recently published, and the process for inclusion varies with country context
- ii. multiple sectors and myriad stakeholders contributed to guidelines, instilling broad interests and a wide conceptual framing
- iii. sustainability was primarily framed through health and nutrition, yet other sustainability domains also emerged as salient
- iv. the most explicit sustainability considerations were found in documents that are focused more on the context of eating, with less explicit focus on specific nutrients
- v. consistent main messages were revealed across explicit sustainability documents



Figure 1. Map of the countries with FBDG included in this analysis. The three categories, indicated by color, show how sustainability was included in the FBDG. Green shows the countries with sustainability explicitly included, orange indicates the countries with sustainability in supporting documents, and red depicts those with attempts made to include sustainability.

FBDG Group	Country	Document	Year Published	Publisher	Types of Document Development Stakeholders	
Sustainability in Official FBDG	Brazil	Dietary Guidelines for the Brazilian Population	2015	Ministry of Health of Brazil	Ministry of Health, Center for Epidemiological Research in Nutrition of the University of Sao Paulo, Brazilian Pan American Health Organization Office, experts from health, education, social protection, and agriculture, Researchers, representatives of civil society groups (professional councils, associations, public policy social control councils, consumer protection organizations)	
	Germany	Ten guidelines for wholesome eating and drinking from the German Nutrition Society	2013	German Nutrition Society	German Nutrition Society, Ministry of Health, Ministry of Agriculture	
	Qatar	Qatar Dietary Guidelines	2015	Qatar Ministry of Public Health	National Dietary Guidelines Taskforce, Public Health and Nutritio Representatives, Qatar National Food Security Program, Academics, Medical Associations, Research Centers, Supreme Council of Health	
	Sweden	Find your way to eat greener, not too much and to be active!	2015	Swedish National Food Agency	National Food Agency, Public Health Agency, Swedish Board of Agriculture, Food Industry, Research Centers, Public Health and Nutrition Experts, Consumer Organization, Patient Organizations	
Sustainability in Supporting/Quasi-official FBDG	France	French National Nutrition Program (supporting the French Food Guide for All - avail. in French)	2011	Ministry of Health; National Institute for Prevention and Health Education	French National Nutrition and Health Program	
	The Netherlands	Dutch Dietary Guidelines (Advisory Report)	2015	Health Council of the Netherlands	"Expert Committee"; Health Council of the Netherlands Standing Committee on Public Health; Standing Committee on Health Care (revised and endorsed report); Netherlands Nutrition Centre; National Institute of Public Health and the Environment	
	Denmark, Estonia, Finland, Iceland, Norway (Sweden)	Nordic Nutrition Recommendations - 2012	2014	Nordic Council of Ministers	Various Ministries of Health in Sweden, Finland, Denmark, Norway, Iceland	
	United Kingdom	United Kingdom Eatwell Guide Booklet	2016	Public Health England	Public Health England, Food Standards Scotland, Welsh Government, Food Standards Agency in Northern Ireland	

FBDG Group	Country	Document	Year Published	Publisher	Types of Document Development Stakeholders	
Sustainability Attempts in FBDG	Australia	Australian Dietary Guidelines	2013	National Health and Medical Research Council	National Health and Medical Research Council; leading experts in the fields of nutrition, public health, industry, and consumer issues; Commonwealth Department of Health	
	China	Chinese Dietary Guidelines and the Food Guide Pagoda	2016	Chinese Nutrition Society	Chinese Nutrition Society; "various stakeholders;" commission of experts from the Chinese Nutrition Society; Ministry of Health	
	United States of America	2015–2020 Dietary Guidelines for Americans	2015	U.S. Department of Health and Human Services; U.S. Department of Agriculture	U.S. Department of Agriculture; U.S. Department of Health and Human Services; Advisory committee (prestigious researchers and scientists in the fields of nutrition, health, and medicine)	

Table 2. Food-based Dietary Guidelines sample description table separated by category of sustainability inclusion<sup>1</sup>.

<sup>&</sup>lt;sup>1</sup> Table information sourced from the UN FAO website of the FBDG database (59).

### 2.4.2 Theme I: Explicit sustainability documents were recently published, and the process for inclusion varies with country context

All documents examined in this study were published after 2013 (except the French supporting document that was released in 2011). In the category of documents with explicit inclusion of sustainability (Brazil, Germany, Qatar, and Sweden), all publications occurred between 2013 and 2015. The recent publication of these explicit sustainability documents does not preclude the possibility that some of the recommendations in the current FBDG are updates from older FBDG. Yet, past versions of the documents in this study have not included sustainability, supporting the finding that explicit sustainability consideration is a recent addition to FBDG. For example, this is Qatar's first FBDG (2015), and Germany (2013), Brazil (2015), and Sweden (2015) have not included explicit sustainability references in previous versions of their FBDG.

Each of the countries in this study have political, sociocultural, environmental, and economic contexts that informed the integration of sustainability in their FBDG. Qatar's topdown approach and natural resource restrictions informed the inclusion of sustainability considerations and excluded agri-business industry (which is not substantial in Qatar). Qatar's process differs from Brazil, where a more bottom-up approach included industry and also many others in a 'democratic' process (55). Yet, both ended up with explicit sustainability messaging in their food guide. Australia and the United States, on the other hand, have substantive agribusiness industries and these outweighed other stakeholders in the final attempts to include sustainability in their 'democratic' FBDG development process. For example, the US public consultation period was extended to give industry more time to comment, and the solely

nutrition-focus prevailed (54). See Appendix A (page 96) for further description and analysis of the situation of food guide development in Brazil, Qatar, Australia, the United States and other countries in this analysis.

### 2.4.3 Theme II: Multiple sectors and myriad stakeholders contributed to guidelines, instilling broad interests and a wide conceptual framing

The documents analyzed in this study were developed with input from multiple sectors and incorporating the views of myriad stakeholders. All documents were published by either a national health agency or ministry and all included multiple stakeholders. According to Lang and Mason (2018), voices of food industry, lobbyists, and producers also played a larger role in the lack of inclusion of explicit sustainability considerations in countries that had made attempts, such as the US and Australia (54). Based on the findings of this document analysis, the FBDG with explicit sustainability considerations mentioned in the documents had input from the public, experts in nutrition, social, and environmental sciences, and ministries, where the other two categories included many of the same stakeholders (ministries, experts from nutrition and health fields, some public consultation) yet also heavier influence of industry (51,54). The most commonly involved development stakeholder groups credited in documents were health ministries (19 total in all documents), followed by experts in public health and nutrition (16 total) and representatives of civil society groups (8 total; e.g. professional councils, associations, public policy social control councils, consumer protection organizations). The least commonly involved stakeholder groups included agriculture experts (3 total), ministries of agriculture (3 total), and food industry (2 total).

Based on the collected development data and document histories (see country profiles in Appendix A , page 96 for further description), countries with sustainability attempts, cited as

unsuccessful (9), in their FBDG had strong political or industry voices from stakeholders consulted in the process and environmental considerations did not receive final government endorsement (54). For example, in the Australian food guide (67), there was strong opposition from industry (e.g. meat and trade) that led to a fierce debate and subsequently the decision to place the sustainability concerns in the appendix of the 2013 guidelines (54). In contrast, although the food industry in Brazil was the main opponent of the guideline's classifications based on food processing levels, industry was not the dominant voice (9). As described in the Brazil FBDG document, among the 3125 public consultation responses collected from 436 individuals or institutions (including the public, private sector businesses, unions, health professionals, professional representative organizations, and universities), industry input was contributed from 17 users (4%) with 230 total contributions (7%) (50). Opposition from the food industry was balanced based on the information gained in the exhaustive public consultation undertaken in Brazil while formulating the advice (instead of after as is usual in other FBDG) (54). The consultation revealed that eater engagement with the guidelines would be higher if the socio-cultural messages of sustainability (e.g. eat with others, find local farmer's markets) were presented at the forefront of the guide rather than only nutrient-intake levels or the environmental sustainability messages (e.g. animal products yield GHG emissions) (54).

## 2.4.4 Theme III: Sustainability was primarily framed through health and nutrition, yet other sustainability domains also emerged as salient

Figure 2 (page 32) depicts the average number of concepts included in each domain across all documents combined (n=11). The average was found by adding all concepts included in each domain in each individual document and dividing it by the total number of concepts in that domain. Concept inclusion by domain is used as the measure of how extensively each

domain was included. Overall, the health and nutrition domain showed the highest proportion of concepts possible included on average (9 of 13, or 71% of the concepts were included). The health and nutrition domain was followed by the sociocultural and political domain (6 of 11, 50% average inclusion), the markets and value chains (5 of 11, 48% on average), and environment and ecosystems domain (5 of 14, 38%). The lowest average inclusion of concepts was found in the food security and agriculture domain (4 of 11, 35%).



Figure 2. Total number of concepts by domain (darker) and average number of concepts included across all documents (lighter) in this study; for a list of all concepts see Table 1 (page 21), for concepts included by country see Appendix A (page 96).

Figure 3 (page 33) depicts the number of concepts included in each FBDG category (i.e. sustainability explicit, in supporting documents, or attempts) by domain. Concept inclusion by

domain is used as the measure of how extensively each domain was included. The division of the countries into the three categories represents a spectrum of how salient sustainability was in the document framing. Figure 3 (page 33) shows that health and nutrition was the primary frame of all three categories, yet it also shows that other domains emerged as salient across all categories and especially in the documents with sustainability attempts.



Figure 3. Number of concepts included in each document group by sustainability domain. Larger blue bar is the total number of concepts in each domain; smaller bars represent the number of concepts included in each FBDG category grouped by domain.

The health and nutrition domain was most prevalent in the documents that had made attempts at sustainability, which was expected, but these documents also showed the highest inclusion of markets and value chains, sociocultural and political, and food security and agriculture concepts compared to the other two categories. It should be recognized however, that the documents with attempts at sustainability were, on average, longer than those in the other categories: explicit group (53 pages on average), supporting documents group (48 pages), and sustainability attempts (112 pages). Of note, the documents with explicit sustainability consideration showed the highest inclusion in the environment and ecosystems domain.

# 2.4.5 Theme IV: The most explicit sustainability considerations were found in documents that are focused more on the context of eating, with less explicit focus on specific nutrients

A few main criteria distinguished the 'context' recommendations from the nutrientfocused. Firstly, context of eating recommendations were often supported by a rationale for how that choice impacts the environment or contexts outside of personal health (e.g. eat more unprocessed foods since ultra-processed foods impact the environment in Brazil (50)), where the more nutrient-focused recommendations were less connected to the environmental or contextual impact of choices (e.g. "Consume less than 2,300 milligrams (mg) per day of sodium" in the US FBDG, (51)p15). As a further example, a specific nutrient recommendation might be "limit calories from added sugars and saturated fats and reduce sodium intake" (51), where a 'context of eating' recommendation looked more like "eat regularly and carefully in appropriate environments and, whenever possible, in company" (50)p126. Secondly, the context of eating documents, categorized in the explicit sustainability consideration group (n=4), were less ostensibly tied to sources of evidence with specific literature not often reflected in the references. For example, only one of four of the FBDG with explicit sustainability considerations included scientific literature to support their recommendations regarding environmental sustainability in the official FBDG. On the other hand, the FBDG that had sustainability in the supporting documents (n=4) or had made attempts (n=3) included more citations to nutrition science or peer-reviewed literature and global reports.

### 2.4.6 Theme V: Consistent main messages were revealed across explicit sustainability documents

The four documents with explicit sustainability considerations each contained similar key messages. Table 3 (page 37) depicts the similar messages from the four countries with sustainability explicit in their documents. Several of these key messages focus on food being a more central and, especially, social part of life; as shown above in Theme IV, recommendations are more about the context of eating. Guidance also centers on food literacy and skills for cooking and choosing healthy or environmentally-conscious foods. Messages for types of foods to consume emphasize eating a variety of whole, un- or less-processed foods, including more vegetables and whole grains. Water is the drink of choice, and, mentioned in the more detailed text of some, choosing tap water over bottled as it uses less plastic-generating waste. Qatar's key messages present a unique, explicit recommendation to "eat healthy while protecting the environment." This simple, yet explicit sustainability inclusion was the result of a discussion by developers about how any statement more complicated was not understood by the development committee of the Qatar guidelines (see Table 1, page 21 for types of stakeholders included) and staff members involved (57).

Brazil	Brazil Germany		Sweden	Generic* Message	Differences by Country
	10. Watch your weight and stay active	<ol> <li>Maintain a healthy weight</li> <li>Be physically active</li> </ol>	<ol> <li>9. Maintain a healthy balance</li> <li>3. Get more exercise</li> </ol>	Be active, maintain a balance	Brazil does not mention balance or weight
8. Plan your time to make food and eating important in your life	9. Allow plenty of time for eating and enjoy mealtimes	8. Take care of your family		Make food and meals central to life and a social activity for families	Sweden does not touch on social activities aspects
<ul> <li>9. Out of home, prefer</li> <li>places that serve freshly</li> <li>made meals</li> <li>5. Eat regularly and</li> <li>carefully in appropriate</li> <li>environments and,</li> <li>whenever possible, in</li> <li>company</li> <li>10. Be wary of food</li> <li>advertising and</li> </ul>		<ul><li>9. Build and model healthy patterns for you family</li><li>10. Breastfeed your baby exclusively for the first six months of their life</li></ul>	10. Look for the keyhole label for healthy foods in the guide	Exercise food and nutrition literacy skills across the lifespan (read labels, make mindful	Germany does not address food literacy or nutrition labels/reading
7. Develop, exercise, and share cooking skills	8. Do not overcook your meals	<ol> <li>Adopt safe and clean</li> <li>food preparation methods</li> </ol>		Have safe cooking methods, share skills in social environments	Sweden does not talk about cooking and food preparation
	7. Drink plenty of fluids, at least 1.5 litres everyday	5. Drink plenty of water		Drink water	Brazil and Sweden do not mention drinks or water
<ul> <li>6. Shop in places that</li> <li>offer a variety of natural</li> <li>or minimally processed</li> <li>foods</li> <li>1. Make natural or</li> <li>minimally processed food</li> <li>the basis of your diet</li> </ul>	<ol> <li>Enjoy a variety of foods</li> <li>Vegetables and fruits - eat 'five-a-day'</li> </ol>	1. Eat healthy choices from the 6 food groups	1. Eat more vegetables and fruit	Eat a variety of natural foods, fruits and vegetables emphasized	All address variety and opting for more fruit and vegetables

Brazil	Germany	Qatar	Sweden	Generic* Message	Differences by Country
	2. Eat plenty of cereals,				Qatar does not
	preferably wholegrain,		4. Switch to	Eat fiber and	mention whole foods
	and potatoes		wholemeal	wholegrains	or grains
2. Use oils, fats, salt, and sugar in small amounts when seasoning and cooking natural or minimally processed					
foods and to create	5. Eat small quantities of		5. Switch to healthier		Germany and Qatar do
culinary preparations	fat and high-fat foods	3. Limit sugar, salt, and fat	fat		not mention
	6. Eat/use sugar and salt				processing, but include
3. Limit consumption of	only occasionally and in		9 Eatloss salt sugar	Limit processed	avoiding foods that are
A Avoid consumption of	moderation.		7. Eat less sail, sugar	toods and those with	more processed with
4. Avoid consumption of			7. Editiess reu anu	more sugar, iat, and	duueu sugars, iats, anu salt
	4 Fat milk and dairy		processed meat	5010	Sur
	products every day; fish				Dairy and meat are
	once or twice a week;				, only mentioned in
	and meat, sausages and				Sweden and Germany,
	eggs in moderation.		2. Eat more seafood	Eat some dairy (low	but are presented as
			6. Switch to low-fat	fat) and fish (in	foods to be consumed
			dairy products	moderation)	in moderation
					Explicit language for
				Unique to Qatar as	environmental
				an explicit key	protection not in the
				message, but	Key messages of Brazil,
		7. Eat bealthuile		innerent in other	Sweden, and Germany,
		7. Eat nealtny while		messages from other	but round throughout
		protecting the environment		three countries	the rest of the guides

 Table 3. Example of the generic (\*broad, grouped and generalized by author) key messages from the four documents with sustainability explicitly

considered (Brazil, Sweden, Germany, and Qatar) and a description of how they align and differ among countries.

#### 2.5 Discussion: Appetite for Change

## 2.5.1 Theme I: Explicit sustainability documents were recently published, and the process for inclusion varies with country context

Explicit references to sustainability first emerged in international food guides after 2013. Sustainability as a recent topic included in FBDG indicates that governments and developing bodies are at a nexus point in changing food guides and food policy toward more explicitly sustainable recommendations. There are a few reasons why sustainability is only a relatively recent addition to FBDG despite calls for inclusion of sustainability principles in food policy and guidelines as early as the mid-1980s (15). Policy makers and the policies themselves can take time to respond to calls for changes (68). Moreover, in a follow-up piece 12 years after the calls of Gussow and Clancy (1986), Gussow (1999) cites views about how the concept of sustainability in diets is "confusing and sometimes threatening" (32)p194. There are trade-offs when developing policies, with or without sustainability considerations, that can cause tension in the developers among what disparate stakeholders advocate in a policy (68). Further, genuine reflexive governance (i.e. responds quickly to academic or public concerns) can be a slower and messier process than a more mechanistic, top-down approach (68).

Food politics come into play when FBDG are developed, and especially when there may be sustainability claims included. Different country contexts lead to different forms of inclusion of sustainability. The United States and Australia had 'democratic' development processes that brought in agri-business as a stakeholder. Yet, Qatar's case, with explicit inclusion of sustainability, was led in a very top-down approach by the authority of the government, including very little industry input (57). Due to complex political conditions, the United States FBDG is an example of the more structured top-down approach that will likely take more iterations of FBDG to fully incorporate growing calls for sustainability considerations (51). While broadening the field of consideration in guideline development, the inclusion of the agribusiness industry worked to exclude explicit considerations in the US example based on politically influential agri-business positioning. A longstanding and well-recorded phenomena in Marion Nestle's *Food Politics* is the weighty political influence of the food industry on the US dietary guidelines, and the conflict of interest of the dual mandates of the US Department of Agriculture (one of the development bodies in US FBDG) to "protect agriculture and to advise the public about diet and health" (69)p72. Agri-business industry often has mixed or wholesale disregard of the 'Triple Bottomline' of environmental, social, and economic considerations (70). Alternatively recognized is that though Qatar's top-down process made for more rapid development, exclusion of industry, and inclusion of sustainability explicitly, there could be some limits to the nation-wide adoption of the guidelines due to lower stakeholder and public involvement (57). So, though inclusion is recent, the process of inclusion of sustainability is impacted by the political climate, varies internationally, and will have to match the context and process that works within each country and development situation.

The Australian case also demonstrates the challenges and political debate around developing food guides. After the first editions of the Australian dietary guidelines were released in 1999 (for 'older Australians') and 2003 (for 'adults' and 'children and adolescents') (9), the threats of climate change prompted emerging sustainability discussions in Australian food policy. In recognition of the serious, anticipated threats to the country from climate change, an assessment of the challenges and positioning of Australia in global food sustainability came in 2010 (54). After the 2010 report outlined the major imminent challenges, and with a strong public campaign to incorporate sustainability, the nutrition scientists tasked with the revision of

the national food guidelines intended to consider sustainability in the new guidelines (9). However, strong opposition from agri-business industry (e.g. meat and trade) led to fierce debate and the decision to place the sustainability concerns in the appendix of the 2013 guidelines (54). Officials who defended the guidelines as solely food- and health-based recommendations asserted that the environmental impact of an individual's dietary choices would reduce if Australians ate healthily and followed the food guides without explicit need for conceptual inclusion (54).

