

Changing diets and transforming food systems

Working Paper No. 282

CGIAR Research Program on Climate Change,
Agriculture and Food Security (CCAFS)

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RESEARCH PROGRAM ON
**Climate Change,
Agriculture and
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Abstract

In an aspirational global food system, everyone would meet but not exceed their nutritional needs, and fulfill personal preferences for tasty, affordable, varied, convenient and healthy food—while keeping climate change under 2°C. Diets are an outcome of people’s choices and are profoundly shaped by socio-cultural, physical and economic factors in the food ‘choice environment’. Historically there have been substantial changes in people’s diets and diets continue to be in flux.

Dietary change offers a route to achieving the aspirational Sustainable Development Goal (SDG) food system, combining positive outcomes for health and for the environment. The most effective strategies to shift diets will involve multiple approaches that deliberately aim not just to influence consumers themselves, but all participants in the food system, taking into account plural values and incentives. Effectiveness of actions will depend on the political economy at national and global levels.

Overall there is reason to be hopeful about the potential for dietary change, given both historic trends and the growing suite of tools and approaches available.

Keywords

Diet; Sustainable Development Goals; food systems; climate change; agriculture; food security.

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Transforming Food Systems Under a Changing Climate:

About the initiative

Transforming Food Systems Under a Changing Climate is an initiative led by CCAFS that aims to realize a transformation in food systems by mobilizing knowledge and catalyzing action. The initiative brings together leaders in science, business, farming, policy and grassroots organizations to identify pathways for transformation. To find additional publications in this series and for more information, please visit:

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Executive summary

An aspirational global food system is one that meets Sustainable Development Goal 2 (SDG2) (zero hunger) and SDG13 (climate change kept below 2°C) in the context of SDG12 (sustainable production and consumption). For diets, everyone would meet but not exceed their nutritional needs, and fulfill personal preferences for tasty, affordable, varied, convenient and healthy food—while keeping climate change under 2°C. This marks a shift from earlier policy goals around maximizing national calorie supply in the name of food security.

Diets are an outcome of people's choices (individual and collective consumer behavior) but within a constrained set of options and norms, as we can only eat what is available, and are profoundly shaped by socio-cultural, physical and economic factors in the food 'choice environment'. Historically there have been substantial changes in people's diets (what, how, when and why they eat) and diets continue to be in flux. In recent decades, countries' food supplies have become more diverse nationally while converging globally.

Dietary change offers a route to achieving the aspirational SDG food system, combining positive outcomes for health and for the environment. The changes involved would vary depending on current dietary patterns, but for many people would involve a greater quantity and more variety of pulses, nuts and vegetables, and contractions in intake of meat, dairy, salt, refined carbohydrates, added fats and sugars.

Recent behavioral research provides useful insights, showing that efforts to influence dietary patterns at scale need to go beyond information-sharing and awareness-raising. Healthy and sustainable foods are more likely to be widely eaten if they are made more appealing (in terms of cost, taste, convenience and enjoyment), more normal (familiar and mainstream) and easier (prevalent, and where possible the automatic or default choice). Behaviors learnt in childhood strongly shape long-term dietary preferences.

The entire food system creates the circumstances of consumers' choices, including subsidies to farmers, technologies for food processing, trade tariffs, and investments in research. Thus, the most effective strategies to shift diets will involve multiple approaches that deliberately aim not just to influence consumers themselves, but all participants in the food system, taking into account plural values and incentives.

Effectiveness of actions will depend on the political economy at national and global levels.

Overall there is reason to be hopeful about the potential for dietary change, given both historic trends and the growing suite of tools and approaches available.

Introduction

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Overview

Food systems are projected to drive ever greater environmental change as we head towards 2030 and beyond, as global demand grows. An income-related nutrition transition—towards higher per capita consumption of calories, a significant part of that consumed as animal-source foods—contributes more than population growth to these environmental impacts (Tilman et al., 2011). Therefore, shifting diets in a different direction, towards eating patterns that are both healthy and sustainable, is increasingly recognized as an important pathway to human and planetary health. Indeed, models suggest that actions on the demand side could have four times the impact of actions on the supply side in mitigating the climate change forcing of food systems (Smith et al., 2013). However, diets are often considered too ‘difficult’ to change, both in practice (limited success in programs designed to change people’s eating behaviors, particularly over-eating) and in principle (what we eat is a matter of sovereign personal choice).