### 2.5.2 Theme II: Multiple sectors and myriad stakeholders contributed to guidelines, instilling broad interests and a wide conceptual framing

This analysis found that myriad stakeholders and input from multiple sectors contributed to the incorporation of sustainability considerations in FBDG. As seen in the Brazilian development process, public consultation that indicated equity in the volume of the voices, facilitated sustainability becoming more fully incorporated. On the other hand, the food industry and some political opponents to sustainability claims in the Australian and US FBDG prevented broader consideration and integration of sustainability domains outside of health and nutrition. Whereas in Brazil, food industry opposition was balanced by the public consultation (see more in Appendix A , page 97). In a summary of lessons learned from international FBDG incorporating sustainability considerations, Seed and Rocha (2018) assert that food industry should be involved later in the development process, collaboration between government and across sectors can support developers who otherwise feel ill-equipped, and that it is possible to incorporate 'win-win' messages to support human and ecological health that transcend sectoral differences (62). A shift to an 'ecologically integrated paradigm' (an approach to diet and health focused on the entire food supply delivering health) in food, nutrition, and health policy will require "authentic

stakeholder involvement" and a "population approach via real stakeholder consultation" (22)p735.

Since the food system operates within and through other systems (e.g. transport and global trade, agricultural policy and labor, and the natural environment), an integrated conceptual model, informed by a diversity of stakeholders, should be used to consider food systems when establishing policies and guidelines even if they are intended for individuals (71). When one ministry or evidence-base has too much sway over policy, industry can push back (as seen in the Australian and US cases above), or eaters might resist a heavy-handed change, as seen in the UK working groups for their Eatwell Plate development when the government changed and the ministry's position on inclusion of sustainability (54). Interestingly in Qatar however, the topdown, more authoritarian approach led by the government, facilitated the explicit inclusion of sustainability consideration (62). Alternatively, if industry has heavy input into guidelines, then considerations outside of the productionist paradigm (e.g. foods as commodities, domination of market solutions, industrial-scale processing, monoculture) can be subverted yielding consequences for the prosperity of people and the planet (9,22). Academics in nutritional and social sciences can offer insights into the food system and nutrition evidence, but can also be limited in scope to the lens of their field and profession (16). Therefore, we are at a point where collaboration across disciplines and sectors is needed to confront the challenges facing global food consumption (68). More narrowly, we need intersectoral discussion and input to develop FBDG with sustainability inclusion to inform and guide eaters (61,62).

### 2.5.3 Theme III: Sustainability was primarily framed through health and nutrition, yet other sustainability domains also emerged as salient

The spread of domain inclusion (Figure 3, page 33) and sustainability framing (Appendix A, page 96) depicts the many ways sustainability has been included in these international FBDG. The variety of ways sustainability considerations have been incorporated indicates that there are many ways that sustainability can be manifested and is included in FBDG. What emerges from this analysis is a sample of FBDG, even if only attempts were made at incorporating sustainability, that include consideration of sustainability domains outside of health and nutrition. The results of this study illustrate FBDG examples that are primarily intended to meet health and nutrition objectives. However, documents analyzed also include sustainability concepts outside of the health and nutrition domain despite the category of sustainability inclusion. Even in guidelines with attempts at including environmental recommendations, the US and Australian guidelines for example, this analysis found at least moderate (around half) conceptual inclusion in the other domains. Consequently, for some who say sustainability considerations are outside the scope of FBDG (51), the results of this study show that health and nutrition are just one part of a complex ecosystem of concepts that are already included in FBDG. Granted, the presence of the sustainability considerations outside health and nutrition does not mean that they are a mandated part of, or focus in FBDG, and therefore should be included. Yet, these results show that though health is a primary frame of FBDG, food recommendations cannot be entirely disentangled from social, environmental, and economic connotations.

## 2.5.4 Theme IV: The most explicit sustainability considerations were found in documents that are focused more on the context of eating, with less explicit focus on specific nutrients

Trends in dietary guideline development indicate there is already a shift toward more food-based guidelines away from a nutrient-focus (16); this study confirms the food-based shift and goes further to show how the different domains of sustainability have been expanded upon in current FBDG by inclusion of the context of eating. This analysis reveals that guidelines which include more explicit sustainability framing also tended to include more messaging around the context of eating (i.e. sociocultural, economic, and environmental framing).

Food-based dietary guidelines are transitioning to food sustainability- and context-based dietary guidelines, evolving from nutrient-focused, to food-based, and now to include sustainability. The 2016 International Food Policy Research Institute Global Food Policy Report suggested that to change diets and shift to a sustainable consumption model, governments need to take a larger, contextual behavior-change approach by evolving social norms, minimizing eater disruption, maximizing awareness as clearly as possible, and selling a compelling benefit (72). In an ecological approach, development of food, nutrition, and health policy is based on robust ecological systems, incorporates societal responsibility, and sets a common framework providing a "corrective lever on the imbalance between individual and social forces" (22)p735. The context-driven, ecological approach to eating that considers sustainability in FBDG can turn an intractable challenge (i.e. diet change in the face of climate change) into a tangible reality for future sustainable food systems (68). Brazil's FBDG is an apt example of that balance of nutrient-focused recommendations with the context of eating and sustainability considerations in a culturally-unique manner, giving recommendations for focusing on traditional or cultural foods that are also less processed, healthier, and more sustainable (54).

Documents with explicit sustainability inclusion referenced (in print) fewer citations to nutrition science or peer-reviewed literature and global reports. Explicit inclusion of sustainability was often not connected to a reference to support claims. This suggests that evidence for sustainability principles may not be the sole or sufficient impetus for inclusion. Scientific evidence for nutrition claims is an important aspect of developing FBDG, yet, Lang and Mason (2017) assert that scientific evidence alone is not likely to achieve comprehensive policy engagement, where dietary change alliances among sectors and users are encouraged and maintained in the political process of developing food guides.

Food guides, though not beholden to the same structure as peer-reviewed literature, though they should be evidence-based (15,32,45). Lack of government support has been cited as the reason for not including sustainability principles in the US and Australian guidelines (9). The US and Australian governments decided that sustainability was 'outside the scope' of the guideline mandate, despite the fact that both countries have detailed evidence reports that include 'sustainability' sections (67,73). Seed and Rocha (2018) note that the US case suggested that an evidence-base is important, but also needs to be balanced by competing interests and reinforced by cross-sectoral alliances (62); as suggested in Theme II (page 40). Further, not including specific references does not mean that claims were not based on sound scientific evidence underpinning the recommendations. For example, Sweden's FBDG (56) is based on a report of supporting scientific evidence (74).

Food-based guidelines acknowledging the context of eating, in concert with nutrition science, have the chance to overcome some of the limitations of the nutritionism paradigm and include sustainability considerations outside of health and nutrition. The limitations of using the reductive approach of solely a nutrient-focus, or 'nutritionism,' where food is understood only in

terms of its constituent nutrients, emerge through attempts to translate scientific research (i.e. biomedical knowledge) into comprehensible dietary recommendations for the general public (17,19). Scholars have suggested that after decades of use, the nutrient-focused guidelines have transitioned to a focus on foods (16). Food-focused guidelines can still retain strong scientific underpinnings, with decades of nutritional science not abandoned but used to inform and strengthen food-based recommendations (16). This study reveals that a further step has been taken by some countries to include sustainability considerations outside of health and nutrition through common messaging about food and the context of eating.

# 2.5.5 Theme V: Consistent main messages were revealed across explicit sustainability documents

Similar recommendations across the documents with explicit sustainability inclusion focus more on food, lifestyle, and the context of eating than specific nutrients. The documents with explicit sustainability messaging have congruent main messages; examples indicated in Table 3 (page 37). These findings indicate that there is some consensus on what a sustainable diet might include and how to incorporate sustainability-oriented recommendations in FBDG. Climate change studies have concluded that dietary change is part of a suite of solutions for moving toward a sustainable future (7,10,75), often reiterated the same messages found in this study.

Agents in the food system (e.g. producers and eaters) work and make choices within larger global systems (71). Since our food system is globally interconnected, consistency in messaging can ally agents across the globe to set goals and tackle similar problems we all face and contribute to, much the way the 2015 Paris Climate Change Accord allied international actors (61). Given certain challenges to including sustainability in FBDG, different policy

approaches can be employed to incorporate consistent sustainable dietary advice (54). Though prime concerns of lead FBDG developers can differ, similar messaging has been established, allowing for retained policy support for sustainability inclusion despite adversaries in government and other opponents of 'selling' sustainable dietary advice (54)p338. Further, strong sustainability foundation with evidence-based nutrition underpinning (even if it is not referenced in-text) is possible and yields guidelines that outline myriad, systemic dietary impacts (54). However, though evidence-based and consistent messaging can support sustainable FBDG, developers and policy makers must be conscious of representations of 'sustainable diets' that make incognizant recommendations which disregard and oppress traditional cultural practices (e.g. completely cutting ruminant meats in favor of tofu when traditional cuisines center on beef or lamb and soy is not a part of the cultural diet).

## 2.5.6 How has sustainability been framed (included and considered) in international FBDG?

Sustainability has been included in recently published FBDG, the inclusion process of which varies with country context, and multiple sectors and myriad stakeholders contributed to instilling broad interests and a wide conceptual framing in the guidelines analyzed in this study. Sustainability has been framed through the primary consideration of health and nutrition in the guides, yet each of the other four sustainability domains also emerged as salient through their representation in the documents. With ten consistent main messages, the most explicit sustainability considerations were found in documents that are framed around the context of eating, with less nutrient-focus.

Developers of the US FBDG concluded sustainability was external to the scope and original objective of the FBDG. However, this study has found sustainability (through the

multiple, systemic domains) has been included in FBDG nonetheless, even in the US guide. It is possible that sustainability is a recent inclusion in FBDG since only recently has the evidence of the need to include considerations outside of health and nutrition begun to impact policies, with changes to policies and governance taking time to respond (68). Empirical evidence providing rationale for including sustainability in policy and food choices has been gathering momentum in recent years (5-8,10). More recently, some assert the current dietary guidelines do not go far enough in terms of setting recommendations for sustainable dietary practice globally (52). Populations in developing countries are moving to more 'Western diets' (e.g. US dietary practices) in the nutrition transition towards more energy-dense, nutrient-poor foods (14). Therefore, it is also important to be cautious in using food guides to privilege 'colonial,' Western diets, which can do epistemic violence to local cuisines and traditional foods (61). It will be important to make context-unique, culturally-relevant recommendations that bring in considerations outside of health (76).

Others may contend that FBDG are intended for promoting health and nutrition goals of a country and therein should not make broad food-based claims outside of human health. Yet, this study shows that FBDG have the opportunity to serve more than one purpose, and in fact, they already do (e.g. policy guidance, education tools, informing eater choice, guiding food production outputs, food marketing and advertising, and governing administration of food programming) (9,10).

#### 2.5.7 Study Limitations

The deductive nature of taking concepts from the Nepal setting in the Downs et al. (2017) framework could have initially limited the scope or been inappropriate for application outside of Nepal. However, the combined deductive and inductive approach employed in this study allowed

the data to also drive the coding and influence the framework for analysis. Further, Downs et al. (2017) claim that their framework was a tool "intended to be applicable to a variety of policy documents and to different country contexts in order to identify the gaps in terms of addressing the different components of sustainable diet" (35)p48.

This study is also limited by the application of the coding and analysis methods by only one person, the author. An application of the same process by another researcher could help to reduce any limits to the reliability and validity of this approach and leaves a direction for future research. Yet, coding, re-coding, formative and summative feedback, and thematic assessment were completed to stymie that limitation. The study is limited to sustainability considerations as they were finalized in the FBDG or supporting documents and does not look at data outside of the texts or development literature. This study is unable to see if other broader considerations were made that did not manifest themselves in the final texts.

Further methodological and interpretation limits remain. It is recognized that this qualitative content analysis is limited in the extent to which the documents address active changes in sustainable diets (i.e. how and if any actual changes are made as a result of the sustainability considerations). The limitation of not addressing how FBDG promote dietary changes may be overcome by identifying the recommendations in FBDG that have policy actions attached to them or intervention studies on consumption following implementation the guidelines. However, policy and intervention data collection are beyond the scope of this study and leaves direction for the future.

Another limitation that must be considered is that there was no weighing of the different framework components. Downs et al. (2017) recognized that some parts of a sustainable diet may have greater impacts on the environment, nutrition, and agriculture than others (35). No

consensus in the larger sustainability community has been reached about the weight of the different trade-offs that are inherent in improving one aspect of sustainability at the potential cost of others (i.e. focusing more on the social than the economic aspects). These trade-offs from the environment, economic, health, and ethical perspectives would have to be addressed in greater depth in a different analysis that would be a possible future direction.

#### 2.5.8 Future Research

Several avenues remain for future research in understanding the ways sustainability can be incorporated into framing and preparation of FBDG. A much larger study could examine the FBDG of all of the countries that have published FBDG documents (83 out of a possible 215 (9)). A larger comparison of sustainability framing and inclusion in other documents could be undertaken for FBDG that have not been identified as including or attempting to include sustainability. More investigation is also needed into the social and economic levers to move diets in more sustainable directions and how to do that through action, policy, and education. Ultimately, there can be no all-purpose definition of a sustainable diet or all-encompassing rules of sustainable food choice guidance, but we do need to create processes to get to sustainable food systems, share options for getting there, and learn from reflecting on the design and framing of sustainability in existing documents (68).

#### 2.6 Conclusion: Recipe for Change

Overall, health and nutrition primarily framed the international FBDG, which was expected. Yet, each document showed ways that sustainability considerations were made within the context of other domains both concurrently and diversely. Sustainability, though a relatively recent explicit inclusion in FBDG, is supported by consultation from myriad stakeholders in the development process and broadens the framing to include both a nutrient-focus and the context

of eating. Framing of FBDG has many possible ingredients (concepts) that can be used to create a context-specific, rich product (the guidelines).

Sustainable food choices can be an aspirational direction for populations to move as signaled by the government or developing body in FBDG (71). In a similar manner to how countries are beginning to coordinate global GHG emissions (e.g. CP.21 Paris Agreement (77)), international coordination of country-level changes to dietary habits should be incentivized given the rising global demand for increasing food production and international trade in agricultural goods (52). Further, dietary shifts have the potential to greatly reduce GHG emissions (among other positive environmental and health outcomes), supporting the claim that dietary shifts can reduce environmental impacts (5-8).

The countries with explicit sustainability considerations can be used as a descriptive, not prescriptive model for how to include sustainability in FBDG. The four countries included in this analysis with sustainability explicit in their FBDG are culturally and geographically diverse countries, each displaying various ways to incorporate sustainability. Ranging across three continents and various sociodemographic landscapes, Brazil, Germany, Qatar, and Sweden each provide an example of a context-unique, culturally-specific means of including sustainability in their FBDG. The documents in this study, along with this analysis, can act as a base recipe for other countries with emerging FBDG to add their own flavor for FBDG that will nourish their population, their country, and the planet.

# Chapter 3: A framework for assessing and integrating sustainability in international food-based dietary guidelines

### 3.1 Introduction

This chapter is placed within the literature background of sections from the above Introduction and Chapter 2 but will not review them here for brevity. In addressing the second objective, readers will see how the same documents and methods outlined in Chapter 2 informed the development of a framework to understand the interconnected and complex nature of sustainability in FBDG.

Given the edifying nature of FBDG, an awareness of the way sustainability is framed is a small step towards understanding how the framing influences sustainable action among food system agents (i.e. producers, eaters, institutions). An understanding of the framing of sustainability within the current FBDG can direct future changes to the guidelines incorporating recommendations in line with international calls to integrate sustainability considerations in FBDG (9). Little is known in the literature about the framing or the conceptual complexity of sustainability in federal policy and guidelines, especially FBDG, despite the implications of influencing action in users. A framework for the evaluation of FBDG is needed to understand how sustainability has been framed and considered in current and future iterations of international FBDG.

### 3.2 Objective and Research Question

The objective of this chapter was to adapt a framework through which to understand how sustainability has been framed in international FBDG. Specifically, this chapter asked how are concepts framed and interconnected in current FBDG? How can the current sustainability framing be used to develop a framework for future integration of sustainability into FBDG?

#### 3.3 Methods

### **3.3.1** Theoretical Framework

Review and development of the sustainability framework for FBDG was done concurrently with the exploration of the nature and extent of inclusion of sustainability in international FBDG in Chapter 1 of this thesis. A framework exists for discussing sustainability in food policy; Downs et al. (2017) developed a food policy framework and applied it to Nepalese food policy (35). The Downs et al. (2017) framework was used as the theoretical framework for this study. Additions, changes, and different category divisions were made to the framework based on other literature reviewed first, then on the emergent concepts from the documents examined. This study followed the qualitative content analysis procedure from Mayring (2010) (58). To make use of the general theory in previous literature and the emergent data, this study used combinations of deductive and indicative coding in qualitative content analysis (58).

#### **3.3.2** Development of Sustainability in FBDG Framework

The framework for this study was informed by the deduction of domains, concepts, and sub-concepts from Downs et al. (2017) and concepts employed in the literature evaluating sustainable diets and food policy. Firstly, to identify the components for the framework, a literature review of both peer-reviewed and grey literature was conducted. In particular, besides Downs et al. (2017) (the foundation of the framework and starting point for literature reviewed), (65), (46), (13), (60), (64), (54), (66), and (9) were examined for the their definitions and components included in sustainable diets. Once components were compiled, concepts and definitions were adapted and combined for clarity and to minimize overlap. Any additional concepts added from the data were added in an iterative and recorded inductive process.

Table 15 (page 133) in Appendix B (page 132) presents the original framework from Downs et al. (2017) employed by this analysis and developed in this study (written permission given by S. Downs for reproduction in this thesis). It is important in the combined deductiveinductive approach that the researcher clearly explains the sources of each concept and examples of the coded data (63). How each category was developed and refined is explicated in the results and Appendix B (page 132), and domains with examples of each concept are illustrated with examples from the analysis in Table 16 (page 134).

#### **3.3.3** Application of the Framework

This study looked at the countries highlighted by the UN FAO and systematically examined the FBDG to analyze how sustainability has been framed in international FBDG (9,54,60). In a 2016 global review intended to support countries in developing, implementing, and evaluating FBDG, the UN FAO highlighted several countries' FBDG (9). The UN FAO database guided the documents examined in this study (59). Table 2 (page 28) depicts the eleven documents collected for primary data. The official FBDG and a few supporting documents from fifteen countries or regions were analyzed: Brazil FBDG (50), Qatar FBDG (78), Sweden FBDG (56) (supporting document analyzed, but not included in these results (74)), Germany FBDG (79), France supporting document (80), The Netherlands FBDG (81), United Kingdom FBDG (82), Nordic countries supporting document the Nordic Nutrition Recommendations (NNR) (Norway, Finland, Denmark, Estonia, Iceland) (83), China FBDG (84), Australia FBDG (67), and the United States FBDG (51).

#### **3.3.4** Framework Feedback and Adaptation

The researcher undertook formative and summative reliability checks after the data from the international documents was collected. Formative feedback on the comprehensiveness, areas of overlap, and areas for improvement was collected from a group of 12 food system sustainability professionals and educators. The formative reliability checks guided concept fit and relevancy for mid-data collection framework improvement and ongoing feedback. This study specifically employed formative reliability checks for i) identifying concept and sub-definition strengths and weaknesses and target areas of work and ii) recognition of when concepts might be moved, cut, or added. A summative check for reliability was done after the process concluded, employing a final review of all concepts and documents. There was only one coder (the study author) for all the reading and coding and four readings of each document and with reformulating and re-coding each time. Thematic connections in matrix coding queries were run in QSR International's NVivo12 Software for cross-country comparison.

#### 3.4 Results

# **3.4.1** Sustainability in FBDG Framework: how can the current sustainability framing be used to develop a framework for future integration of sustainability into FBDG?

To address the objective of adapting a framework through which to understand how sustainability has been framed in international FBDG, the Downs et al. (2017) framework was modified and applied to analyze the documents in this study. Figure 4 (page 55) depicts the five domains of the Sustainability in FBDG Framework, each with sub-concepts within that domain. Most of the concepts included in the framework for FBDG were based on the literature (outlined in the Methods), some were added from this analysis (see below). From the literature and data reviewed, a framework for integrating sustainability principles into FBDG was compiled and



Figure 4. Sustainability in Food-Based Dietary Guidelines (FBDG) Framework. Domains and concepts included in FBDG with sustainability considerations; concepts in white included in all documents reviewed (*n*=11), concepts in bold were inductively added by the author from this analysis.
adapted. The framework, adapted from Downs et al. (2017), was formalized into five domains and 57 sub-concepts within those domains. The full explanation of the concepts with descriptions and examples from the text can be found in Table 16 (page 134) in Appendix B (page 132).
Eight of the total 57 concepts were included in all eleven of the documents reviewed (waste, policy, education benefits of healthy diet, physical activity, healthy weight, food system, water consumption), these are highlighted in Figure 4 (page 55) in white. Figure 4 (page 55) also shows in bold the seven concepts that were added compared to Downs et al. (2017) by the author from this analysis. The seven concepts added were: waste, food system, educational benefits of

diet, healthy weight, physical activity, water consumption, and policy. There were three concepts in the original Downs et al. (2017) framework that were not included in any of the FBDG reviewed, which were removed from the final framework: stability, on farm food loss, and land tenure.

# 3.4.2 Concept inclusion in documents: how are concepts framed and interconnected in current FBDG?

Sustainability concepts were included in a diversity of ways in the documents reviewed. Despite the length of the document, all documents included four of five domains and often with many concepts included in each domain. Concepts included in each domain are compared in Figure 5 (page 57) across documents. Examples from the text and more information on coding definitions and references made in documents can be found in Table 16 (page 134) in Appendix B (page 132).

Within this sample, identified by the UN FAO as having the most comprehensive inclusion of sustainability (9), there is not complete inclusion of all concepts in the framework within any single FBDG. Figure 5 (page 57) provides an overview of the degree to which each of the documents analyzed in this study addressed the five domains of the Sustainability in FBDG Framework. For this analysis, all 60 concepts from the original Downs et al. (2017) framework were included to see if there was inclusion of all concepts. Overall, the documents addressed the health and nutrition domain the most on average (9 out of 13 concepts included), followed by the sociocultural and political domain (6 out of 11 concepts included), the markets and value chains

(5 of 11 concepts included), environment and ecosystems (5 of 14 concepts), with the lowest average inclusion in the food security and agriculture domain (4 of 11 concepts).



Figure 5. Number of concepts included in each domain grouped by document. Sustainability inclusion categories are indicated by the text color; Green: explicit sustainability, Orange: sustainability in supporting documents, Red: sustainability attempts. Note: NNR means Nordic Nutrition Recommendations, supporting document for FBDG in Norway, Sweden, Finland, Iceland, Denmark, and Estonia.

There were gaps in terms of the extent to which the FBDG addressed the different concepts of the framework, but no document included fewer than 11 (17%) of the concepts.
Figure 6 (page 59) depicts the overall number of concepts (out of 60) included within each of the documents. The Australian and Brazilian FBDG each included the most concepts, and these were also the longest documents analyzed at 210 and 150 pages, respectively. These two FBDG documents showed a wide range of inclusion as well, with high numbers of concepts included in each of the five domains (see Figure 5, page 57). However, Australia's explicit environmental sustainability concepts and considerations were mostly relegated to the appendix of the guide due to industry input and government changes during document development (54). Germany, the United Kingdom, and China's FBDG were the guides with the lowest inclusion of concepts. Again, this lower inclusion may have been tied to the length of document as each of these were the shortest documents reviewed; the Germany document was one page in length, United Kingdom's guide was 11 pages, and China's guide three.

# Number of Concepts Included



Figure 6. Number of concepts included by country document out of a total of 60 concepts in 5 domains. Note: NNR denotes Nordic Nutrition Recommendations, supporting document for FBDG in Norway, Sweden, Finland, Iceland, Denmark, and Estonia.

# 3.4.3 Conceptual Complexity: how are concepts framed and interconnected in current FBDG?

There were many examples of overlapping coding in this analysis. The colors indicate which of the five domains of the framework each phrase or part of the sentence was coded under: blue for sociocultural and political, green for environment and ecosystems, red for health and nutrition, orange for food security and agriculture, and purple for markets and value chains. To illustrate this, one quote from the Brazil FBDG depicts coding from multiple domains:

"Depending on their characteristics, the production and the distribution of foods can be socially and environmentally sustainable, promoting justice and protection of the living and physical world, or else may generate social inequalities and threats to natural resources and biodiversity" (50)p18.

A second quote depicting the complex, interconnected use of the different domains in one main idea can also be seen in this quote from the Brazil FBDG:

"Adequate and healthy diet should be accessible both physically and financially, and harmonious in quantity and quality, meeting the needs of variety, balance, moderation, and pleasure. Furthermore, it should derive from sustainable practices of production and distribution" (50)p8.

These quotes are just a few that depict the complex and interconnected nature of the concepts in the framework. The circles of the framework shown in Figure 4 (page 55) are overlapping to give some indication of the complexity of representing the different domains in food guides. There is not a simple way to code the food guidance into distinct domains. The framework developed in this study shows how the different aspects of food and eating (i.e. social, environmental, economic) cannot be disentangled.

# 3.5 Discussion

#### **3.5.1** Sustainability in FBDGs Framework

Increasing calls for integrating sustainability into FBDG (9,15,32,52,54,60,61) are strong but lacking a blueprint for how to include sustainability considerations. The purpose of this study was to develop a framework through which to understand how sustainability is framed in FBDG internationally. Specifically, this study adapted a framework for integration of sustainability concepts into FBDG based on previous food policy literature. The framework was used to explore how sustainability is considered in complex and interconnected ways in current international FBDG. The framework, adapted from Downs et al. (2017) and developed in this study, included five domains and 57 total concepts.

The novelty of this framework in application to FBDG is in the way it encourages the interrogation of dietary recommendations and cultivates the idea that diets have many dimensions. The five domains simultaneously bring in considerations that broaden the scope of guideline development, while also providing the concepts for narrowing in on evidence and stakeholders to include in the process. Modernity has produced consumption habits systematically disconnected from the Earth (85). This framework is a way to address those disconnections and promote bottom-up changes in diets through individual choice. Yet, countries individually and governing bodies internationally must recognize that FBDG are part of a series of steps in supporting sustainable future food systems. Focusing solely on eater advise in FBDG to incorporate sustainability places undue responsibility for global food system impacts and changes on eaters (61). If responsibility is placed on eaters in FBDG as the only or leading policy lever or action addressing sustainable diets, other interventions, policies, and regulations

(e.g. changes to production/processing, labeling, industry regulations, food marketing) are overlooked as necessary, parallel steps for addressing sustainability in diets (61).

A framework was developed to evaluate the relative weight of various sustainability domains in food guides, heretofore lacking in the literature. The framework from this study builds upon Downs et al.'s (2017) work where they developed a way to account for sustainability in food policy through a framework for diverse countries and settings. Differing from Downs et al.'s (2017) framework, this study developed the framework through international document analysis, building upon many countries' documents rather than one country with multiple food policies.

This framework can be used to develop dietary guidelines in different countries in a way that addresses the complex and interconnected nature of dietary guidance. This analysis revealed that the food guide documents were more focused on the health and nutrition domain than food security, agriculture, and environments and ecosystems as found in Downs et al. (2017), which was expected as these were FBDG not food policies. Yet, integrating the health and nutrition domain with the other four in the framework is a critical step in changing the ways individuals are taught and socialized to eat. The framework brings in ways of understanding and recommending diets that explicitly reveals the connections among our food choices, our health, and our environment. Dietary guidelines that can educate eaters about the many externalities of their diets have the potential to shift entire ontologies around food and consumption habits (61).

#### **3.5.2** Applicability of the Sustainability in FBDG Framework

The application of this framework is intended to assist FBDG in the promotion of seasonal and bio- and culturally-diverse diets that are appropriate to the country context. The framework may be used as an analysis tool to assess the inclusion of sustainability in FBDG that

already exist (as seen in this thesis). Alternatively, governments and developers may apply it to the process of integrating sustainability considerations into their new or updated versions of FBDG. To apply the framework, developers can start by identifying the domains they wish to consider (e.g. health and nutrition and food security and agriculture), or any combination of the domains. Then, the concepts within those domains can be emphasized based on the context and considerations of that country. The definitions and examples of each concept (found in Table 16, page 134, in Appendix B , page 132) can help developers to select and formulate recommendations, along with expert nutrition advice and evidence, to develop and guide recommendations for sustainable diets.

The framework developed here is intended to be applicable to a variety of contexts and settings. For countries with published FBDG, the framework can be used to examine the framing of sustainability with the aim to address gaps in future publications (35). The opportunity to develop FBDG with sustainability framing in the initial version of a nation's food guidance can be strengthened through the application of this framework. Countries without food guides can use this framework to address the various components of sustainable dietary guidance in their development process paired with multiple sectors, ministries, and experts (62). When applying the framework in different countries (e.g. low-, middle-, and high-income) the framework will help developers to address different, potentially overlapping issues, reflective of the country context (35).

This framework presents systemic, transformative alternatives to the 'business as usual' recommendations for dietary practices. How can we make meaningful, macro-level change in consumption habits? Through a confluence of strategies that starts with including sustainability in recommendations, policies, and education (10,61). System-wide changes start with system-

wide, or systemic thinking (86). Qatar, Sweden, Brazil, and Germany brought in thinkers and stakeholders who envisioned alternative futures and instilled that vision for change into the guidelines for their respective countries. Embracing the possibility of "healthy diets from sustainable food systems" (10)p1, these countries have started to address the crucial and immediate challenge of shifting diets.

Consequently, more work needs to be done to investigate the social, economic, and environmental impacts of shifting diets. For example, could the sustainable diets recommended in these guides and other seminal literature (e.g. EAT-Lancet Commission report (10)) be viable options that maintain cultural traditions, enable equitable and accessible food for all, and ensure a lower impact on the global ecosystem? Is the recommendation for increased plant-based protein form nuts a viable option climatically or energetically if we, for example, would shift corn and soy production in the North American Midwest to feed cattle into nut production to feed humans? This framework and 'sustainable' dietary recommendations need to be critically examined for their usefulness and potential, unintended negative impacts.

The Sustainability in FBDG Framework developed in this study can act as a tool, not a normative mandate, for countries developing FBDG to meet international sustainability goals. Integrating sustainability concepts into food guides can provide a means for meeting international calls for sustainability and addressing global progress towards the UN's 2015 SDGs (31). Further, in countries that do not yet have FBDG (132 of 215 – 61% according to the UN FAO), particularly low-income and developing countries (9), there is an opportunity for 'leapfrogging' forward into a food guide that meets the primary objective of promoting health while also approaching the "rich, live and tricky challenge" of a sustainable diet (61)p47.

This study contributes to a reframing of the question: how can countries craft FBDG for greater population and planetary health? Table 16 (page 134) in Appendix B (page 132) displays each domain and concept alongside a definition and example of each concept. The examples in existing FBDG depict ways to 'green the realm' of a country's policy landscape, creating a roadmap for policymakers to address the multiple dimensions of sustainable consumption (87). Further, this framework shows the many different, and complex ways diets can be approached when it comes to establishing sustainable dietary recommendations. Countries developing food guides can leverage their guide to act as a signal or tool for implementing sustainable practices in the public and private sectors and be potentially transformative of values across the food system (61,62,87).

#### 3.5.3 Representing Conceptual Complexity of Sustainability

In this study, the many ways that countries used the concepts under the umbrella of 'sustainability' shows how complex, malleable, and practical the term can be. The impacts of modern diets are increasingly being recognized as severe (15), and "integrated and coherent sustainable dietary guidelines are essential" to provide alternatives to harmful, dominant food systems practices (61)p43. However, users of the terms 'food systems sustainability' and 'sustainable diets' need to be wary of the concepts becoming useless rhetorical tools for governments to feign transformation of policy and systems. Even by the UN, in a 2008 report "Food Sustainability: A Guide to Private Sector Action" offered what could be seen as institutional legitimization of current (unsustainable) market forces by asserting that fair markets and an understanding of basic economics will assist the poor (e.g. farmers and laborers in low-income countries) in becoming better business people, enhancing their food production and livelihood sustainability (88). Koc (2010) recognizes that alternative discussions of sustainability

terms are valuable in engaging existing institutions of practice and thought, but that it is just as important not to let them be used as a means to the end of legitimizing practices of current, unhealthy, ineffective food systems (89). So, if sustainability considerations in FBDG are to be useful, the framework (domains and concepts within them) developed in this study needs to be open to critical scrutiny and evolve with multiple applications in pluralistic contexts (89).

Recommendations of sustainable dietary practices in FBDG must navigate complexities. It is recognized that different countries, regions, and even communities and individuals will have different values, practices, and barriers when it comes to how and what to eat (5,10,54,61,90). Therefore, the framework developed in this study is intended to be applicable across contexts to understand how sustainability has been framed in FBDG. Looking at the full system that brings nourishment to eaters (who may or may not adhere to guidelines), there is not a single origin or final end point of the food system (71). Therein, FBDG need a framework that does not stop at considering single nutrients but provides language to holistically incorporate sustainability and address the tensions around shifting to sustainable diets (91). Tensions may include disregarding or shaming cultural practices of meat and dairy consumption, food insecurity and indigenous food sovereignty, the economic burden of consuming fish or other fresh foods from sustainable sources, and the political challenges of reducing land use and bringing equitable means of crop production and distribution into the fore of eater minds, to name a few (52,57).

Users of the framework developed in this study need to be critical of the concepts and definitions when applying it to consider sustainability in FBDG. Sustainability can be a useless and trite term and does not provide helpful framing for food guides if not examined and used critically (68). However well intended, 'sustainability' in food systems might be a term used with little substantive meaning. Hinrichs (2010) notes that 'sustainability' may be a comforting term

given current food movement dynamics (i.e. food fashions/fads (61)), but then questions how effective the term is in guiding the challenging intellectual and physical work that needs to be done (68). Yet, the broad uptake and use of sustainability in many contexts, through time, rhetorical settings, and the documents in this analysis, is seen as a strength indicative of its malleability and value (68). Even if the definition is contested, the notion of sustainability remains useful in reference to FBDG precisely because 'sustainability' is not static and consistently defined, but open to debate and evolution away from being staunchly formulaic (92). The results of this study show that when applying this framework, users can and need to consider the conceptual complexity of sustainability considerations and their interconnections.

# **3.5.4** The Journey Forward: Alternative Views

FBDG developers (i.e. ministries and governments) or industry may push back on using FBDG to consider diet changes outside of health. However, there is consensus in the scientific literature on the fact that humans (and their food consumption patterns) are responsible, in part, for global climate change (1,2). We can make changes in diets that will improve both the health of the planet and the health of people by switching to sustainable diets (5-8), and FBDG have been put forth as a useful and meaningful way to shift to sustainable diets at a population-level (9,10). Having a policy position that "stick[s only] to the health message" with the rationale that including other topics confuses eaters or eating according to the health messages will also lead to lower environmental impacts (61)p22, disregards the cultural dimensions of food, assumes consumption choices are driven solely by health, and does not go far enough in signaling needed environmental, policy, and system improvements (52).

It might be argued that if all guidelines internationally use the same framework to be 'sustainable', then everyone would be eating the same things; mandated by the governments and

researchers of the West, individual choice and food culture would be lost. It is recognized that developing a framework for application internationally, especially across cultures and low-, middle-, and high-income countries, is challenging as there are different sociocultural, economic, and environmental factors in play (35). However, sustainable FBDG will not mean "globally uniform diets, but culturally appropriate expressions of the same ecological and nutritional baselines" (61)p45. Using the Sustainability in FBDG Framework and incorporating sustainability considerations in FBDG will not mean an end to choice but would, in fact, be a way for eaters to question the pervasive and dictatorial influence over food tastes by commercial advertising and industry, who wield large budgets and lobbies to promote often unsustainable dietary patterns and foods (61).

# 3.5.5 Study Limitations and Future Directions

This study is not without its limitations. The framework developed in this study does not address FBDG or policy strength for influencing a sustainable diet. For example, Germany's FBDG included four of the five domains, and 17% of the concepts, but these numbers do not give an indication of the strength of the remarks made or exactly how explicit the connections to sustainability were. A way to overcome this is to identify the recommendations made in the guidelines that have actions associated with them and implementing a future study of how effective sustainability claims made in FBDG are at changing dietary practices. Simply finding the presence or absence of a concept does not tie eater action for change in a sustainable direction. A challenge of developing any policy or guideline is that they do not necessarily translate into immediate or effective action (35). Much more work is needed to identify the indicators of change and measure impacts of including sustainability in FBDG. The application of this framework is a first step in understanding the inclusion of sustainability in FBDG. Another potential limitation is that this framework does not imply any weighting of the different concepts. Recognizing that different components of a sustainable diet can have greater impacts on the environment, nutrition, or agriculture than others (35), there is no current consensus about the weight of the different trade-offs inherent in improving one aspect of sustainability at the potential cost of others. These trade-offs from the environment, health, and ethical perspectives would have to be addressed in greater depth in another analysis that would be a possible future direction.

The framework is limited to identifying possible concepts and considerations to include in FBDG based on the emphases of sustainability by developers. Though it was designed to be useful in diverse settings with little normative language, when this framework is applied in the future in different settings, adaptations will need to be made to reflect the country context and level of FBDG development in the past (from none in many developing countries to wellestablished in countries such as the United States).

#### 3.6 Conclusion

#### 3.6.1 Beyond Sustainability in FBDG

A concluding suggestion of the UN FAO in their global review of FBDG is that countries with guidelines should begin to incorporate sustainability into future versions, where countries without FBDG are in the "unique position to develop integrated guidelines from the outset" (9)p64. There is a possibility that low- and low-middle-income countries can start out with FBDG that provide the win-wins of including dietary recommendations that are consistent with good health (62) and have lower environmental impact in developing contexts (9). The framework developed in this study can be used to include sustainability considerations in FBDG both in countries where non-communicable diseases and overconsumption are dilemmas and

where food scarcity, hunger, and underconsumption are critical concerns. This framework links a range of critical issues that dietary choice and food consumption affect. As the need for resilient food systems is recognized (93-96) and climate change continues to impact the health of people, societies, and the planet (8,97,98), addressing sustainability in policies and FBDG in particular will become ever more important (28,61,62).

It is recognized that putting sustainability considerations into FBDG will not be enough to change eater behavior since there are many other factors that come into play when individuals make food choices in context of their families and communities (99). Though dietary change may be reasonable for an individual, in the small remaining timeframe to limit global climate change and prevent further ecological damage, more widespread behavioral change will be hard to achieve (76). Yet, recognizing FBDG limitations in reach and impact, we might be able to move beyond the guidelines for populations to start to see the value in alternative ways of being fulfilled in improving their lives and satisfied with making sustainable choices instead of feeling relegated to making sacrifices (e.g. eating less meat, buying more expensive local or organic food) (85). Countries developing FBDG can use this framework as a roadmap to create a guide for their population to see a diversity of ways of eating and enjoy the flavors of a complex lifestyle where they make decisions for their own benefit and the benefit of the environment around them.