In this report, we set out to challenge the view that little can be done about dietary change, with a more hopeful vision for dietary transformation. We contend that diets are in constant flux, with large changes evident even within single generations and across very different cultures. Change, indeed, is not only possible, but the norm. We add to a suite of voices (Fanzo et al., 2017; Mason and Lang, 2017; Willett et al., 2019) that contend that a broad approach to healthy and sustainable diets—one that involves new tools for behavioral change but also encompasses actions across the whole food system—will be essential to enabling the needed transformations at the global scale.

A vision for diets that deliver the SDGs

Just over ten years from now we collectively hope to achieve the vision of the SDGs: a world in which, among other goals, there is zero hunger (SDG2) while climate change remains under 2°C and closer to 1.5°C (SDG13). We now know that to get there we will need not only greater food security among poorer people and poorer countries, but also shifts to greater sustainability in patterns of consumption

universally (SDG12). Food systems have multiple connections across all other SDGs as well (Caron et al., 2018; Murray, 2018).

Is achieving zero hunger within climate constraints possible? In theory, yes. Modelling studies find that it is possible for everyone to have a nutritious diet, made up of diverse foods that could vary among cultures, without breaching the 2°C limit, even with population growth by 2050 (Bahadur et al., 2018; Springmann et al., 2018). However, this would involve changes in diets for many. For undernourished people, it would often involve diversifying the types of foods consumed each day, combined with moderate increases in animal-source foods. For people at the high end of the consumption spectrum, it would involve decreasing energy intake and shifting towards a more plant-centric diet, with a higher volume and diversity of pulses, nuts, wholegrains, tubers and vegetables.

In practice; however, there have been disincentives for governments, the industry, and even civil society organizations to take action on diets in a holistic manner, leading to governance and market failures in the food system (Swinburn et al., 2019).

Governments have been willing to implement health and agricultural development programs to address undernutrition, and are beginning to take steps to address poor dietary quality, but we are yet to see comprehensive ‘whole food system’ strategies that balance multiple desired outcomes related to nutrition, food security, the climate, the environment, and economic development (Béné et al., 2019). Diets are seen as a matter of personal choice, which—despite their enormous potential public health costs and environmental impacts—should not be meddled with by ‘nanny states’ (Lang, 2017). Eating patterns are almost entirely absent from climate policy and climate action; for example, only two Nationally Determined Contributions to the Paris Agreement mention diets, and only 16 mention nutrition (out of 195 surveyed; CCAFS/CGIAR unpublished data).

Industry and civil society have also been slow to take up the cause. Mainstream industry, while willing in principle to sell healthy and sustainable foods, has followed a pathway of securing market share by encouraging lowest-common-denominator consumer preferences for highly processed foods made from refined cereals, sugar, plant oils, dairy, meat and salt (Chandon and Wansink, 2012; Moss, 2013). Civil society and philanthropic movements have suffered historically from a schism between those concerned with development and food security and seek to maximize agricultural production and food availability (e.g. AGRA, 2017), versus those that

emphasize the environment and see food production primarily as a threat (e.g. Campari, 2018).

Fortunately, times are changing and more integrated visions are emerging among governments, businesses, and social movements. Inter-sectoral processes around the SDGs show potential to unite competing agendas (Wahl, 2017). This can enlarge the space for much-needed debates and decisions on managing trade-offs within food systems (Béné et al., 2019). Governments that have traditionally focused on a simple national food security goal of maximizing the national breadbasket, measured in tons or calories, are showing greater concern toward addressing overnutrition, spurred in part by the global rise of obesity and food-related non-communicable diseases (Hawkes et al., 2015; Hyseni et al., 2017; Popkin and Reardon, 2018). Some are also entering into conversations around the environmental impacts of diets (Song et al., 2016; Vermeulen et al., 2019). Thus, a window of opportunity is now open to reassess whether action on diets is feasible from local to global levels.