# **Chapter 4: Conclusion**

The conclusion of this thesis will provide a brief overview of the results and discussion presented in Chapters 2 and 3. The key findings of this study will be reviewed and the next steps of application of the framework developed above will be elucidated. The conclusion will invite the reader to consider how this study and interdisciplinary, systems thinking frameworks are providing the foundation for updating worldviews on the inextricably interconnected nature of food, health, and the environment.

## 4.1 Key Lessons

The findings of this study support the field of literature that demonstrates FBDG have potential to address sustainability (10,55,57,62). Some go further to assert that FBDG should include sustainability principles since considering health alone could jeopardize the current food system, the future of food production, and human health and wellbeing

(6,9,15,32,52,62,71,91,100).

"These Guidelines have been developed with the objective of facilitating access for people, families, and communities to knowledge on characteristics and determinants of healthy eating, enabling them to expand their autonomy to making better choices for themselves, reflect on everyday situations, seek changes in themselves and the environment they live in, contribute to ensuring food and nutrition security for all, and demand compliance with the human right to adequate food" (50)p21.

The opening section of the Brazilian FBDG outlines the intention of the guide. The above quote depicts the unique approach to food and diets that Brazil took in their guidelines; they recognize the interconnected nature of diets, human health, social equity, and environmental wellbeing. It is an element that I will continue to reference in this chapter given that the Brazilian guidelines, among others in this study including Qatar's, Sweden's, and parts of Australia's FBDG, illustrate many ways of including sustainability considerations in national-level food guides.

#### **4.1.1 Objective #1**

This study specifically examined how sustainability has been included in international FBDG and compared common elements in the development process of sustainability inclusion in international FBDG. In response to objective number one (to examine how sustainability has been framed in international FBDG and compare across country contexts), the international comparison revealed that explicit sustainability documents were recently published in a process that varies with the context of the country, and myriad stakeholders contributing to guidelines impart a wide conceptual framing. Further, though the guides are framed primarily through health and nutrition, other sustainability domains also emerged as salient, where the most explicit sustainability considerations were found in documents that focus on the context of eating, with less explicit focus on specific nutrients. Several consistent main messages were revealed across explicit sustainability documents.

This study found that sustainability concepts have been recently included and published in at least eleven international FBDG, included only since 2011 in four supporting documents, and since 2016 in seven official guidelines. We are at a critical inflection point where there is incorporation of sustainability in FBDG heeding early calls (15,45) and recent recommendations made by international governing bodies and seminal global reports (9,10). There is a need to keep up the momentum so that the sustainability transition found in this study continues internationally, and the inclusion of sustainability in these eleven FBDG is not a short fad or policy outlier. We are at the precipice for systemic change. The global challenge of sustainable

and healthy diets needs to be tackled from the bottom up through individual choice to move away from the nutrition transition (i.e. diets heavier in sugar, salt, and animal-based foods; long ago adopted as a 'Western' diet, and recently emerging in developing countries) globally (14) and towards a radical (drawing on the original meaning: from the root) new sustainability transition. Figure 7 (page 73) depicts five patterns of nutrition transitions (12) in human history and the indicated and possible next phase into sustainable dietary patterns. Starting with individual choices, improvements can be led by national health and governance through dietary guidelines (61).



Figure 7. The five patterns of the Nutrition Transition from Popkin (2006), with pattern #6 indicated as the potential next phase into a new 'Sustainability Transition'.

There are multiple sectors (e.g. ministries, academics, civil society groups, industry) and many different stakeholders (e.g. health and agriculture practitioners, civilians, nutrition and food researchers) that were brought to the table when sustainability was included in the FBDG analyzed. These findings support previous work asserting the importance of bringing in and balancing many stakeholder interests to develop culturally-appropriate, nutritionally-sound, and environmentally-conscious FBDG (9,54,62).

Involvement of many stakeholders in FBDG can address the many demographic, socioeconomic, and education factors that come into play in awareness and use of FBDG (101,102). For example, the 2007 FBDG of Canada were critiqued and have been described as poorly understood, used, and economically and socio-culturally inappropriate for some Canadian eaters (20,103-107). The value of the developers (often the government) taking an equitable and holistic view in document development is the ability to consider and incorporate multiple perspectives of those who are impacted by the policy and to understand the linkages among stakeholders in the food system (71). The more recent, 2019 version of Canada's Food Guide was developed through a process that engaged multiple stakeholders, which included two rounds of public consultation, focus groups with stakeholders who use the guide, and very emphatically expressed that food industry was not consulted in the process (23,24). Health Canada claims that they have given "actionable advice" and the 2019 FBDG does include more context of eating recommendations as well as some explicit environmental messaging (108). Yet, the 2019 Canada's Food Guide changes have been criticized in the media for "being too simple and fuzzy" as well as "mildly patronizing" suggesting a loss in the quality of the nutrition recommendations (109). This study lends further evidence to the notion that FBDG are one tool in a larger toolbox of methods working toward sustainable food systems, and many voices must be at the table to ensure food systems change is supported by emerging dietary recommendations for eater health and the health of the planet (68).

At the University of British Columbia Farm, the work undertaken at the Centre for Sustainable Food Systems is predicated on the idea that "no one thing does just one thing." Guidelines are significant in that they serve multiple functions, and this study contributes to current knowledge on how FBDG are no longer doing 'just one thing' of translating nutrition requirements into individual recommendations (9,10,61). Although human health and nutrition are the primary frame, and perhaps even the mandated purpose, of FBDG, other domains within the framework emerged as salient aspects of the documents analyzed. For example, the quote from the Brazilian FBDG (see page 71) provides recognition of the multipotentialities of food guides (16,19). FBDG are no longer doing just one thing and are an important part of a country's signaling for policy development, education, industry, and eaters to move towards substantive, sustainable national food policy and population-level action (6,9,10,53).

This study has significant and immediate applicability in the Canadian context. The new Canadian Dietary Guidelines were released at the beginning of 2019, an updated version of the widely used 2007 Canada's Food Guide. Provincial and Territorial school boards (110-120), educational programming and public health initiatives (118,121,122), and university coursework (123) have taken direct guidance from Canada's FBDG. Nutrition monitoring and evaluation studies and tools of public health practitioners have utilized the FBDG of Canada to assess dietary quality and adherence to the guidelines (124-128). Moreover, the 2019 Canadian Dietary Guidelines demonstrate a recognition of the connections between diets and the environment beyond their primary directive of guiding the health of Canadians:

"While health is the primary focus of Canada's Dietary Guidelines, there are potential environmental benefits to improving current patterns of eating as

outlined in this report. For example, there is evidence supporting a lesser environmental impact of patterns of eating higher in plant-based foods and lower in animal-based foods" (24)p15.

Though there are limitations of food guides to address complex issues of a sustainable diet, food guides have started conversations in our current, Canadian context (in 2019 with much recent media attention) and worldwide. Canada's new food guide has, if nothing else, started to reframe the question of "*what should I eat to be healthy*?" to "*what impact do my food choices have on my wellbeing and the health of the environment*?"

In this study, it was found that the most explicit sustainability considerations were found in documents that were more food context-based rather than being nutrient-focused (as discussed in Chapter 2), and there were consistent messages across the guidelines that made explicit sustainability recommendations. See Chapter 3, Table 3 (page 37) for the explicit sustainability recommendations with similar versions of main messaging. The consistent messages indicate that there is some consensus on what makes a 'sustainable, healthy diet.' The findings of this study can help inform future investigation into what sustainable diets are, how they are defined in practice, and how recommendations are made with consistency. The International Food Policy Research Institute recommends that government policies be aligned with promoting sustainable diet choices and "ensure coherence among agriculture, health, nutrition, water, biodiversity, and climate change policies" to promote sustainable dietary choices (72)p78. The consistency in messaging of sustainability recommendations, including more framing around the context of eating, is an important step facilitating future, unified movement toward more healthful and sustainable food systems (10).

# **4.1.2 Objective #2**

To address objective number two (to adapt a framework through which to understand how sustainability concepts have been incorporated into international FBDG), based on the international analysis and the foundational framework of Downs et al. (2017), a proposed framework with five main domains (health and nutrition, food security and agriculture, markets and value chains, environments and ecosystems, and sociocultural and political) and 57 concepts was developed.

This study outlines a framework for assessing the prominence of sustainability in FBDG. This framework has practical implications for developing future FBDG with sustainability considerations. Further, the framework presents a theoretical contribution through a comprehensive view of the complex and interconnected nature of sustainability framing. This framework can be used to address the lacuna of guidance for assessing and including complex considerations of sustainability in dietary guidelines. The framework has broader significance for developing sustainable FBDG in countries without FBDG and in those seeking to update their guidelines integrating the evolving evidence for the importance of sustainability in this modern era of the Anthropocene, typified through climate change adaptation (10).

Since dietary advice is so complex, frameworks for developing food guides need to reflect the many complex parts of the food system in which eaters act. The framework developed in this study provides theoretical background and practical concepts for including sustainability in international food guides. Social aspects of food literacy in reading labels and having the knowledge base to utilize the recommendations in guidelines need to be considered. Food security considerations of local availability of foods recommended and users' ability to access and (biologically) utilize food are relevant to developing guidelines. The possible environmental

impacts of recommended diets on local and global ecosystems must be considered for sustainable future food supply. Further, eaters' economic ability to afford recommended diets that often include more expensive foods means that guidelines need to be considerate of the connections among food choices, socioeconomic disparities, and noncommunicable diseases (129,130).

# 4.2 Strengths of this Study

A strength of this study is that it includes a novel cross-country comparison, which advances understanding of how international governments have framed sustainability in their food guides. The cross-country comparison showed different types of sustainability inclusion that present signals to a country's people and policymakers for sustainable choices. This study addresses the lack of literature around sustainability considerations in food guides around the world, which is significant because of the growing acknowledgement of the need for food guides and public health practice more broadly to include sustainability considerations (9,15,32-34,45,52).

A further strength of this type of rigorous analysis and international comparison that has not been done before is the contribution of the framework adapted here. Investigation of the sustainability framing can support work understanding how those sustainability messages and FBDG influence actions of users including eaters (changing actual diets), educators (impacting understanding of the food system), practitioners (recommending diets with multiple goals of health and lower environmental impact), and policymakers (influencing agriculture or industry policy) (9,10,44). If FBDG are meant to influence users, the framing impacts attitudes and opinions of those who interact with the frame and can lead to dietary choices with both health

impacts and sustainability externalities (e.g. social stigma, economic concerns, ecosystem influences) (7,10).

This analysis can inform important future work in continuing to develop FBDG with sustainability. Rizvi et al. (2018) assert that FBDG without sustainability do not go far enough in considering the externalities of dietary choices. If the population of each country in the world ate according to the US FBDG, we would dramatically exceed the planet's current capacity to sustain life and need an extra gigahectare (the size of Canada) of additional farm land to feed the current population (52). The analysis of this thesis adds to current literature asserting that a turning point for FBDG to include sustainability is overdue (9,10,15,32,61).

This current study also presents a framework for integrating sustainability into future FBDG. The framework is strengthened by both its foundation in previous literature and the inductive methods of drawing influence from the documents analyzed in this study. The proposed framework is significant in that it depicts the complex and interconnected nature of sustainability concepts and framing in FBDG in a comprehensive, yet comprehensible way. Approaching sustainable dietary guidance with this framework allows for users to understand how sustainability has been framed in FBDG and identify possible gaps where food guides can broaden their frame to include a more holistic focus.

# 4.3 Limitations

The lack of "enforcement" in food guides positions them to be more of a passive frame for users to understand their world and does not offer a mandate for action, which leaves many directions for research into the ways users interact with the sustainability framing in FBDG. A limitation and a caution for users of the framework developed in this study is that it is not a normative set of instructions. This study is meant to be descriptive and the framework

characterizes sustainable consideration without stressing the importance of one domain or frame over the other (e.g. environment and ecosystems over sociocultural and political). This study is limited to an indication of how sustainability has been included and some context of the development of sustainability framing in international FBDG. Users of the framework developed here should not take it as a set of rules for what should be included in guides, rather as a comprehensive tool that displays the complex and interconnected nature of diets, health, culture, and the environment.

Food guides should be a part of moving toward larger, systemic changes. With food guides aligned in a suite of solutions, they might be able to facilitate thinking beyond guidelines to develop a country or global ethos that moves past the technical fixes which adroitly allow constant, continuous consumption (1,10). As China's food guide asserts, with our diets and choices we should "develop a new ethos of diet civilization" (84)p3. Not through food guides alone, but in concert with other means (e.g. shifts in food production, policy, manufacturing, transportation, etc.), humanity might start to see the opportunities we have to create ways of living that are better for both the environment and enjoyable for us (85).

#### 4.4 Next Steps for Research and Implications for Future Practice

Since this study only included a sample of eleven FBDG from the UN FAO database, a future study could address all of the available FBDG internationally to describe the sustainability framing (9). A view of the total sum of the international field of FBDG, which have not been cited as 'explicitly including sustainability' might show how much sustainability language has already been integrated into guides. This study found the sustainability inclusion was a relatively recent inclusion *explicitly*, but the domains and concepts included in the framework address many aspects of diets not limited to language that would traditionally be considered 'green' or

'environmental' (e.g. eat with others, cook your own food, etc.). Therefore, this framework could be applied to more FBDG in addressing how sustainability is framed in guides currently and how it could be included in the future.

Further investigation is needed into the different levers that can work in unison with food guides, policy, and education to address unsustainability in dietary practices. Economic and social incentives, movements, and action add to the plethora of ways to improve sustainability of dietary practices. For example, lowering the cost of fresh and whole foods while increasing the prices of processed or environmentally-harmful foods could incentivize eaters economically. Social change through movements toward vegetarianism and veganism could influence eaters to transition to more plant-based diets (131,132). Policy and guidelines, no matter how explicit, useful, or well-framed, do not often or immediately translate into action (35). Much more work is needed to assess the various ways to change diets and influence eaters for better health personally and environmentally, which are both part of a future of sustainable dietary practices. This framework can be used as a first step in understanding and including sustainability in FBDG.

#### **4.5** A Roadmap to Sustainable Development Goals

"Food and nutrition represent a common thread linking the 17 UN Sustainable Development Goals" (SDGs) (133)p7. Dietary change as a way to meet climate change mitigation goals (134) and the SDGs (6,35,61) is an emerging and unifying theme in the literature (61,62). Aleksandrowicz et al. (2016) assert that the uptake of sustainable diets could offer a route to achieving a subset of the SDGs, such as goals related to climate change, agricultural practices, water use, and health (6). The SDGs are similar to and can be impacted by sustainable diets since the different components of each span various sectors (e.g. farming,

production, processing, transport, consumption, waste management) and fall under the responsibility of many ministries (e.g. health, agriculture, education) (35).

To address SDGs, countries have the opportunity to develop FBDG with sustainability framing; using the framework developed in this study there is potential for policy symmetry to deliver systemic 'win-wins' (61,62). Lang (2017) describes a 'SDGs squared' strategy where various stakeholders for various reasons could support guidelines with sustainability framing and transform food systems simultaneously (61). Further, UN FAO recommendations for how to develop FBDG with real effects on the environmental impact of diets assert that guidelines need to be developed in consultation with civil society and industry, while separately, but concurrently based on evidence and guidance of health and environment professionals (9).

# 4.6 **Potential for Policy 'Leapfrogging'**

Often discussed in terms of technological advance, policy 'leapfrogging' has been explored in developing countries, and sustainable FBDG present a future direction for developing contexts. The idea of 'leapfrogging' by using this framework gives a development strategy for countries to bypass stages of FBDG development (i.e. those unsuccessful in achieving healthy diets) to the establishment of modern dietary guidelines that provide for health and sustainability (135).

Qatar for example, although it is a wealthy country, developed their first version of FBDG in 2013 with explicit sustainability considerations (57). Qatar's case is an interesting one that other countries developing their initial food guides can learn from (57,62). In line with FAO suggestions for developing sustainable FBDG (9), the Qatar food guide:

- i) was owned by the government and supported by multiple departments (e.g. Non-Communicable Diseases Division and the Department of Community Medicine, Residency Training Program);
- ii) promoted and linked with public polices (e.g. Qatar National Development Strategy);
- iii) included a range of academic and professional expertise where sustainability inclusion was championed by multiple agencies including the National Food Security Programme;
- iv) brought in consideration of the relationship between food and the environment aligning with cultural context;
- v) was accessible but ambitious guiding choices about overconsumption
  (importantly of all foods, especially of meats *and* gave particular guidance to vegetarians), food waste reduction, and efficient food preparation (57,78).

Where Qatar and other countries could improve their sustainability positioning when developing food guides is to:

- i) be linked to industry standards, advertising regulations, and public procurement;
- ii) be developed with the inclusion of other ministries (e.g. energy and industry, municipality and environment, economy and commerce);
- iii) consult with the public, civil societies, and industry;
- iv) place emphasis on valuing food (9).

As mentioned in Chapter 2 in section 2.4.2 (page 29), the unique context of Qatar and their exclusion of agri-business industry input differed from other countries with explicit sustainability (Brazil), yet those with attempts at incorporating sustainability let their strong agribusiness sector outweigh other voices (United States and Australia). This framework offers a strategy to advance FBDG development and broaden guideline scope to include sustainability considerations, but leapfrogging FBDG will require both determined and pervasive political and cultural will (135). To summon sufficient political will, policy makers have to address the influence that industry has over development of policies and guidelines. Including industry stakeholders with strong national influence has proved to stymie the integration of sustainability in FBDG and should be done but only later in the process (62).

There is a potential for great advancement in the field of developing FBDG globally and in no group more so than the low- and low-middle-income countries. According to World Bank classification (136) the UN FAO found that only two of 31 low-income countries (6%) and 12 of 51 Low-middle-income countries (24%) have FBDG at all. On the other end of the spectrum, 26 of 53 Upper-middle-income countries (45%) and 43 of 80 High-income countries (53%) have FBDG published as of 2016 (9). Globally, only 83 of 215 countries (39%) have FBDG, so there is room for expansion internationally and wide application of the framework developed in this study. However, when applying this framework, users should recognize the need to be wary of 'Western' institutions hegemonically mandating food practices and policy change. This framework is not meant for upholding colonial ideas of cultural and social control, and a critical stance should be taken when applying it to any FBDG development.

#### 4.7 The Take-Away

Most notably, the results of this study point to a shift in guideline development which includes multiple stakeholder voices bringing in considerations outside of health and incorporates sustainability with more food-based framing and consistent messaging. The knowledge gained through this study is significant in showing that FBDG can be more than

banal recommendations for healthy choices. Granted the power lies in their ability to be accessed, understood, and utilized, FBDG are "potentially transformative, as once in place, sustainable diet guidelines would be a signpost for a values shift across the food system" (61)p44. As already described in the Brazil guide (page 71), FBDG serve many purposes when developed with framing to achieve multiple objectives. This study shows that we are at a pivotal moment in FBDG development with the incorporation of sustainability framing for more sustainable food guides and, ultimately, food systems. We are updating, sharing, and connecting our worldviews on the inextricably interconnected nature of food, health, and the environment to ignite the larger systemic revolution needed for sustainable and healthy individuals, populations, and the planet.

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# Appendices

## Appendix A

## A.1 International Country Vignettes

The total number of pages in each document (as numbered by the authors of respective documents), and the total number of sustainability concepts included in each document out of a total of 60 concepts spread among the five domains is described in Figure 3 (page 33). Each country document, context, and sustainability framing is described below, separated by category given to each country by the UN FAO review (9). Figure 8 (page 97) depicts the number of pages and concepts present in the 11 documents in this study. The Australian FBDG had the most pages (210) and concepts (53) included, while Germany the least number of pages was 67 (ranging from 1 to 210) and the average number of concepts included was 28.5 (out of 60; ranging from 10-53).