The aspiration for diets in a sustainable global food system would be everyone on the planet meeting but not exceeding their nutritional needs, while fulfilling preferences for tasty, affordable, varied, convenient and healthy food (roughly in that order of importance to consumers; Chandon and Wansink, 2012). This brings us to the broad question of this paper: how might governments, civil society and private sector work to transform diets towards this ideal, while also reinforcing the ability of food systems to deliver on their other objectives—including jobs, rural development and environmental stewardship—keeping us within the 2°C limit? Considering diverse aspects of this large and knotty question, we offer learning and case studies from dietary change around the world, and draw out promising strategies for future change.

What might a healthy and sustainable diet look like?

While there is no single definition of a healthy and sustainable diet (Garnett, 2014; Bailey and Harper, 2015), the synergies and trade-offs between health and environmental outcomes from diets have been the subject of growing recent empirical research, modelling and commentary (Tilman and Clark, 2014; Hallström et al., 2015; Garnett, 2016; Jones et al., 2016; Mason and Lang, 2017; Poore and Nemecek, 2018; Searchinger et al., 2018; Springmann et al., 2018). Those that take a global view tend to identify the need for some form of contraction and convergence across contrasting dietary patterns. Garnett (2016) proposes a convergence that involves the diversification of plant foods for almost everyone, contraction in total food intake

among those with ‘western-type’ diets but expansion among ‘the poor in poor countries’, and contraction in livestock, dairy and fish consumption among both the ‘healthy wealthy’ and the broader ‘western-type’.

The EAT-Lancet Commission (Willett et al., 2019) has attempted to define a culturally flexible global diet that satisfies adult human nutritional needs while also meeting environmental objectives. Eaten universally, this diet—shown in the table below—could help keep us within acceptable boundaries for greenhouse gas emissions (2°C), land use change and water use (nitrogen and phosphorus cycles proving more difficult to moderate), if practiced in tandem with improved agricultural techniques and reductions in food loss and waste (Springmann et al., 2018). This type of diet is also highly compatible with good health (e.g. the diet for cardiovascular health given in Mozaffarian, 2016).

Table 1. A planetary health diet, with possible ranges, for an intake of 2500 kcal/day (Willett et al., 2019)

| Food group | Food subgroup, examples | Reference diet (g/day) | Kcal/day | Possible ranges (g/day) | Comments |
|---------------------------|---|------------------------|----------|-------------------------|---|
| Whole grains | Rice, wheat, corn, other | 232 | 811 | 0 to 60% of energy | Mix and amount of grains can vary to maintain isocaloric intake |
| Tubers/starchy vegetables | Potatoes, cassava | 50 | 39 | 0 to 100 | |
| Vegetables | All vegetables | 300 | | 200 to 600 | |
| | Dark green vegetables | 100 | 23 | | |
| | Red & orange vegetable | 100 | 30 | | |
| | Other vegetables | 100 | 25 | | |
| Fruits | All fruit | 200 | 126 | 100 to 300 | |
| Dairy foods | Whole milk or derivative equivalents (cheese, etc.) | 250 | 153 | 0 to 500 | |
| Protein sources | Beef, lamb | 7 | 15 | 0 to 14 | Exchangeable with pork |
| | Pork | 7 | 15 | 0 to 14 | Exchangeable with beef/lamb |

| | | | | | |
|---------------------|--------------------------------|----------|------------|----------|---|
| | Chicken, other poultry | 29 | 62 | 0 to 58 | Exchangeable with eggs, fish, or plant protein sources |
| | Eggs | 13 | 19 | 0 to 25 | |
| | Fish | 28 | 40 | 0 to 100 | |
| | Legumes | | | | Legumes, peanuts, tree nuts, seeds, and soy are interchangeable |
| | Dry beans, lentils & peas | 50 | 172 | 0 to 100 | |
| | Soy foods | 25 | 112 | 0 to 50 | |
| | Nuts -Peanuts -Tree nuts | 25 25 | 142 149 | 0 to 75 | |
| Added fats | Plant oils -Palm | 6.8 | 60 | 0-6.8 | Some lard or tallow optional where pigs or cattle are consumed |
| | Unsaturated oils | 40 | 354 | 20-80 | |
| | Dairy fats (included in milk) | 0 | 0 | | |
| | Lard/tallow | 5 | 36 | 0-5 | |
| Added sugars | All sweeteners | 31 | 120 | 0 to 31 | |