Figure 8. Number of pages and sustainability concepts present (out of 60 total) in the selected FBDG documents by country (NNR designates the Nordic Nutrition Recommendations).

## A.2 Sustainability Explicit in Official FBDG

### Brazil

The 2015 version of the Guidelines for the Brazilian Population are the second edition published by the Mistry of Health of Brazil, the first were published in 2006 (54,59). Brazil's 2015 FBDG was championed politically and retained after a tumultuous change of minister and government. The retention was due, in part, to the novel manner of presenting guidelines for dietary patterns or packages (54). For example, the "Golden Rule" highlighted in the first section of dietary guidance is "always prefer natural or minimally processed foods and freshly made dishes and meals to ultra-processed foods" (50)p47. The strong 'everyday' or cultural messaging took a broader food literacy approach instead of extoling or vilifying particular nutrients. The unique Brazilian recommendations, focused on the amount of processing of food instead of individual nutrients, allowed for the 2015 FBDG to become normalized after overcoming the policy hurdle of a change in government leadership (54). The Brazilian Food Industry was the main opponent of the guideline's classifications based on food processing levels. Industry was not the dominant voice since throughout the development process 3125 responses were collected from 436 individuals or institutions (including the public, private sector businesses, unions, health professionals, professional representative organizations, and universities) (9).

A retained nutrition focus and a novel consideration of the environmental implications informed the revision of the Brazilian food guide. Exhaustive public consultation was undertaken while formulating the advice (instead of after as is usual in other FBDG). The public consultation revealed that eater engagement with the guidelines would be higher if the socio-cultural messages of sustainability (e.g. eat with others, find local farmer's markets) were presented at the forefront of the guide rather than the environmental sustainability messages (e.g. animal products yield GHGs). Therefore, the 2015 guidelines were propagated on cultural appeal and with consideration of the diversity of Brazilian foods and cultures (54). Further, Brazil's FBDG are offer a unique social and internally-critical perspective by identifying obstacles to following the recommendations given in the FBDG. For example, when confronting the obstacle eaters might face of sustainable food supply (e.g. "Ultra-processed foods are on sale everywhere, promoted by advertisements and discounts on all media...by contrast, natural or minimally processed foods get little publicity and some are not even available close to people's homes") the Brazil FBDG gives advice to be mindful of shopping practices and when eating away from home (50)p106. The Brazilian document and key messages are further described in Table 4 (page 99).

Brazil has a comprehensive framing of sustainability in their official FBDG document. Out of the total of 60 concepts in the five domains, the FBDG of Brazil included 50; concepts included are found in Figure 9 (page 100). Brazil includes more concepts than any of the other countries in the first category of "sustainability explicit in the FBDG," granted it is the longest in the category at 150 pages. The Brazilian FBDG included one of the most balanced representations of the five domains compared to other countries in this analysis. The number of concepts included in the Brazilian FBDG in each respective domain in decreasing order are: markets and value Chains (11/11, 100%), health and nutrition (12/13, 92%), sociocultural and political (10/11, 91%), environment and ecosystems (10/14, 71%), food security and agriculture (7/11, 64%). For example, this means that 100% of the concepts under the markets and value chains (11) were included in the Brazilian FBDG.

Document	Dietary Guidelines for the Brazilian Population
Development Process	Participatory consultation with multiple sectors of society, workshops to evaluate the first draft with experts from various sectors, second draft was presented for public consultation in a website platform run by Ministry of Health; Ministry of Health and Epidemiological center finalized the guidelines from comments made in public consultation.
Key Messages	<ul> <li>Ten Steps to Healthy Diets</li> <li>Make natural or minimally processed food the basis of your diet</li> <li>Use oils, fats, salt, and sugar in small amounts when seasoning and cooking natural or minimally processed foods and to create culinary preparations</li> <li>Limit consumption of processed foods</li> <li>Avoid consumption of ultra-processed foods</li> <li>Eat regularly and carefully in appropriate environments and, whenever possible, in company</li> <li>Shop in places that offer a variety of natural or minimally processed foods</li> <li>Develop, exercise, and share cooking skills</li> <li>Plan your time to make food and eating important in your life</li> <li>Out of home, prefer places that serve freshly made meals</li> <li>Be wary of food advertising and marketing</li> </ul>
Document Description (no. of pages)	Several different chapters with topics such as: choosing foods, from foods to meals, modes of eating, and understanding and overcoming obstacles. No single visual but guides steps to healthy diets. (150 total pages)
Self-Identified Target Audience	Brazilians who are 2+ years of age, aimed at health professionals working on health promotion and disease prevention (e.g. health professionals, nutrition and health educators, and community and social workers).
Type of Source Citied (number of sources)	Document does not cite any specific sources, but they give resources for further reading in each chapter of the guide. One of the guiding principles in development is "different sources of knowledge inform sound dietary advice."
T-1-	$\mathbf{L} = \mathbf{A} + \mathbf{D} + \mathbf{a} + \mathbf{A} + \mathbf{D} + \mathbf{A} + $

Table 4. Brazilian FBDG document details, UN FAO (59).



Figure 9. Brazilian FBDG sustainability considerations by domain and concept represented in text.

# Germany

The official FBDG of Germany are a short, one-page list of recommendations for healthy lifestyle choices. Information about the German FBDG document and the key messages are outlined in Table 5 (page 102). To supplement the one-page document, in German, there are

visual representations of types of foods to eat and relative amounts in a nutrition circle and food pyramid (59). Five (of ten total) specific connections to environmental sustainability are highlighted in the German FBDG: i) when recommending an active lifestyle the guidelines say to "walk or take the bicycle from time to time...this protects the environment and promotes your health;" ii) in the fruits and vegetables recommendation of 'take 5 a day' is to "favor seasonal products;" iii) when choosing fish, "choose fish from recognized sustainable sources;" iv) "to reduce unnecessary packaging waste" use ingredients that are fresh; and v) the first recommendation is to eat a diverse range of foods for "health promo[tion] and foster a sustainable diet" (79)p1. Few other specific references are made to sustainability in the text of the current German FBDG, but sustainability was a recurring theme of communication around the unveiling of the 2013 version (79).

Beyond the official food guide, the German Council for Sustainable Development expanded on the sustainable eater advice in the *Sustainable Shopping Basket – A guide to better shopping* (54,137). The Sustainable Shopping Basket is a supporting FBDG document and is aimed at environmentally conscious shoppers. The home- and eater-oriented advice of the Sustainable Shopping Basket was not aimed, as the Brazilian and Swedish documents were, at an official restructuring of population-level dietary practices (54).

The German FBDG displays a variety of sustainability concepts even though it is the shortest FBDG at one page. Representations of concepts from four of the five domains are included in the one-page document; Figure 10 (page 103) shows the ten concepts included in the German FBDG. Concepts from the markets and value chains domain were not included in the single-page document, but concepts in this domain are included in a supporting document available to the German public (only in German), the *Sustainable Shopping Basket* (e.g.

discussion of product labeling, eater marketing, infrastructure etc.) (137). The number of concepts included in the German FBDG in each respective domain in decreasing order are health and nutrition (6/13, 46%), sociocultural and political (2/11, 18%), environment and ecosystems (2/14, 14%), food security and agriculture (1/11, 9%), markets and value chains (0/11, 0%). For clarification, this means that 46% of the concepts under the health and nutrition (6 out of 13)

domain were included in the German FBDG.

Document	Ten guidelines for wholesome eating and drinking from the German Nutrition Society
Development	The German Nutrition Society is responsible for developing dietary guidelines for the country,
Process	no more is said about the process (from available data in English).
Key Messages	1. Enjoy a variety of foods
	2. Eat plenty of cereals, preferable wholegrain, and potatoes
	3. Vegetables and fruits - eat 'five-a-day'
	4. Eat milk and dairy products every day; fish once or twice a week; and meat, sausages and
	eggs in moderation.
	5. Eat small quantities of fat and high-fat foods
	6. Eat/use sugar and salt only occasionally and in moderation.
	7. Drink plenty of fluids, at least 1.5 litres everyday
	8. Do not overcook your meals
	9. Allow plenty of time for eating and enjoy mealtimes
	10. Watch your weight and stay active
Document	Nutrition circle divided into 6 groups: cereals and potatoes; vegetables; fruits; milk and dairy
Description	products; meat, sausages, fish and eggs; and fats and oils. Size of group decreases from first to
(no. of pages)	last, indicating relative quantities of the individual food groups; water included in the middle of
	the circle. There is an accompanying pyramid representation of the dietary recommendations
	(In German).
Colf Identified	(1 total page)
Self-Identified	General healthy German population
Target	
Audience	No courses sited in the document, it is a one name list of recommendations. There is a claim
Source Citied	mode about evidence: "The Corman Nutrition Society (DCE) has compiled 10 distant guidelines
Source Citied	have about evidence. The German Nutrition Society (DGE) has compiled 10 dietary guidelines
(number of	based on the most recent scientific knowledge, to help you enjoy eating and maintain a
Sources)	Definited diet.

Table 5. German FBDG document details, UN FAO (59).



Figure 10. German FBDG sustainability considerations by domain and concept represented in text.

# Qatar

Qatar was the first "newly developed" country to articulate "clear multi-criteria sustainable dietary guidelines" (54)p335. Notably, the seventh of eight main guidelines in the Qatar FBDG is to "eat healthy while protecting the environment" (78)p7. Surprised at the sustainability considerations, Lang and Mason (2017) indicated that the Qatar FBDG case is an

interesting one for many reasons in the policy development field. Despite its status as a beneficiary of the Middle Eastern oil-producing industry, Lang and Mason (2017) point out that the state of Qatar had previously recognized their population was a risk from climate change. Qatar has also historically been plagued with issues of diet-related, non-communicable diseases (e.g. type 2 diabetes (138)), an epidemic now recognized by the Qatari government (78). Nutrition scientists consulted in the process formulated the guidelines with the understanding that they could work to "prevent further complications from the nutrition transition" and "take a regional lead on progressive ecological public health" (54)p335. Yet, the Qatar example presents an interesting case of developing FBDG with sustainability considerations that can emerge on one end of the political spectrum, from democratic (e.g. Sweden) to more authoritarian governments (54). Descriptive information about the Qatar FBDG and key messages are highlighted in Table 6 (page 105).

The Qatari guidelines give a set of unique sustainability advice, though most explicit sustainability discussion is relegated to the one section that recommends eating "healthy while protecting the environment" (78)p1. The guidelines first justify why they have chosen to include sustainability, then also describe ways food consumption is linked to the surrounding environment (e.g. GHG emissions, depletion of fish stocks, solid waste accumulation) (78). The Qatari guidelines identify water shortages and low amounts of arable land as serious concerns for the state of Qatar (9). Further, Qatar's FBDG has legumes as a separate food group to include more plant-based proteins with plant-based diets emphasized in the introduction (78). The section on meat and alternatives refers to choosing fish from sustainable sources as well (78).

The Qatar FBDG represents sustainability considerations with references to concepts in each of the five domains. Concepts included in each of the domains can be found in Figure 11

(page 115). A majority of the Health and Nutrition domain is included in the Qatar FBDG (11/13, 85%), and around half of the concepts in each of the other four domains are included. The environment and ecosystems domain was included the second most (8/14, 57%), followed by the markets and value chains domain (6/11, 55%), and both the food security and agriculture (5/11, 45%) and the sociocultural and political domains (5/11, 45%).

Document	Qatar Dietary Guidelines
Development	Evidenced-based; compared with international reports; information from international
Process	reviews; expert committee meetings; public focus groups
Key Messages	1) Eat healthy choices from the 6 food groups
	2) Maintain a healthy weight
	3) Limit sugar, salt, and fat
	4) Be physically active
	5) Drink plenty of water
	6) Adopt safe and clean food preparation methods
	7) Eat healthy while protecting the environment
	8) Take care of your family:
	-Breastfeed you baby exclusively for the first six months of their life
	-Build and model healthy patterns for you family
Document	Shell-shaped plate with 6 food groups: cereals and starchy vegetables; vegetables; milk, dairy,
Description	and alternatives; fruits; legumes; fish, poultry, meet, eggs, and alternatives.
(no. of pages)	(40 total pages)
Self-Identified	Healthy population, 2-65 years old
Target	
Audience	
Type of	Public Health Journal (4); Other country FBDG (6); International Non-governmental
Source Citied	Organization (9); Research Group – Uni (2); Other country government resource (9); Book (2);
(number of	In-country government resources (2); University Extension (1)
sources)	
Table 6. Oata	ri FBDG document details. UN FAO (59).

Table 6. Qatari FBDG document details, UN FAO (59).



Figure 11. Qatar FBDG sustainability considerations by domain and concept represented in text. *Sweden* 

The Swedish collaboration of the National Food Administration and the Environmental Protection Agency brought publication of official FBDG with sustainability as a main consideration in 2015 (54). More information about the document and main messaging is summarized in Table 7 (page 108). The dietary guidelines of Sweden (and all Nordic countries) are based on the broad messages of the Nordic Nutrition Recommendations (see below for more information) (9). The most recent, 2015 version starts on page one by stating that "what you eat isn't just important to your own personal wellbeing; it's important to the environment as well" (56)p1. However, an early (2009) publication was not without its opponents. Amid concerns of the Swedish FBDG favoring local and seasonal foods (risking free-trade with other EU countries) and suggesting eaters eat less meat, the country was asked to retract their guidelines by the European Food Safety Authority (54). The EU Commission objected to the 2009 guide as well, fearing that the messages would give the Swedish producers an unfair market advantage (9).

After calls from the greater European community for retraction, six years later, the 2015 Swedish FBDG were released with very clear sustainability considerations. The document is entitled *Find your way to eat greener, not too much, and be active!*, indicating a blatant environmental, or "green" development lens (9). The prologue of the FBDG is entitled "Sustainable big picture" (56). Within the guidelines, subcategories are then ranked on environmental impact (e.g. wholegrains as low, diary as "good and bad for the environment" (56)p12. Further, the official Swedish FBDG are accompanied by a *Risk and Benefit Management* report that outlines the scientific basis for the recommendations and the considerations that led to the official FBDG (74). The official FBDG of Sweden does not have an extensive reference section. However, to provide the evidence base for the official guide, several of the references and pieces of evidence cited in the accompanying report are centered on sustainability.

Sweden shows the strongest variety of sustainability consideration in three of the five domains. About half of the concepts from health and nutrition (7/13, 54%), sociocultural and political (5/11, 45%), and the environment and ecosystems (6/14, 57%) domains are included.

The food security and agriculture (1/11, 9%) and markets and value chains (1/11, 9%) domains

show less inclusion in the Swedish FBDG with only one concept in each domain present in the

FBDG. The concepts included in the Swedish FBDG can be found in Figure 12 (page 109).

Document	Find your way to eat greener, not too much and to be active!
Development Process	Based on input from the Nordic Nutrition Recommendations; uses scientific evidence of environmental impacts; open hearings with experts in public health and nutrition; the food industry; consumer associations and patient organizations; consultations with the general public; tested with consumers
Key Messages	<ol> <li>1) Eat more vegetables and fruit</li> <li>2) Eat more seafood</li> <li>3) Get more exercise</li> <li>4) Switch to whole meal</li> <li>5) Switch to healthier fat</li> <li>6) Switch to low-fat dairy products</li> <li>7) Eat less red and processed meat</li> <li>8) Eat less salt, sugar</li> <li>9) Maintain a healthy balance</li> <li>10) Look for the keyhole label for healthy foods in the guide</li> </ol>
Document Description (no. of pages)	Document with several key recommendations, one-minute advice at the end (eat more or less of this of that). Have the Keyhole symbol in the document to identify healthy food products in each category, but also signals to manufacturers to "move product innovation." (22 total pages)
Self-Identified Target Audience	Healthy adults, adolescents, and children over 2 years of age.

 Table 7. Swedish FBDG document details, UN FAO (59).



Figure 12. Swedish FBDG sustainability considerations by domain and concept represented in text.

#### A.3 Sustainability in Quasi-Official or Supporting Document FBDG

#### France

Sustainability considerations are found, to some extent, in the supporting document of the French food guide. France's official FBDG, *The Food Guide for All*, is available only in French, so it was left out of the analysis for this study. However, the supporting document, *French National Nutrition and Health Program*, is the program under which the official French dietary

guidelines are published (9). Further document description and main messages about the French FBDG supporting document is outlined in Table 8 (page 111). The supporting dietary guidance does not specifically discuss environmental sustainability concerns, but makes social sustainability a priority with the first of four main focus areas being to "reduce nutrition-related health inequalities between social classes through specific actions within general preventive measure" (80)p13. Further, the French Agency for the Environment and Energy (ADEME), produced recommendations aimed at shaping shopping habits of 'eco-citizens' (9). The ADEME is an agency that works in France for advocacy and implementation of policy in sustainable development, energy, and environment. The recommendations of ADEME, focused on purchases, promote seasonality, combination of the environment and fun, buying ecolabled foods, and limiting food waste (9).

Despite the lacuna of official FBDG sustainability guidance, the country of France has made broader, more integrated changes towards sustainability in the food system. France scored highest in The Economist's Food Sustainability Index 2017, listed as the "global top performer" meaning that the country has demonstrated "strong and effectively implemented government policy on food waste and loss, agriculture-related conservation and research, and nutrition education" (133)p3. Further, it is illegal in France for supermarkets to discard food when it is approaching the sell-by-date (54).

The French supporting document for their FBDG has concepts from each domain included in its sustainability consideration. As expected, the domain most included is the health and nutrition domain (11/13, 85%), but this is closely followed by the markets and value chains domain (8/11, 73%). The sociocultural and political domain was half included (6/11, 55%) followed by the food security and agriculture (3/11, 27%) and environment and ecosystems

domains (3/11, 21%). Concepts included in the French FBDG are shown in Figure 13 (page

112).

Document	French National Nutrition Program (supporting the French Food Guide for All - avail. in French)
Development Process	Developed by a multi-sectoral committee with representatives from different ministries, national health agencies, public research, public research institutions, and "other relevant groups;" preliminary guides subjected to extensive consultation process with "variety of stakeholders and actors;" guidelines are part of the National Nutrition Policy
Key Messages	<ol> <li>Increase the consumption of fruits and vegetables, regardless of their forms (raw, cooked, natural, prepared, fresh, frozen or canned), to achieve at least 5 servings of fruits and vegetables per day.</li> <li>Consume foods that are rich in calcium (mainly dairy products, in addition to vegetables and mineral water rich in calcium, for those who consume mineral water)</li> <li>Limit the consumption of total fat and particularly of saturated fat; these are provided by certain foods which are best consumed in moderation (pastries, meats, butter, sauces and certain cheeses)</li> <li>Increase the consumption of starchy foods, including cereals (especially whole grain cereals, which provide fiber), potatoes, pulses, etc. They should be present at each meal.</li> <li>Eat meat, fish, other seafood and eggs alternating 1 or 2 times per day, giving preference to leaner meat cuts and fish (at least twice a week)</li> <li>Limit the consumption of sugar and foods high in sugar (soft drinks, candies, chocolate, pastries, desserts, etc)</li> <li>Limit the consumption of alcoholic drinks, which should not exceed 2 glasses (10 cl) of wine for women and 3 for men per day (2 glasses of wine of 10 cl are equal to 2 pints of beer or 6 cl of spirits)</li> <li>Increase physical activity in daily life to achieve at least the equivalent of 30 minutes of fast walking per day (take the stairs, running errands on foot, etc) and reduce sedentary activities in children (time spent watching tv, playing video games, etc)</li> <li>Limit the consumption of salt and always prefer iodized salt; enjoy the benefits of sunlight in moderation; and monitor your weight regularly.</li> </ol>
Document Description (no. of pages)	The National Nutrition Program has four "focus areas" and sets up the foundation for the official guide. FOCUS AREA 1: Reduce nutrition-related health inequalities between social classes through specific actions within general preventive measures. FOCUS AREA 2: Develop the practice of physical and sporting activities and limit sedentary behaviour FOCUS AREA 3: Organise detection and management of nutrition-related health conditions in patients; reduce the prevalence of undernutrition. FOCUS AREA 4: Prevent and manage the nutritional disorders of disabled people. The official guide provides 25 portraits that represent different patterns of eating behaviours (e.g. "I want to eat, protect my health and enjoy it" or "I struggle to make ends meet" or "I do not cook") and provides specific recommendations tailored to each one. (63 total pages)
Self-Identified Target Audience	The PNNS has developed guides for the general public, pregnant and lactating women, parents of children 0-3 years, parents of children 3-18 years, teenagers, people older than 55 years and caregivers of the elderly.
Type of Source Citied (number of sources)	Research Group – Uni (1); Book (1); In-country government resources (1); University Extension (1)

Table 8. French FBDG document details, UN FAO UN FAO (59).