The interplay between diets and food systems

The conceptual framework in use by the global nutrition community is shown below (Figure 1; Fanzo et al., 2017). The proximate driver of human diets is consumer behaviors. However, these behaviors are not independent of the wider food system. In particular, they are intimately linked to food environments—the places and contexts in which consumers access food, shaped by a range of personal circumstances, social norms, market forces and policy choices. Food environments in turn are linked to activities and outcomes at all of the stages of food supply chains. Finally, the interlinked system of diets, food environments and food supply chains is under the direct influence of a range of wider demographic, socio-cultural, political, economic, technological, and environmental drivers (Figure 1).

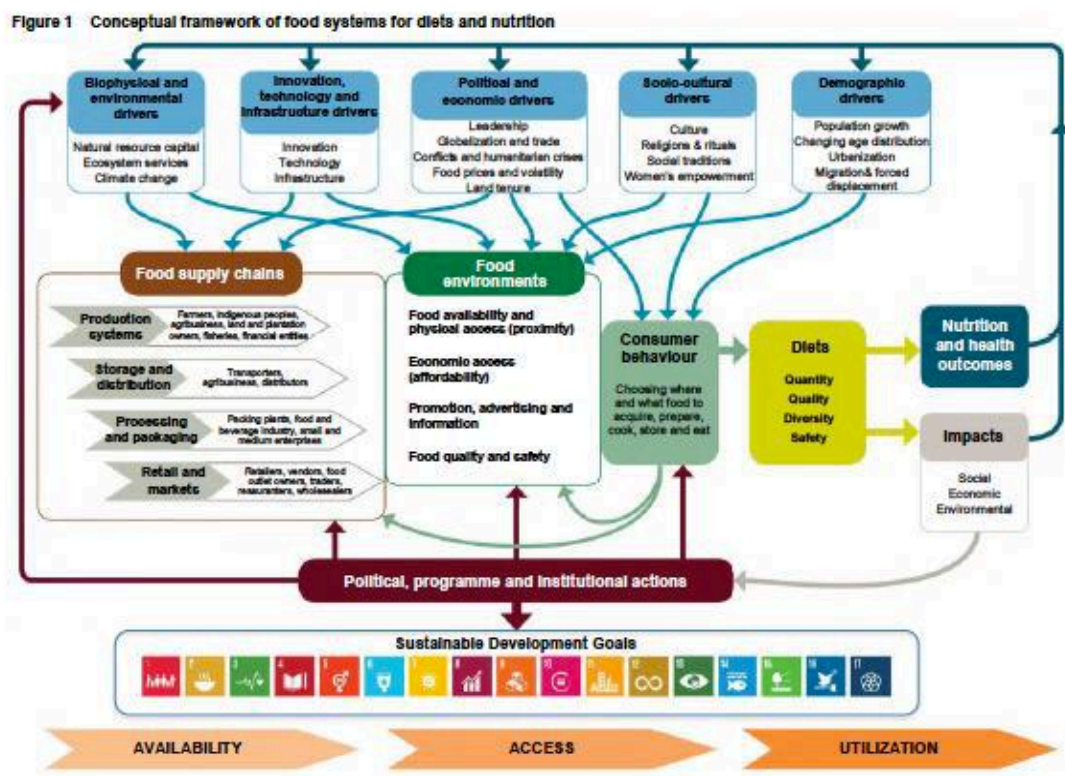


Figure 1. Conceptual framework of food systems for diets and nutrition.

Source: Fanzo et al., 2017.

Aside from trying to capture the enormous complexity of food systems, how does this framework help us to understand, and hence wield, dietary change in the context of food system transformation? First, it emphasizes the interconnections between a person’s choice (whether rational or not) and their food environment in shaping dietary outcomes. Typically, the food environment offers limited choice, particularly for less wealthy consumers (Mela, 1999). Providing cues in the food environment may be an especially effective way to influence consumer behaviors and dietary outcomes. Emerging strategies and tools to change dietary choices within the context of food environments are covered in detail in section 2.

Second, it suggests that we should not consider ‘consumer behavior’ as an independent, exogenous, demand-side driver of food systems; instead we need to consider how consumer behaviors and other food system functions interact and influence each other. Consumer choices do indeed drive agriculture and the food industry, but these choices (or lack of choice) are also shaped by innovations and shocks across the food supply chain, as well as by larger-scale drivers from the political-economic (e.g. industry concentration and lobbying power) to the biophysical (e.g. land and soil degradation). Deliberate actions in the public or private

sector to change these aspects of food systems are seldom, if ever, designed to change diets—but perhaps could become part of the future portfolio of levers for dietary change.

Taking the larger-scale drivers first, how do the different drivers identified in the conceptual framework (Figure 1) influence diets? Potential environmental tipping points under climate change, such as the disappearance of Himalayan glaciers or the collapse of the North Atlantic overturning circulation, could trigger food system transformation (Benton et al., 2017). The impact of biophysical and environmental drivers on diets depends largely on market integration and the dependency of livelihoods on agriculture. For example, diversity in agricultural production is a stronger driver of food supply diversity in poorer countries than in wealthier countries where food supply is more strongly influenced by international markets (Remans et al., 2014). Technological innovation in the supply chain has been a fundamental driver of dietary change through human history (Herrero et al., 2019). Exemplars include the plough and the Haber-Bosch process that revolutionized fertilizer production, while other examples are the upsurge of breakfast cereals as a result of extrusion technologies, or year-round consumption of meat, dairy, fruit and vegetables since canning and refrigeration have reached scale.

Liberalization—the removal of trade and investment barriers—has arguably been one of the key economic drivers of dietary change globally through its impacts on supply chain business structures (see below), intertwined with migration to urban areas, the increase in off-farm employment in rural areas, and per capita income growth in both urban and rural areas (Popkin and Reardon, 2018). In Africa, for instance, trade in processed food now constitutes 30 to 60% of all agricultural trade (Badiane et al., 2018). Agriculture receives over USD 600 billion in subsidies per year globally (OECD, 2018a), and the production patterns shaped by these subsidies can drive dietary outcomes; for example, the rise in obesity in the United States of America has been linked to subsidies to maize growers that drive oversupply of cheap high-fructose corn syrup to the food processing industry (Franck et al., 2013). Likewise, a key socio-cultural driver has been greater participation of women in informal and formal employment sectors outside the home, which has created larger incomes for women as well as rising preferences for convenience foods, and have led to mixed nutritional outcomes in different countries (Nie and Sousa-Poza, 2014; Eshete et al., 2017; Oddo et al., 2017).

These systemic drivers have spurred changes throughout the food supply chains that in turn affect diets. Food supply chains globally take a number of different models, including *modern* (long in distance, highly concentrated, vertically integrated, product-differentiated, high in processing, capital-intensive), *traditional* (local, disconnected, low in processing and value-addition, labor-intensive), *modern-to-traditional* (large-scale processors selling into small local stores), and *traditional-to-modern* (supermarkets buying from small-scale producers) (Gómez and Ricketts, 2013). An overall trend towards modernization in supply chains has been synchronous with a rise in dietary diversity, at least with regard to major staples, for the average person (section 1), coupled with greater consumption of processed foods in both urban and rural areas. In east and southern Africa, for example, processed food accounts for 39% of all food expenditure (Tschirley et al., 2015). Processed foods could be healthy, in theory, but current brands are mainly unhealthy: an assessment of more than 23,000 processed food types around the world found that 69% failed to meet minimum standards to qualify as healthy foods within a balanced diet (Dunford and Taylor, 2018). While there is a strong focus in modern supply chains on food safety, wider health risks associated with branded foods (e.g. of obesity and diabetes) are only beginning to emerge as a matter for public policy attention, while environmental risks remain a minority concern (Hossain et al., 2015).