Figure 13. French FBDG sustainability considerations by domain and concept represented in text.

Nordic Nutrition Recommendations: Denmark, Finland, Iceland, Norway, and Estonia (Sweden)

The Nordic countries (Finland, Sweden, Norway, Iceland, Denmark, Estonia) each develop their own official FBDG, but they are broadly informed by the Nordic Nutrition Recommendations (NNR), which includes evidence-based, population- and culture-specific guidelines for the countries' individual FBDG. The 2012 NNR includes a full chapter on the sustainability of food choices and the interrelations among health, food, the environment entitled "Sustainable food consumption – environmental issues" (83)p137. This study only analyzed the sustainability chapter for sustainability consideration and framing as it was most pertinent to the research question. A description of the full document and key messages can be found in Table 9 (page 114).

The NNR 2012 edition is the first version to include a full chapter designated to sustainability, though it is mainly focused on the GHG emissions as they relate to food and diets (9). The sustainability chapter recognizes that climate change is only one aspect of sustainability, but maintains that there is a lack of evidence available to inform guidance of dietary choices relating to other issues (e.g. economic and social aspects) (83). In recognition of the environmental aspects of sustainability, the opening statement of the sustainability chapter comments that "the way we choose to consume food has an effect on the environment as measured in terms of climate change, toxic impact, biodiversity, eutrophication, acidification, land use and change, and water use" (83)p137.

The Nordic Council of Ministers, the body that publishes the NNR, is an intergovernmental body that, among its other tasks, also sets up a labeling system to inform eater choices in markets. The Nordic "Keyhole" label is used in Nordic countries to highlight eater products that align with the NNR (9). Beyond the Keyhole label, Nordic countries party to the Nordic Council of Ministers use the NNR to shape their latest dietary guidelines. The current NNR published in 2014 (officially named NNR – 2012) informed the guidelines of Denmark,

Estonia, Finland, Iceland, Norway, and Sweden (note that Estonia is not a party to the Nordic Council of Ministers, but has distinct cultural attachments to the other Nordic Countries) (9).

Recognizing that it is the Sustainability Chapter of the NNR, the framing of sustainability in the document is generally broad across all the domains. Unsurprisingly, the environment and ecosystems domain (11/14, 79%) is the largest, and it is followed by the food security and agriculture domain (7/11, 64%). The health and nutrition domain (8/13, 62%) moderately included in this chapter, would probably be larger in the remainder of the document beyond the Sustainability Chapter. The final two domains were also moderately included with markets and value chains (6/11, 55%) and sociocultural and political (5/11, 45%) concepts present. The concepts included in the NNR in each of the five domains can be found in Figure 14 (page 115).

Document

Nordic Nutrition Recommendations – 2012

Development Process	A "Nordic perspective" has been considered in setting the NNR reference values. Claim to have used an evidence-based and transparent approach in assessing the associations among nutrients, foods, and certain health outcomes. Systematic reviews and individual chapters were peer-reviewed, reviews were published in the Food & Nutrition Research journal. Draft chapters of the NNR were open to public consultation. "Recommendations have been changed only when sufficient scientific evidence has evolved since the 4th edition."
Key Messages	"This 5th edition, the NNR 2012, gives Dietary Reference Values (DRVs) for nutrients, and compared with earlier editions more emphasis has been put on evaluating the scientific evidence for the role of food and food patterns contributing to the prevention of the major diet-related chronic diseases. Recommendations on physical activity are included and interaction with physical activity has been taken into account for the individual nutrient recommendations wherever appropriate. A chapter on sustainable food consumption has been added."
Document Description (no. of pages)	Book with several chapters that Nordic countries are supposed to derive nutrition guidance from. (Sustainability Chapter: 24 pages, Full document: 627)
Self-Identified Target Audience	"The primary aim of the NNR 2012 is to present the scientific background of the recommendations and their application. A secondary aim is for the NNR 2012 to function as a basis for the national recommendations that are adopted by the individual Nordic countries."
Type of Source Citied (number of sources)	Public Health Journal (11); International Non-governmental Organization (10); Research Group - Uni (3); Other country government resource (3); In-country government resources (21); University Extension (1)

Table 9. Nordic Nutrition Recommendations document details, UN FAO (59).



Figure 14. Nordic Nutrition Recommendations Sustainability Chapter sustainability considerations by domain and concept represented in text.

# The Netherlands

The Dutch FBDG, though focused on the nutrition aspects of the scientific evidence behind dietary recommendations, has a small segment about the environment. The section entitled "Ecological Aspects" in the official FBDG claims that "following a number of the recommendations would lead to dietary patterns with ecological benefits" (81)p78. The guidelines further point out that the new version has implied "lower ecological burden" because they recommend eating fish only once a week as opposed to the 2006 version recommending eating fish "less than twice a week" (81)p78. In recognizing the difficulty of making sustainability claims, the Dutch FBDG also asserts that simply following the guidelines is not sufficient to cause any significant reductions in food-related ecological impacts; reductions in a more significant sense would need to come from larger changes to the food system or "food production chain" as the guide names it (81)p78. The document and the key messages of the FBDG of the Netherlands are further described in Table 10 (page 117).

The Netherlands brought sustainability into their food policy in through more incremental path. A 2008 food policy document was produced by the Dutch Ministry of Agriculture based on broader European Union language about sustainable food consumption and production (54). The 2008 policy was followed by a 2011 Dutch Health Council report on dietary guidelines being a necessary step in protecting the environment (54). The 2015 official FBDG of the Netherlands followed that report, but the focus of the guidelines is almost entirely on health and nutrition (9). The Dutch FBDG includes concepts from each of the five domains, but not in as balanced of proportions. The official Dutch FBDG (not supporting document) is the only document that includes a larger proportion of the sociocultural and political domain (7/11, 64%) than the health and nutrition domain (8/13, 62%). Markets and value chains (5/11, 45%) is included more than the environment and ecosystems (4/14, 29%) and food security and agriculture domains (2/11, 18%). The exact concepts included in the FBDG of the Netherlands can be found in Figure 15 (page 118).

Document	Dutch Dietary Guidelines (Advisory Report)
Development Process	Expert committee developed the advisory report with "current knowledge" on relationship between diet and chronic disease with associated healthy dietary pattern recommendations.
Key Messages	<ul> <li>Follow a dietary pattern that involves eating more plant-based and less animal-based food, as recommended in the guidelines;</li> <li>Eat at least 200 grams of vegetables and at least 200 grams of fruit daily;</li> <li>Eat at least 90 grams of brown bread, whole meal bread or other wholegrain products daily;</li> <li>Eat legumes weekly;</li> <li>Eat at least 15 grams of unsalted nuts daily;</li> <li>Take a few portions of dairy produce daily, including milk or yogurt;</li> <li>Eat one serving of fish weekly, preferably oily fish;</li> <li>Drink three cups of tea daily;</li> <li>Replace refined cereal products by whole-grain products;</li> <li>Replace butter, hard margarines, and cooking fats by soft margarines, liquid cooking fats, and vegetable oils;</li> <li>Replace unfiltered coffee by filtered coffee;</li> <li>Limit the consumption of sugar-containing beverages;</li> <li>Don't drink alcohol or no more than one glass daily;</li> <li>Limit salt intake to 6 grams daily;</li> <li>Nutrient supplements are not needed, except for specific groups for which supplementation applies</li> </ul>
Document Description (no. of pages)	FBDG represented by a circle (the actual guide is in Dutch); Circle divided into four food groups and one beverage group; fruits, vegetables, and breads, cereals and potatoes are more than half of the circle; animal-source foods, spreads and cooking fats make up smaller part; water, tea, and coffee complete the circle (94 total pages)
Self-Identified Target Audience	Advisory Report is for background "The guidelines document is used by professionals, particularly health providers and nutritionists." FBDG: for general public over the age of 2
Type of Source Citied (number of sources)	Public Health Journal (14); International Non-governmental Organization (2); Other country government resource (4); In-country government resources (45)

Table 10. Dutch FBDG document details, UN FAO (59).



Figure 15. The Netherlands FBDG sustainability considerations by domain and concept represented in text. The United Kingdom

The official FBDG of the United Kingdom does not include much integrated sustainability language. In the section on meat and alternatives, the one mention of sustainability is in choosing fish from "sustainable sources," otherwise there are few other indications that sustainability was considered in the development of the official UK FBDG (82). A more detailed overview of the UK FBDG is listed in Table 11 (page 120). After the nutrition scientists of Public Health England requested environmental advice from the Carbon Trust (54), their 2016 FBDG does recommend a cut back on processed and red meats (82); yet, this limits dietary advice to the ubiquitous dichotomy of nutrients and carbon (54).

Though there was broad system support for sustainability to be a main piece of the UK food policy landscape, government shifts prevented national sustainability language in an official capacity. A 2008 Cabinet Office Food Matters review proposed a change in the national food system after the oil and food prices spiked in 2007-2008 in the UK (54). 2008 was the same year that the UK government established the Council of Food Policy Advisors, which was formed to advise the government on food affordability, security, supply, and environmental impact (9). The council released a report in 2009 with three areas identified for government action "government [should] a) define a low impact (sustainable) healthy diet; b) exemplify best practice in health and sustainability through public food procurement; and c) [create] a strategy for increasing consumption and domestic production of fruit and vegetables" (139)p6. A national food policy strategy "Food 2030" committed the UK government to specifically promote sustainable diets in a systematic approach to link public health advice and ecological food supply (54). However, government action for sustainability in diets essentially ceased overnight with the 2010 election and the change of government (54). The same Department for Environment, Food and Rural Affairs that published the 2009 report for government action, then downplayed a Green Food Project under food industry pressure (54).

The FBDG of the United Kingdom is a relatively short document compared to the other countries in this analysis at 11 pages. Four of the five domains are included, but in a relatively low amount. The domain with the most inclusion is the health and nutrition domain (6/13, 46%)

as expected, then the sociocultural and political (3/11, 27%) follows. Markets and value chains

(1/11, 9%) has one concept included as does environment and ecosystems (1/14, 7%), none from

the food security and agriculture domain are included (0/11, 0%). The 11 concepts in the four

domains included in the UK FBDG are listed in Figure 16 (page 121).

Document	United Kingdom Eatwell Guide Booklet
Development Process	The national document, "The Balance of Good Health" (1994), was changed in 2007 to "The Eatwell Plate." The most recent model was revised with the leadership of Public Health England.
Key Messages	<ol> <li>Eat at least 5 portions of a variety of fruit and vegetables every day.</li> <li>Base meals on potatoes, bread, rice, pasta or other starchy carbohydrates; choosing wholegrain versions where possible.</li> <li>Have some dairy or dairy alternatives (such as soya drinks); choosing lower fat and lower sugar options.</li> <li>Eat some beans, pulses, fish, eggs, meat and other proteins (including 2 portions of fish every week, one of which should be oily).</li> <li>Choose unsaturated oils and spreads and eat in small amounts</li> <li>Drink 6-8 cups/glasses of fluid a day.</li> <li>If consuming foods and drinks high in fat, salt or sugar, have these less often and in small amounts.</li> </ol>
Document Description (no. of pages)	The UK's national food guide, the Eatwell Guide, is a visual representation of how different foods contribute towards a varied and nutritious diet. It is based on 5 food groups and shows the proportion that each food group should contribute to a healthy balanced diet. (11 total pages)
Self-Identified Target Audience	The Eatwell Guide is the key nutrition policy tool for health professionals and others working to improve dietary health. It is supported by the 8 tips for eating well. The guidelines are directed at the general population from the age of 2 years. Between the ages of 2 and 5 years, children should start moving towards the diet depicted in the Eatwell Guide.
Type of Source Citied (number of sources)	No references are cited for the document, but they give a list of resources to turn to for more information: In-country government resource (4)

Table 11. British FBDG document details, UN FAO (59).





## Australia

Much like the United Kingdom, Australia has had calls from sectors of the country to include sustainability considerations in food policy, but government changes and industry input hampered suggested sustainability integration. The official 2013 Australian Dietary Guidelines do not make explicit sustainability references in the recommendations in the body of the text.

However, the calls for sustainability were relegated to the appendices with one appendix on "equity and the social determinants of health and nutrition status" (p101) and another regarding "food, nutrition, and environmental sustainability" (67)p130. The full document of the Australian FBDG is described in Table 12 (page 123). The UN FAO report the categories for this study are based on grouped Australia as a country with attempts to include sustainability (9). However, with government shifts away from the framing, the inclusion of sustainability only in the appendix is taken to be a reticent commitment to sustainability by the Australian government (9,54).

Despite its categorization by the UN FAO as a country with attempts at sustainability or where sustainability was only discussed, the Australian FBDG has the most comprehensive inclusion of sustainability concepts in the five domains of any country in this analysis. Granted, the Australian document is the longest and the sustainability consideration is relegated to the appendices, it is a broad conceptual inclusion in each of the five domains. All of the markets and value chains (11/11, 100%) and all of the health and nutrition (13/13, 100%) concepts were included in the document. Food security and agriculture (10/11, 91%) is broadly included and the sociocultural and political (9/11, 82%) and environment and ecosystems (11/14, 79%) domains follow. The full listing of the concepts included in the Australian FBDG can be found in Figure 17 (page 124).

Document	Australian Dietary Guidelines
Development	Review led by committee of the National Health and Medical Research Council; jointly
Process	partnered and funded by the Commonwealth Department of Health.
Key Messages	The guidelines include five core recommendations which aim to direct people to the types and
	amounts of foods they should consume.
	1. To achieve and maintain a healthy weight, be physically active and choose amounts of
	nutritious food and drinks to meet your energy needs.
	2. Enjoy a wide variety of nutritious foods from these five groups every day: plenty of
	vegetables, including different types and colours, and legumes/beans; fruit; grain (cereal)
	foods, mostly wholegrain and/or high cereal fibre varieties, such as breads, cereals, rice, pasta,
	noodles, polenta, couscous, oats, quinoa and barley; lean meats and poultry, fish, eggs, tofu,
	nuts and seeds, and legumes/beans; milk, yoghurt, cheese and/or their alternatives, mostly
	reduced fat (reduced fat milks are not suitable for children under the age of 2 years). And drink
	plenty of water.
	3. Limit intake of roods containing saturated rat, added sait, added sugars and alconol.
	4. Encourage, support and promote breastieeding.
Document	The Guidelines are a large formal document "providing the scientific evidence for healthier
Description (no. of	Australian diets" and stens through each of the five main guidelines in denth. Australia uses a
pages)	plate visual to guide healthy eating that visually represents the proportion of the five food
Pubee)	groups for recommended consumption each day. The food groups included in the plate are:
	grain cereal foods; vegetables and legumes/beans; fruits; lean meats and poultry, fish, eggs,
	tofu, nuts and seeds; reduced fat dairy products and/or alternatives.
	(210 total pages)
Self-Identified	The Australian dietary guidelines are aimed at the healthy population aged over 2 years. The
Target Audience	document includes specific information for population sub-groups such as pregnant women,
	children or older adults where there are significant differences in nutritional requirements
	when compared to the general population.
Type of Source	Public Health Journal (808); International Non-governmental Organization (73); Research
Citied (number of	Group – Uni (16); Other country government resource (10); Book (26); In-country government
sources)	resources (195)

document details, UN FAO (59)



Figure 17. Australian FBDG sustainability considerations by domain and concept represented in text. *China* 

China has a brief, yet multi-format set of guidelines developed with succinct sustainability messaging that contributes to recommendations with comparatively low

environmental impacts<sup>2</sup>. The 2007 version was shortened from ten to six guidelines in the 2016 edition, and the latest version included recipes, visual graphics, and charts for ease of use by the population (54). The details of the Chinese FBDG document are outlined in Table 13 (page 126).

Environmental factors are mentioned in the dietary guidance from the Chinese Nutrition Society in the sixth of six guidelines recommending citizens "eliminate waste and develop a new ethos of diet civilization" (84)p3. In an international comparison of 38 national FBDG, the diet outlined in the 2016 Chinese FBDG ranks among the lowest in environmental impacts of recommendation-compliant diets measured in land use (in ha), eutrophication (in kg phosphate), and GHGs (in kg carbon dioxide equivalents) (60). Even with a short sustainability mention in the guidelines, the messaging at the health and nutrition level would itself, when adhered to by the population, have a low environmental impact. Yet, there is not enough available in English or enough room in the short set of guidelines to consider much beyond the environmental and a few sociocultural aspects of sustainability in the Chinese FBDG.

The Chinese FBDG is one of the shortest documents reviewed in this analysis but has at least one sustainability concept from each of the five domains considered. Not surprisingly, the health and nutrition domain has the most inclusion (7/13, 54%), then the sociocultural and political domain (2/11, 18%) follows. The last three domains each have one concept included in the Chinese FBDG: markets and value chains (1/11, 9%), food security and agriculture (1/11, 9%), and environment and ecosystems (1/14, 7%). Concepts included in the Chinese FBDG are listed in Figure 18 (page 127).

<sup>&</sup>lt;sup>2</sup> The official FBDG from China are only available in Chinese, so the information for this study came from Wang et al. 2016 in the Journal of Zhejiang University-SCIENCE B (Biomedicine & Biotechnology) (84).

Document	Chinese Dietary Guidelines and the Food Guide Pagoda
Development Process	The guidelines have been prepared and revised by the Chinese Nutrition Society in collaboration with various stakeholders. The 2007 version was developed by a Commission comprised of experts from the Chinese Nutrition Society and proclaimed by the Ministry of Health. The 2016 version is a revision of the 2007 guidelines.
Key Messages	<ol> <li>Eat a variety of foods, with cereals as the staple</li> <li>Balance eating and exercise to maintain a healthy body weight</li> <li>Consume plenty of vegetables, milk, and soybeans</li> <li>Consume an appropriate amount of fish, poultry, eggs, and lean meat</li> <li>Reduce salt and oil, and limit sugar and alcohol</li> <li>Eliminate waste and develop a new ethos of diet civilization</li> </ol>
Document Description (no. of pages)	China uses the 'Food Guide Pagoda', which embodies the core recommendations of the guidelines. It includes 5 levels, representing the recommended proportion of the different food groups in the diet. Recommendations to drink plenty of water and to do physical activity are also included in the food guide. In addition, two auxiliary graphics have been developed for better understanding and practical use: the 'Balanced diet abacus' and the 'Balanced meal plate'. (3 total pages)
Self-Identified Target Audience	The guidelines are directed at the general population (healthy people over 2 years of age) and include recommendations for specific population groups.
Type of Source Citied (number of sources)	No sources are cited in the document which is the list of the recommendations and smaller details explaining the advice.
Table 13. Chinese FBDG document details, UN FAO (59).	