1. Diets in flux

Authors: Colin Khoury, Jonathan Mockshell and Christophe Béné

A few decades ago, palm oil was rare in the Colombian diet. Now it the single most important source of fat in national food supplies, providing a quarter of consumption (Khoury et al., 2014). This rapid dietary transition was tightly linked to rapid change in agriculture and food processing. During this period, Colombia became one of the world's largest producers of this oil crop, joining Indonesia, Malaysia, Thailand and Nigeria in supplying inexpensive and temperature-stable cooking oil to the world.

Such enormous dietary change—and associated agricultural sector transformation—are not unique to Colombia, nor to palm oil. Food products made from major crops such as wheat, rice, maize, soybean, sugar, and potato, as well as meat and dairy, are much more available worldwide than they were a half-century ago—symptomatic of the globalization of our diets, where the ingredients that humans eat across the world are becoming more and more homogeneous. Over the last five decades, national food supplies have grown 36% more similar (Khoury et al., 2014). At the same time, people, almost without exception, are eating more food than their grandparents did. The 2,250 calories humanity consumed on average across countries worldwide in 1960 rose to 2,800 by 2010, a 24% increase globally. Similar trends are true for protein (+25%), fat (+46%), and food mass (+25%) (Khoury et al., 2014).

While much of this new food is domestically produced, about 18% is internationally traded (FAOSTAT, 2019), with wide variation in import-dependence across countries (Porkka et al., 2013). Diets that were primarily based on singular staples a half century ago, for instance rice in Asia, have diversified to include other cereals and starches, including both domestic and imported wheat and potatoes. While for countries like Indonesia this has been accompanied by a shift to more highly refined and processed foods with fewer vegetables in the diet (Vermeulen et al. 2019), in other Asian countries more healthy eating patterns have prevailed (Case study 1 on South Korea and Japan). Meanwhile maize-dominated diets in Latin America, and sorghum- and millet-based diets in sub-Saharan Africa have diversified in the same way (Case study 2 on Zambia and Zimbabwe). At the more extreme end of the spectrum, the United Arab Emirates had a 330% increase over 50 years in the number of crops contributing to calories in its national food supply, diversifying well beyond its initial reliance primarily on rice, wheat, sugar, and dates (Khoury et al., 2014).

During this dietary transition there have been winners and losers among the major types of foods. Wheat, rice, maize, sugar crops, and animal products, already the most dominant worldwide 50 years ago, have only become more important globally. Other foods have emerged as widespread staples, particularly the oil crops such as soybean, palm oil, sunflower, and rapeseed oil. As these winners have come to take more precedence in food supplies around the world, former staples such as sorghum, millets, rye, cassava, sweet potato, and yam have become marginalized. They have not disappeared, but they have become less important to what is eaten every day, in all regions except the poorest and most rural. Brazil's consumption of soy, brought about in large part due to intensive investment in the domestic cultivation of the crop, has contributed to a more than 40-fold increase in per capita intake, replacing formerly important foods such as groundnut (Khoury et al., 2014). New foods are entering the global repertoire, for example quinoa, which was relatively unknown outside the South American Andes a couple of decades ago, and is now cultivated in 100 countries and consumed in even more (Bazile et al., 2016).