Figure 18. China FBDG sustainability considerations by domain and concept represented in text. United States of America

The United States FBDG are a case of federally mandated changes not taking into consideration the full scope of scientific evidence, expert recommendations, and public input. The United States government is required to update the dietary guidelines every five years led by the US Departments of Agriculture (USDA) and Health and Human Services (HHS) (9). In the development process of the 2015-2020 edition, which occurred during 2013-2015, the Dietary Guidelines Advisory Committee (DGAC) published a report that argued for the promotion of food security and the further consideration of evidence showing the impacts of food consumption on the planet (9). The 2013 DGAC membership included a scientist who was called by the Obama administration specifically to consider the relationship of diets and the environment for the first time (54); the committee was made of 14 experts in human health and nutrition, who were assisted by three outside consultants on sustainable food systems, agriculture, and the environment (9). Yet, despite calls from the DGAC to link "health, dietary guidance, and the environment [to] promote human health and the sustainability of natural resources and ensure current and long-term food security," there was compelling resistance to broadening the guidelines to include considerations beyond nutrition (73)p5. The DGAC report, submitted by law to the Secretaries of State for the USDA and HHS, was not well-received by the former, who accused the recommendations of "dietary nannying" causing the guidelines to be published restricted to the nutrition-based approach alone, any explicit sustainability language eliminated from the final publication (54).

The US FBDG do address broader considerations of diets outside of health through the use of the "social-ecological model for food and physical activity decisions" included to "help health professionals understand how layers of influence intersect to shape a person's food and physical activity choices" (51)p65. The categories of factors that influence food and beverage intake highlighted in the Social-Ecological Model in the US FBDG are a) social and cultural norms and values (e.g. religion, body image, traditions); b) sectors (e.g. systems, organizations, business and industries); c) settings (e.g. homes, schools, worksites); and d) individual factors (e.g. demographics and other personal factors) (51). One of the resources cited for the

information in the Social-Ecological Model is an article by Story et. Al. (2008) entitled "Creating healthy food and eating environments: Policy and environmental approaches" (140). Later in the official US FBDG document, there are sections on "food access" and "household food insecurity" (p67), as well as guidance to readers about setting up environments (e.g. homes, schools, and communities) to align with the dietary guidelines (51). Table 14 (page 131) gives an overview of the US FBDG document and lists the key messages.

The US FBDG contains concepts from each of the domains, but there is not a balance of representation across the domains. Since the sustainability considerations were largely left out of the document, as cited above, the environment and ecosystems domain has the lowest amount of inclusion (2/14, 14%) and the health and nutrition domain (13/13, 100%) has the highest. The markets and value chains domain (8/11, 73%) is the second most included, followed by the sociocultural and political (7/11, 64%) and the food security and agriculture domain (5/11, 45%). Figure 19 (page 131) Table 14 (Page 131) lists the concepts included in each domain in the US FBDG.
Document	2015–2020 Dietary Guidelines for Americans
Development Process	Update happens in two stages 1. Reviewing the current scientific evidence: public was invited to submit comments throughout advisory deliberations; The Committee used four methods to examine the scientific evidence on the relationships between diet and health: original systematic reviews; review of existing systematic reviews, meta-analyses, and reports by federal agencies or leading scientific organizations; data analyses; and food pattern modeling analyses. The work of the Advisory Committee was submitted to the Secretaries of HHS and USDA in the Scientific Report of the 2015 Dietary Guidelines Advisory Committee and made available for public comment. 2. Development the Dietary Guidelines for Americans: The Dietary Guidelines for Americans document is written by a group of experts from both HHS and USDA, who have extensive knowledge of nutrition and health science, federal nutrition recommendations, and program implementation. The 2015-2020 edition builds upon the 2010 edition with the scientific justification for revisions informed by the Advisory Committee's report and consideration of public and Federal agency comments. A peer-review step also was completed, in which non-federal experts independently conducted a confidential review of the draft policy document for clarity and technical accuracy of the translation of the evidence from the Advisory Report into policy language. The final 2015-2020 Dietary Guidelines was reviewed and approved by agencies across both Departments and, ultimately, by the Secretaries of HHS and USDA.
Key Messages	<ul> <li>The 2015-2020 Dietary Guidelines for Americans provides five overarching Guidelines that encourage healthy eating patterns:</li> <li>1. Follow a healthy eating pattern across the lifespan. All food and beverage choices matter. Choose a healthy eating pattern at an appropriate calorie level to help achieve and maintain a healthy body weight, support nutrient adequacy, and reduce the risk of chronic disease.</li> <li>2. Focus on variety, nutrient density, and amount. To meet nutrient needs within calorie limits, choose a variety of nutrient-dense foods across and within all food groups in recommended amounts.</li> <li>3. Limit calories from added sugars and saturated fats and reduce sodium intake. Consume an eating pattern low in added sugars, saturated fats, and sodium. Cut back on foods and beverages higher in these components to amounts that fit within healthy eating patterns.</li> <li>4. Shift to healthier food and beverages choices. Choose nutrient-dense foods and beverages across and within all food groups in place of less healthy choices. Consider cultural and personal preferences to make these shifts easier to accomplish and maintain.</li> <li>5. Support healthy eating patterns for all. Everyone has a role in helping to create and support healthy eating patterns in multiple settings nationwide, from home to school to work to communities.</li> </ul>
Document Description (no. of pages)	The guidelines are a large formal document with three main chapters (1. Key Elements of Healthy Eating Patterns; 2. Shifts Needed to Align with Healthy Eating Patterns; 3. Everyone Has a Role in Supporting Healthy Eating Patterns) and an accompanying visual, MyPlate. The US Department of Agriculture's food icon, MyPlate, serves as a reminder to help individuals make healthier food choices. The MyPlate icon emphasizes the fruits, vegetables, grains, protein foods, and dairy groups. MyPlate is intended to prompt individuals to think about building a healthy plate at meal times. (122 total pages)
Self-Identified Target Audience	The Dietary Guidelines is intended for policymakers, nutrition educators, and health professionals in developing nutrition policy, education messages, and eater materials for the general public and for specific audiences, such as children. Recommendations from the Dietary Guidelines are intended for Americans ages 2 years and older, including those at increased risk of chronic disease. The focus of the Dietary Guidelines is disease prevention – they are not intended to treat disease.

Document	2015–2020 Dietary Guidelines for Americans
Type of Source Citied (number of sources)	
	Public Health Journal (2); In-country government resources (21)

 Table 14. American FBDG document details, UN FAO (59).



Figure 19. US FBDG sustainability considerations by domain and concept represented in text.

## Appendix B

Domains	Key components of a sustainable diet	Keywords/Description of concepts
Health and Nutrition	Communicable Disease Burden of Population	Infectious disease, parasitic infections, bacterial infections
	Dietary Diversity	Diet quality, nutrient adequacy of diet
	Exercise, Physical Activity or Sedentary Lifestyles	Physical fitness
	Food Safety and Foodborne Illness or Contamination	Adulteration, sanitation, food handling, overuse of antibiotics
	Health Influence of Agriculture and diseases linked to chemicals and pesticide use	Infectious diseases, zoonotic, vector borne
	Malnutrition (in all forms)	Stunting (and related cognitive development), undernutrition, underweight, overweight, obesity, wasting, double burden, micronutrient deficiency
	Non-communicable Disease Burden of the Population	Cardiovascular disease, diabetes, stroke, asthma, allergies, chronic disease, diet-related disease
ood Security	Energy, macronutrients and ultra- processed foods consumed	Fat, sugar, calories, junk food
	Sanitation and Hygiene	Hand washing, open defecation, access to clean water
Food Security	Diverse Production Systems	Gardens, community farms, intercropping, crop diversity
Food Security and agriculture	Food access and Food security	Food assistance, food poverty, social safety nets, cash transfer, food aid
	Food Production and Agricultural Productivity	Quantity of food produced, yield
	Incentives or Disincentives for Production	Subsidies, fiscal policy, technology adoption, extension
	Intra-household distribution of food	Allocation of food within the household
	Nutritional Quality of Food Being Produced	Nutrient-rich foods, Nutrient-dense
	On Farm Food Loss Seasonality, Local and Indigenous Crops	Post harvest loss, loss during harvest Traditional crops, wild foods, seasonality, indigenous
	Soil Health and Fertility	Soil nutrient management, nutrient cycling, organic matter, composting
	Sustainable Agriculture and Intensification	Climate smart agriculture, IPM, precision agriculture, good agricultural practices
	Water use for agricultural production	Draining of reserves, irrigation, rain water collection, waste water use, catchment systems
	Air Pollution and Quality	Cooking fuel exhaust, smoke
	Biodiversity	Extinction, endangerment, overfishing, invasive species, monocultures, exploitation, landraces

## **B.1** Original framework from Down's et al. (2017)

Domains	Key components of a sustainable diet	Keywords/Description of concepts
Environment and Ecosystems	Clean Energy and Green or Sustainable Technologies	Hydropower, solar energy, fuel-efficient technologies, renewable energy sources, biofuels (including from animal waste)
	Deforestation, Wetland and Agricultural Land Loss	Conservation, land use conversion, degradation, alteration of natural habitats
	Ecosystem Services (including Fish Stocks & Marine ecosystem)	Management of natural resources
	Fossil fuel use (Cultivation, Processing & Transport)	Coal, charcoal, solid cooking fuel use
	GHG emissions	CO2, CH4, nitrous oxide, chlorofluorocarbons
	Multi-functional Landscapes	Landscapes that simultaneously provide food security, livelihood opportunities, maintenance of species and ecological functions
	Pesticide, Herbicide and Fertilizer Use Resilience	Agricultural inputs, chemical fertilizer, bio/organic fertilizer Climate change, climate variability, extreme weather, natural disasters, floods, droughts
	Soil contamination, loss and degradation	Erosion, salinity
	Water contamination and quality	Chemical/agricultural run-off, salinity
Markets, trade and value chains	Adequate Infrastructure and Access to Markets	Distance to markets, market infrastructure, legal access, formal markets, transport costs to market, roads, storage, cold chain storage
chants	Food availability and affordability	Food prices food environment
	Employment in value chain	Food processing, food service, food retail
	Food Distribution and Transport	Food miles (from farm to plate)
	Food marketing	Advertising, food packaging, food promotion, media outreach, social marketing
	Food waste	Food loss, food discard
	Gross Domestic Product (GDP)	Economic productivity, economic growth, Agricultural GDP
	Globalization of markets/trade	Imports, exports, foreign direct investment, international markets, trade agreements, investment agreements, commercialization, trade deficit
	Incomes and livelihoods	Subsistence farming, poverty alleviation
	Rural-urban migration	Urbanization, agricultural transition, abandonment of farmlands
Sociocultural and	Animal welfare	Animal poaching, animal rearing, confined-animal feeding operation, animal husbandry
political	Food consciousness	Trends and general awareness of how various diet affects health issues and environmental issues
	Conflict	War, fragile states, violence, instability, humanitarian crisis
	Consumer acceptability and taste	Convenience, preferences
	Increased consumer demand for	Demand for animal products, foods rich in micronutrients,
	nutrient-rich and diversified foods Equity Issues	processed and ready made foods, diversity of food products Vulnerable populations, gender, at risk populations, low
	Food Sovereignty and Food Rights	Right to food, farmer rights, control/ ownership of food system, food sufficiency
	Food knowledge, skills, and education	Cooking, food preparation, training, recipes, nutrition knowledge, nutrition/health literacy
	Labor Conditions and Standards Land tenure	Workers rights, labor shortage, workload Land grabbing, land ownership, land use planning, zoning

Table 15. Theoretical foundation for this thesis: an overview of the key concepts and keywords describing concepts of the sustainable diets policy analysis framework applied to Nepal food policy. Permission to

reproduce in this thesis granted from Downs et al. (2017).

## **B.2** Full framework with definitions and examples developed in this study

Domain	Concepts	Concept Definition	Concept Source	Example	Example Reference	Changes Made from Original	Code Count	Files Coded
Environment and Ecosystems	agricultural inputs	pesticides, herbicides, fertilizers, over-fertilization, synthetic, chemicals, dioxins PCBs, poison, phosphorus, contaminants, organic fertilizers, bio-fertilizers, spray, mechanization, industrialization	Donini 2016, Garnett 2014	Becoming your own gardener and producer of vegetables, fruits or even just of some aromatic herbs, increases the sense of value of food. Discover how delicious food can be grown economically and organically, without the use of chemicals.	Brazil FBDG	pesticides combined into concept, added industrialization and mechanization from NNR	67	10
	air quality	air pollution, smoke, cooking fuel exhaust	Downs 2017	People from South-East Asia are less likely than Australian-born people to smoke, drink alcohol at risky or high- risk levels and be overweight or obese.	Australia FBDG	added air pollution from Sustainability Professional feedback	9	3
	biodiversity	extinction, endangerment, overfishing, depleted, trawling, scraping, invasive species, monocultures, exploitation, landraces, threatened species, rich diversity of plant and animal life, flora, fauna, pollination, bees, biological diversity	Burlingame 2012, Donini 2016, Garnett 2014, Gonzalez Fischer 2016, Johnston 2014, Lang 2017, Roos 2015	Free-range beef and lamb can also have positive effects. In Sweden, for example, they help to produce a rich agricultural landscape and ensure that natural pastures are kept open. This benefits lots of species under threat.	Sweden FBDG	added depleted from Qatar FBDG	40	6
	conservatio n	deforestation, wetland loss, agricultural land loss, land use conversion, protecting the environment, environmental quality, wildlife, habitat loss	Behrens 2017, Downs 2017, Roos 2015	Planetary boundaries In general, current sustainable food consumption issues have been focused on climate impact, i.e. in terms of greenhouse gas emission (carbon dioxide equivalents), and less on the effect of toxic impact, biodiversity, eutrophication, acidification, land use, land use change, and water use.	NNR	deforestation, wetland loss, and agricultural loss combined into conservation, added wildlife from Sustainability Professional feedback	17	5

Domain	Concepts	Concept Definition	Concept Source	Example	Example Reference	Changes Made from Original	Code Count	Files Coded
	ecosystem services	fish stocks, fish farming, marine ecosystems, sustainable stocks, land ecosystems, natural resource management, wild resource	Garnet 2014, Johnson 2014	Depending on their characteristics, the production and the distribution of foods can be socially and environmentally sustainable, promoting justice and protection of the living and physical world, or else may generate social inequalities and threats to natural resources and biodiversity.	Brazil FBDG	added wild resource from Sweden FBDG	20	6
	fossil fuel use	processing, transport, coal, charcoal solid cooking fuel, non- renewable energy	Johnston 2014	The production and consumption of food, including processing, packaging, transportation, and waste disposal all affect our environment.	Qatar FBDG	added non-renewable energy from Brazil FBDG	15	5
	greenhous e gas emissions	carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, emissions, pollutants	Behrens 2017, Donini 2016, Garnett 2014, Johnston 2014, Roos 2015	The impact on climate is estimated by computing and converting the greenhouse gases into carbon dioxide equivalents (CO2e) which is the summary measurement of the emissions of carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and the extremely powerful refrigerants used to keep fish cold on ships at sea.	NNR	added emissions from Qatar, added pollutants from Sweden Supporting Doc	37	7
	land use	species maintenance, ecological cultivation, agro-ecological production, ecological production, environmental integrity, agricultural security, multi-functional landscapes, rich agricultural landscape, productive lands	Downs 2017, Gonzales Fisher 2016, Lang 2017	Support and find bargains at specialty shops, municipal and farmers' markets, street vendors, and other places selling fresh or minimally processed foods, including those produced by organic and agro- ecological methods.	Brazil FBDG	combined multi- functional landscapes into land use concept, added: land use from Australia, ecological integrity and agro- ecological from Brazil, rich agricultural landscape from Sweden FDBG, ecological cultivation and ecological production from Sweden supporting doc	15	6

Domain	Concepts	Concept Definition	Concept Source	Example	Example Reference	Changes Made from Original	Code Count	Files Coded
	resilience	climate change, global warming, climate variability, sustainable, sustainability	Garnett 2014, Roos 2015, Lang 2017	Historically, dietary guidance has been based on experimental evidence from nutritional science and epidemiology, with sustainability often referred to in the context of 'triple bottom line' considerations of economic, social and environmental factors.	Australia FBDG	resilience split into stability concept, sustainable and sustainability added by author	156	9
	soil degradatio n	soil loss, soil contamination, erosion, salinity	Johnston 2014	PRIMARY PRODUCTION (agriculture and aquaculture) soil loss; polluted runoff; greenhouse gases; waste	Australia FBDG	concept name shortened and placed into the concept definition	3	1
	stability	extreme weather, natural disasters, floods, droughts	Garnett 2014, Roos 2015, Lang 2017	-	-	stability split into separate concept from resilience, centered on climate patterns	0	0
	sustainable technologie s	fuel-efficient technologies, renewable energy sources, biofuels, clean energy sources, biofuels, clean energy, green energy, waste heat, genetically modified foods (GMOs)	Downs 2017	The climate impact from producing peppers and tomatoes has dramatically declined with the introduction of residual heat use from nearby industries and the use of renewable energy sources. In Iceland, a substantial portion of the tomatoes consumed comes from greenhouses heated by geothermal power.	NNR	added waste heat from Sweden supporting doc, added GMOs from Brazil FBDG	4	3
	waste	solid waste, plastic, packaging, landfills, reusable bags, recycle, trash, garbage	Added by author	This all results in environmental degradation and pollution, loss of biodiversity, and draining and loss of water, energy and other natural resources. Production and consumption also causes creation of vast amounts of waste and garbage, dumped in disgusting and dangerous landfill sites.	Brazil FBDG	waste concept added by author, added: reusable bags, recycling, trash, garbage from Sustainability Professionals; solid waste from Qatar FBDG; plastic from US FBDG; packaging from German FBDG; landfills from Brazil FBDG	39	8

Domain	Concepts	Concept Definition	Concept Source	Example	Example Reference	Changes Made from Original	Code Count	Files Coded
	quality	off, agricultural run-off, salinity, eutrophication, acidification	Downs 2017	pollution and lakes without problems with over-fertilization or acidification, to functioning ecosystems in forests and agricultural land.	supporting doc	Sweden supporting doc		
	agricultural productivit y	food production, quantity of food produced, yield, scale, arable land, healthy land	Johnston 2014	The environmental consequences of food production depend on the agricultural system used and the particular environmental aspect examined, as these differ in impact, with implications for yield, quality and affordability.	Australia FBDG	concept name shortened and placed into the concept definition; added yield and scale from Australia FBDG	17	6
Food Security and Agriculture	diverse production systems	gardens, community farms, intercropping, crop diversity, crop succession, urban agriculture, peri-urban agriculture, polyculture	Johnston 2014	As a citizen, you can also support the movement to create and develop community gardens to produce organic foods. These gardens, created in city squares, streets and other locations, and within schools, community centres, and health units and other public spaces, encourage interaction, strengthen the community, and produce healthy food. You can go further and as a member of an organisation press the municipal authorities to support urban and peri-urban agriculture projects that encourage organic food production in unused areas in and around cities, including for example planting fruit trees in public spaces.	Brazil FBDG	added crop succession from Sweden supporting doc; added polyculture from Sustainability Professionals	11	5

omain	Concepts	Concept Definition	Concept Source	Example	Example Reference	Changes Made from Original	Code Count	Files Coded
	food security	food assistance, food poverty, social safety nets, welfare, welfare dependent, cash transfer, food aid, food access, accessibility	Burlingame 2012, Donini 2016, Garnett 2014, Gonzalez Fisher 2016, Lang 2017	This means, the right of every person to have uninterrupted physical and economic access to adequate food, or access to the means for obtaining food, without compromising other fundamental rights, such as those to health and education.	Brazil FBDG	added welfare and welfare-dependent from Brazil FBDG	74	6
	food system	food chain, systems of food production	Added by author	Considering the multiple determinants of feeding practices and the complexity and challenges that are involved in the shaping of current food systems, the Food Guide reinforces the commitment of the Ministry of Health to contribute to the development of strategies for the promotion and realization of the human right to adequate food.	Brazil FBDG	concept added from Brazil FBDG	57	5
	intra- household food distribution	food allocation among family members or members in household	Donini 2016	Hence the recommendation above, that family and household members share responsibility for all household activities related to food acquisition and preparation of meals.	Brazil FBDG	connections made to food literacy and skills	22	4
	nutritional quality	quality of food being produced, nutrient-rich foods, nutrient- dense foods	Downs 2017, Gonzalez Fisher 2016	There are many different ways that these nutrient-dense foods can be chosen to contribute to nutritious dietary patterns that suit personal preferences. However economic, social and cultural factors can affect the ability of individuals and groups to access nutritious foods.	Australia FBDG	in FBDGs this concept is more about food choice than production	25	3
	on farm food loss	post-harvest loss, loss during harvest	Donini 2016	-	-	not included in any FBDGs	0	0