The nutrition transition has been associated with both positive and negative health outcomes. The global rate of hunger declined from 19% to 12% over the two decades from 1990 to 2012 (FAO, IFAD and WFP, 2015a), though has slightly risen again since 2015 (FAO, 2018). The percentage of children who are stunted fell from 40% to 24% (IFPRI, 2016). In most regions, intake of fruit, nuts and seeds, and polyunsaturated fatty acid has also shown positive trends (Masters, 2016). For many people, rural-urban migration has improved the quality and diversity of their diets (Case study 3 on Vietnam). The transition toward more processed food has likely contributed to reducing hunger by making adequate calories, protein, and fat more available worldwide. It is unclear though how the dominance of highly processed staple foods is affecting the sufficiency of vital micronutrients such as vitamin A, iron, and zinc in regions where deficiencies are significant in diets. The nutrition transition has also been associated with a global rise in obesity, heart disease and type 2 diabetes. The combined number of overweight and obese adults globally is projected to rise from 1.33 billion to 3.28 billion from 2005 to 2030 (IFPRI, 2016; Kelly et al., 2008). In Nigeria and Ethiopia, the number of adults with diabetes is projected to double between 2011 and 2030 (Whiting et al., 2011).

Case study 1: Healthier appetites in South Korea and Japan: a differently shaped nutrition transition (Bee Wilson)

Pleasure and preference are often the missing elements in food policy. In just a few decades the world's diet has shifted towards sweetness and away from higher fiber foods (Popkin and Nielson, 2003). But just because most populations around the world are currently habituated to eating diets low in vegetables and high in ultra-processed and sweetened foods does not mean that this will always be the case.

Two countries that offer hope that the curve of the nutrition transition can be bent in a healthier direction are Japan and South Korea, which managed to achieve a transition to globalized economies in the second half of the twentieth century while still retaining relatively healthy patterns of eating and among the lowest levels of obesity for high-income nations.

Between 1962 and 1996, GNP in South Korea increased seventeen-fold (Kim et al., 2000). Given how rapidly South Korea moved from poverty to wealth and became exposed to new world markets, we would expect the country to have moved equally rapidly to an obesogenic diet high in sugar, new fats and packaged foods.

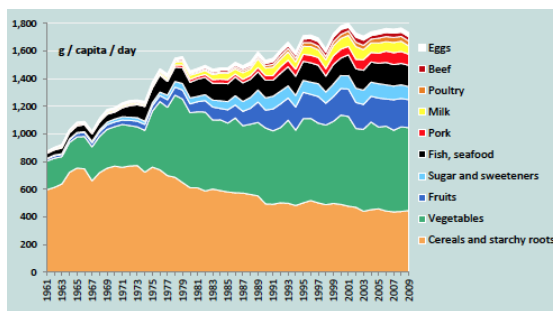


Figure 2: Average food consumption in South Korea, 1961–2009. Source: Reproduced from Keats and Wiggins (2014) based on FAOSTAT data.

But compared to eaters in other fast-growing economies, Koreans retained their traditional diets to a much greater extent, enjoying meals relatively low in fat and high in vegetables. In 2009, despite all the other changes to Korean society the amount of vegetables Koreans ate was actually higher than it had been in 1969 (286 grams compared to 271 grams per capita), and more diverse (Lee et al., 2012). Part of the explanation is cultural. South Koreans have long seen vegetables as desirable rather than merely healthy. King of all dishes in

Korea is *kimchi*, cabbage fermented with garlic, chilis and radish. *Kimchi* is not just a condiment but a staple, eaten in volumes second only to rice (Lee et al., 2002).

South Korea's healthy preferences also stem from the government's concerted effort to protect traditional cooking against the new globalized diet. From the 1980s, the government's Rural Living Science Institute trained thousands of workers in free cooking workshops aimed at educating families in how to make Korean dishes (Kim et al., 2000). In addition, there were mass media campaigns to promote local foods and farmers on TV (Kim et al., 2000).

Japan is another example of a country that managed to control the curve of the nutrition transition in the late twentieth century through a combination of cultural, social and economic changes, including government intervention. If South Korea managed this feat by retaining traditional food habits in the face of modernity, Japan did so by radically changing its collective appetites.

Modern Japanese cuisine—with its focus on fresh vegetables, seaweed, fish and soups—has a global reputation for healthiness, which is reflected in the country’s very low levels of obesity (Ng et al., 2014). Yet much of what we think of as ‘Japanese food’ would have been unrecognizable—and disgusting—to a Japanese person of earlier centuries. Pre-1900, Japanese people did not tend to eat spices or meat or wheat, so it is surprising that many now regard ramen noodle soup as the national dish: a spicy combination of greens, pork, broth and wheat noodles (Kushner, 2012). The foundations of much of today’s cuisine were laid in the 1920s, when the Japanese government—worried about the poor health of its military—introduced cooking classes promoting new meat dishes and new cooking methods such as stir-frying (Collingham, 2011).