Domain	Concepts	Concept Definition	Concept Source	Example	Example	Changes Made from	Code	Files
	seasonal, local, indigenous crops	traditional crops/foods/farming, wild foods, seasonal, indigenous, local, regional	Burlingame 2012, Donini 2016, Johnston 2014	Traditional dietary patterns, evolved and adapted often for very many generations, are also vital evidence. These amount to vast repositories of knowledge about the types and varieties of plants and animals best adapted to climate and terrain and other environmental factors, to techniques of production that have proved to be most productive and sustainable.	Brazil FBDG	added traditional foods/crops/farming from Brazil FBDG	100	10
	soil health and fertility	soil nutrient management, foil fertility, nutrient cycling, nitrogen cycle, organic matter, composting	Johnston 2014, Lang 2017	Milk cows often eat a large amount of hay, and ley farming for several years is positive for crop succession, the fertility of the fields and to keep down the use of pesticides in the cultivated landscape.	Sweden supporting doc	added nitrogen cycle from Sustainability Professionals	10	3
	sustainable agriculture and intensificati on	climate-smart agriculture, integrated pest management, precision agriculture, good agricultural practices, permaculture	Downs 2017	During ecological cultivation, no chemical pesticides are used, which decreases the total usage of chemicals and the spreading of these to the surrounding environment. This contributes to a poison-free environment and is positive for biological diversity, especially in large- scale agricultural landscapes. Certain aids are allowed, such as sulphur, soap water and lime6. Further, weeds and pests are controlled through for example choice of type, crop succession, mechanical processing and a longer distance between plants.	Sweden supporting doc	added permaculture from Sustainability Professionals	1	2

Domain	Concepts	Concept Definition	Concept Source	Example	Example Reference	Changes Made from Original	Code Count	Files Coded
	water use for agricultural /food production	draining of reserves, rain water collection, waste water, catchment systems, shortage of water, irrigation, contaminates groundwater, water in manufacturing	Garnett 2014, Johnston 2014, Lang 2017	The crowding of animals, characteristic of these systems, stresses the animals, increases animal wastes, requires systematic use of antimicrobial drugs, pollutes and contaminates groundwater, reservoirs, lakes and rivers, and generates diseases of animals that transmit to humans.	Brazil FBDG	added: shortage of water from Qatar FBDG, contaminate groundwater from Brazil FBDG, water in manufacturing from Australia FBDG	10	4
Health and Nutrition	communica ble	infectious disease, parasitic, food-bourne disease, toxicological, microbes, microorganisms	Johnston 2014	Adopting safe and clean food preparation methods can help to avoid food poisoning or food borne illness.	Qatar FBDG	added toxicological from Sweden supporting doc, added microbes and microorganisms from US FBDG	18	5
	dietary diversity	diet quality, nutrients, nutritional adequacy of diet, plant-based diets, vegetarian, vegan, balance calories, energy balance, variety, whole foods	Gonzalez Fischer 2016, Johnston 2014	Adequate and healthy diet should be accessible both physically and financially, and harmonious in quantity and quality, meeting the needs of variety, balance, moderation, and pleasure. Furthermore, it should derive from sustainable practices of production and distribution.	Brazil FBDG	added: plant-based diets from Qatar FBDG, added vegetarian and vegan from Sweden FBDG, balance calories and energy balance from Germany FBDG, variety and whole foods from Brazil FBDG	1362	11
	pop. disease burden	infections, bacterial infections, health care	Johnston 2014	Raise awareness among health care professionals by: updating the online undernutrition training tool and promoting training courses on undernutrition.	Australia FBDG	added health care from Sustainability Professionals	51	7
	educational benefits of diet	better grades/communication/vocabul ary/mental health, less tobacco/depressed, contribute to society and community	Added by author	Beyond nutritional benefits, children and teens who eat together with their families are more likely to get better grades in school, have a broader vocabulary, use less substances like tobacco, be less depressed, and contribute more to their community and society.	Qatar FBDG	added whole concept from Qatar FBDG	49	6

Domain	Concepts	Concept Definition	Concept Source	Example	Example Reference	Changes Made from Original	Code Count	Files Coded
	energy and caloric intake	limit sugar/added sugars/salt/added salt, sugar- sweetened, sugar additives, junk food, fast food, macronutrients, processed, ultra-processed, commercially-made, industrial products, energy-dense foods	Donini 2016, Garnett 2014, Johnston 2014	More than two-thirds of commercials aired on Brazilian television are for food products sold in fast food chains, 'snack packs', cookies, cakes, breakfast cereals, candies and other sweets, soft drinks, sweetened juices, and powdered drinks, which are all ultra- processed products.	Brazil FBDG	added limit salt and added salt from Brazil FBDG	1439	11
	food safety	food-bourne illness, salmonella, E. coli, contamination, adulteration, food handling, washing food, overuse of antibiotics, multi-resistant bacteria, safe storage, hand washing	Downs 2017	These food systems produce foods free of contaminants, protect biodiversity, contribute to a fairer distribution of productive lands and the creation of work, and respect and improve knowledge and traditional forms of production.	Brazil FBDG	added: washing food from Brazil FBDG; safe storage and hand washing from Qatar FBDG	135	10
	health influence of agriculture	infectious diseases, disease linked to chemicals and pesticide use, zoonotic, vector- bourne	Garnett 2014	Over the past century, deficiencies of essential nutrients have dramatically decreased, many infectious diseases have been conquered, and the majority of the U.S. population can now anticipate a long and productive life. At the same time, rates of chronic diseases—many of which are related to poor quality diet and physical inactivity—have increased.	US FBDG	-	6	4
	healthy weight	maintenance of healthy weight, BMI, muscle mass	Added by author	Following the Qatar Dietary Guidelines help people to stay healthy and strong, maintain a healthy weight, and reduce their risk of obesity, diabetes, cardiovascular diseases, cancer and osteoporosis.	Qatar FBDG	added: maintenance of healthy weight from Qatar FBDG, BMI from Brazil FBDG, muscle mass from Australia FBDG	139	7

Domain	Concepts	Concept Definition	Concept Source	Example	Example Reference	Changes Made from Original	Code Count	Files Coded
	malnutritio n	stunting (related cognitive and physical development), undernutrition, underweight, overweight, obesity, wasting double-burden, micronutrient deficiency, chronic malnutrition	Donini 2016, Garnett 2014	The recommendations in these Guidelines are therefore designed to promote adequate and healthy diets in Brazil, and thus accelerate the decline of undernutrition, and check and reduce rates of obesity and diet- related chronic diseases.	Brazil FBDG	added obesity from Brazil FBDG	512	11
	non- communica ble disease	diabetes, cardiovascular disease, stroke, asthma, allergies, chronic disease, diet- related disease, cancer, carcinogenic, osteoporosis, nutrition transition	Donini 2016, Johnston 2014	Other chronic diet-related diseases, such as hypertension (high blood pressure), heart diseases and some common cancers, have also been increasing. Previously viewed as problems which only affected older people, nowadays many of these diet- related diseases afflict young adults and even teenagers and children.	Brazil FBDG	added: cancer, carcinogenic, and osteoporosis from Qatar FBDG; nutrition transition	1081	11
	physical activity	sedentary lifestyles, physical fitness, exercise, activity	Added by author	Avoiding ingesting excessive food and physical inactivity is the best way to maintain energy balance.	China FBDG	added whole concept from many documents including Qatar FBDG	630	11
	sanitation and hygiene	access to clear water, sanitary, hygienic, open defecation	Garnett 2014, Gonzalez Fischer 2016	However, access to and availability of clean and safe water may be limited for some population groups, particularly in remote communities.	Australia FBDG	hand washing moved to food safety	14	6
	water consumpti on	drink water, conserve water when cooking	Added by author	Conserve water in food preparation.	Qatar FBDG	added: drink water from Brazil FBDG, conserve water when cooking from Qatar FBDG	61	11

Domain	Concepts	Concept Definition	Concept Source	Example	Example Reference	Changes Made from Original	Code Count	Files Coded
Markets and Value Chains	adequate infrastructu re and access to markets	distance to markets, legal access, formal markets, transport costs to market, roads, cold-chain/cold storage	Garnett 2014, Gonzalez Fischer 2016	Until recently, most people's diets were made up from food purchased from specialist shops like grocers, greengrocers and butchers, and from municipal, small and street markets and vendors, or from meals at local restaurants and bars. Some was purchased or acquired direct from producers, and people in the countryside produced some of their own food.	Brazil FBDG	domain name shortened (trade dropped)	25	7
	employme nt in value chain	food processing/service/retail	Downs 2017	Support and find bargains at specialty shops, municipal and farmers' markets, street vendors, and other places selling fresh or minimally processed foods, including those produced by organic and agro- ecological methods	Brazil FBDG	-	59	7
	food avail. and afford.	food prices/environment/availability, monetary distribution, distribution of wealth, farmers markets, specialty shops street vendors	Garnett 2014, Gonzalez Fischer 2016, Johnston 2014, Lang 2017	There is an urgent need to nationally monitor and sustainably address the factors affecting the price of nutritious foods, particularly for vulnerable groups who suffer a disproportionate burden of poor health.	Australia FBDG	added monetary distribution, distribution of wealth, farmers markets, specialty shops, street vendors from Brazil FBDG	75	5

Domain	Concepts	Concept Definition	Concept Source	Example	Example Reference	Changes Made from Original	Code Count	Files Coded
	food distribution and transport	food miles (farm to plate), distance between producers and consumers	Johnston 2014	Factors affecting environmental sustainability include the techniques employed for soil conservation, use of organic or synthetic fertilizers, the planting of conventional or genetically modified seeds, chemical or biological control of pests and diseases, intensive or extensive forms of stockbreeding, the degree of use of antibiotics, production and treatment of wastes and residues, conservation of forests and biodiversity, intensity and nature of food processing, the distance between producers and consumers, transportation, and the amount of water and energy consumed.	Brazil FBDG	added distance between producers and consumers from Brazil FBDG	15	6
	food marketing	advertising, brands, food packaging, food promotion, media outreach, social marketing	Donini 2016, Johnston 2014	Ultra-processed foods include confectionery, drinks that are sweetened with sugar or artificial sweeteners, powders for juices, sausages and other products that are derived from meat and animal fat, pre-prepared frozen dishes, dried products such as cake mix, powdered soup, instant noodles, ready- seasonings, and an infinity of new products that arrive at the markets every year including packaged snacks, morning cereals, cereal bars, and 'energy' drinks.	Brazil FBDG	added brands from Brazil FBDG	80	6
	food waste	food loss/wastage/discard, spoiled food, throw away	Donini 2016	Food wastage and food safety Store foods appropriately—Decreasing food waste can substantially reduce the environmental impact of food and has financial benefits for households.	Australia FBDG	added food wastage from Australia FBDG, added spoiled food from Qatar FBDG, added	35	9

Domain	Concepts	Concept Definition	Concept Source	Example	Example Reference	Changes Made from Original	Code Count	Files Coded
						throw away from Sweden FBDG		
	Gross Domestic Product (GDP)	economic productivity, economic growth, agricultural GDP	Garnett 2014	Dietary patterns are now rapidly changing in most countries, particularly in economically emerging countries.	Brazil FBDG	-	17	4
	incentives or disincentiv es for production	subsidies, fiscal policy, technology adoption, extension	Downs 2017	Food science and technology is constantly developing new products that have hyper-attractive appearance, smell, taste and texture.	Brazil FBDG	concept moved from Food Security domain	8	2
	incomes and livelihoods	subsistence farming, poverty alleviation, income opportunities, family farming, local economies, livelihood opportunities	Johnston 2014	In most parts of the world, the means of production and distribution of food has been changing, in ways that jeopardise the equitable distribution of wealth, the autonomy of farmers, the generation of employment and income opportunities, and the protection of natural resources and biodiversity, as well as production of safe and healthy food.	Brazil FBDG	added income opportunities, family farming, local economies from Brazil FBDG	33	5
	rural-urban migration	urbanization, agricultural transition, abandonment of farmlands	Downs 2017	In urban areas there may be less access to supermarket foods and greater access to fast foods.	Australia FBDG	-	22	3
	supply chain dynamics	imports, exports, foreign direct investment, international markets, trade agreements, investment agreements, commercialization, trade deficit, globalization of markets	Johnston 2014, Lang 2017	The need for cheap oils, sugar and other raw materials for ultra- processed foods creates monocultures and farms producing for export and not for local consumption.	Brazil FBDG	changed concept from globalization	34	8

Domain	Concepts	Concept Definition	Concept Source	Example	Example Reference	Changes Made from Original	Code Count	Files Coded
Sociocultural and Political	animal welfare	animal poaching, animal rearing, animal protection, confined- animal feeding operation, animal husbandry, free range	Garnett 2014	They are being displaced by industrialised food systems. These include monocultures, very large farms that produce one or a few crops as raw materials for the manufacture of ultra-processed foods or for the feed used in the intensive production of animals.	Brazil FBDG	added: animal protection and free range from Sweden FBDG	8	5
	conflict	fragile states, war, violence, instability, humanitarian crisis	Downs 2017	Excessive drinking increases the risk of many chronic diseases and violence and, over time, can impair short- and long-term health.	US FBDG	conflicts in wars not included in any FBDG	3	3
	consumer demand	foods rich in micronutrients, demand for products, processed and ready-made foods, diversity of food products, overconsumption, overeating, quantity	Downs 2017	The expansion of the production of natural or minimally processed food, particularly those originating from agro-ecological agriculture, depends on increased demand. With the increased demand for these foods, there will be a corresponding increase in the number of producers and traders, and consequently, price reductions.	Brazil FBDG	added overconsumption from Qatar FBDG, added overeating from Brazil	53	8
	cultural acceptabilit Y	convenience, preferences, religion, tradition, culturally appropriate, breastfeeding, share meals, eat together, food culture, eat slow, context of eating, eating environment	Garnett 2014, Gonzalez Fischer 2016, Lang 2017	Humans are social beings. Eating together is ingrained in human history, as is the sharing and division of responsibility for finding, acquiring, preparing, and cooking food. Eating together, with everything that is involved with eating, is part of the evolution and adaptation of humanity and the development of culture and civilisation. Eating together is a natural, simple yet profound way to create and develop relationships between people. Thus, eating is a natural part of social life.	Brazil FBDG	added: religion, tradition, culturally appropriate, share meals, eat together, eat slow, context of eating, food culture, eating environment from Brazil FBDG; breastfeeding from Qatar	433	11

Domain	Concepts	Concept Definition	Concept Source	Example	Example Reference	Changes Made from Original	Code Count	Files Coded
	equity Issues	vulnerable populations, disadvantaged, future populations, gender, at-risk populations, low socioeconomic groups, minority groups, food supply, social inequalities, social justice, equitable, fair	Burlingame 2012, Gonzalez Fischer 2016, Johnston 2014, Lang 2017	Adequate and healthy diet is a basic human right. This right implies ensuring permanent and regular access, in a socially fair manner, to food and ways of eating that satisfy the social and biological requirements of everybody. It also takes into account special dietary needs, and the needs to be culturally appropriate, and allow for differences in gender, race, and ethnicity.	Brazil FBDG	added: disadvantaged, social inequalities, social justice, equitable, fair from Brazil FBDG	209	8
	food consciousn ess	awareness of diet effects, climate impact, impact on the environment, interlinked holistic, eco-friendly, ecolabled, climate certification, climate footprint, life-cycle perspective/analysis, intersectoral	Downs 2017	High fibre vegetables are an eco- friendly choice. They have less of an impact on the environment than salad greens and can be stored for longer. Ecolabelling makes it easier to find fruit and vegetables that have been grown in eco-friendly ways. Only a very small number of chemical pesticides can be used in organic farming, and climate certification is helping to reduce climate impact.	Sweden FBDG	added: interlinked holistic, eco-friendly, ecolabled, climate certification, climate footprint, life-cycle perspective/analysis from Sweden FBDG; intersectoral from Brazil FBDG	74	7
	food literacy	cooking, food preparation, training, recipes, nutrition literacy, quality of food choices, health literacy, food education, food skills, food storage, role model, home-made foods, dining-in, freshly prepared, food/nutrition labels, limit pre- prepared, meal planning, shopping, organisation of kitchen stores, preparing ingredients	Garnett 2014, Johnston 2014	'Understanding and overcoming obstacles', identifies barriers in the way of healthy diets – information, supply, cost, culinary skills, time, advertising - and indicates how these can be surmounted, by people as consumers, family members, and as citizens.	Brazil FBDG	added: food storage from Australia FBDG; role model from Qatar FBDG; dining-in, freshly- prepared, food/nutrition labels, limit pre- prepared, meal planning, shopping, organisation of kitchen stores, preparing ingredients from Brazil FBDG	492	11

Domain	Concepts	Concept Definition	Concept Source	Example	Example Reference	Changes Made from Original	Code Count	Files Coded
	food sovereignty	right to food/health/healthy food, cooperatives, farmer rights, autonomy of farmers, food rights, human rights, control of food system, ownership of food system, producing in solidarity, food sufficiency	Donini 2016, Gonzalez Fischer 2016	Factors affecting the social sustainability of food systems include the size and use of farms, the freedom of farmers to choose seeds, fertilisers and ways to control pests and diseases, working conditions and exposure to occupational hazards, the nature and number of intermediaries between farmers and consumers, the fairness of the trading system, employment generation and the sharing of profit between capital and labour.	Brazil FBDG	added cooperatives from Sustainability Professionals, added food rights/human rights from Brazil FBDG	21	3
	labor conditions	workers' rights, labor shortage, workload, labor standards	Garnett 2014	Long established sustainable food systems that favour family farming, traditional effective farming techniques and soil management, intensive use of labour, intercropping of various foods combined with the rearing of animals, minimal food processing done by farmers and by local industries, and supply systems based on small traders and municipal and local markets, are losing strength.	Brazil FBDG	-	6	3
	land tenure	land grabbing/ownership/use planning, zoning	Downs 2017	-	-	not included in any FBDGs	0	0
	policy	food policy, political context	Added by author	The Qatar Dietary Guidelines are part of the National Nutrition and Physical Activity Action Plan 2011-2016. They lay the foundation for the promotion of healthy eating and the development of healthy food policy.	Qatar FBDG	whole concept added by author, added food policy from Qatar FBDG, added political context from Brazil FBDG	129	6

Table 16. Framework adapted from Downs et al. (2017) with domains, concepts, definitions and examples from text in this analysis. Code count is the number of times that concept was coded in the eleven documents, and files coded denotes the number of files (out of eleven) that were coded for that concept.