Another factor in changing Japanese palates was American post-war food aid. In 1947 the occupying US forces brought in a new school lunch program to alleviate the severe hunger among Japanese school children (Collingham, 2011). The American lunches guaranteed that every child would have milk and a white bread roll (made from US wheat) plus a hot dish: often some kind of stew made from the remaining stockpiles of canned food from the Japanese army, spiced with curry powder. While these meals were not necessarily a healthy influence, the generation of Japanese children reared on these eclectic lunches grew into adults who were open to unusual flavor combinations. Then in the 1950s national income doubled, and with new money came new ingredients and the national diet became far more varied than in the past, with a higher ratio of protein to refined carbohydrate. As food historian Naomiche Ishige has explained, once levels of food consumption rose again to pre-war levels, ‘it became clear that the Japanese were not returning to the dietary pattern of the past, but were rather in the process of creating new eating habits’ (Ishige, 2001). High life expectancy in Japan is explained by high levels of access both to healthy diets and to healthcare (Ikeda et al., 2011).

South Korea and Japan offer the hope that healthier food preferences are possible, with the right interventions. When green leafy vegetables are a pleasure (assuming they are also affordable and available), people will eat them.

Case study 2: Maize in Zimbabwe and Zambia: age-old staple or passing fad? (Sonja Vermeulen)

Southern Africa’s staple food, eaten three times a day by many, is a stiff porridge made from ground maize, known as *nshima* in Zambia or *sadza* in Zimbabwe. In Zimbabwe ‘*sadza* is considered almost a sacred food and a meal is not a meal without it’ (Bonzo et al., 2000) while ‘*nshima*... has always been the basis of life in Zambia for as far back in history as people can remember.’ (Tembo, 2012).

Yet maize has been the dominant staple grain across southern Africa for no more than a hundred years. Though present since the 1500s, it took over 400 years to oust small grains such as sorghum and millet as the ‘sacred food’ and ‘basis of life’. As late as the 1930s, in a detailed monograph on the Bemba people in Zambia, the economic anthropologist Audrey Richards observed, ‘I have watched natives eating the roasted grain off four or five maize cobs under my very eyes, only to hear them shouting to their fellows later, “Alas, we are dying of hunger. We have not had a bite to eat all day!”’ (Richards, 1939).



A meal of white maize sadza with tripe and greens. Credit: Pippa Mpunzwana-Hill.

The story of maize in southern Africa reveals how politics, economics and societal needs can interact to create diets that can become established in people's minds as traditional. Maize was slower to penetrate in southern Africa than in other parts of the continent. The early use was as a vegetable (i.e. sweet corn), grown by small-scale farmers on wetlands to supplement the main sorghum and millet harvest. Maize had three advantages: early maturation, providing something to eat while waiting for the slower-growing small grains; low susceptibility to birds, so it could be left in the field for longer; and finally low labor requirements, which made it popular among women farmers, particularly when men left to work on the mines (McCann, 2001).

Maize production and consumption were transformed in the late 19th and early 20th centuries by the introduction of new dent

varieties from the US, such as Hickory King (the ancestor of many strains widely grown today in southern Africa), and the establishment of large-scale commercial mills (Eicher and Mapfuma, 1997). Commercial production of *nshima* and *sadza* meal from soft dent maize, rather than the earlier hard flint maize or small grains, provided cheap bulk food for mine workers away from home. Until the 1920s, the export market for industrial starch exceeded the domestic food market for maize meal. Since the British starch market paid a premium for white starch, the Southern Rhodesian government restricted yellow maize production via the 1925 Maize Act. One unintended consequence was shaping of a marked preference among Zimbabwean consumers for white over yellow maize that has continued into the 21st century (Smale and Jayne, 2010), even in times of severe drought and shortage.

The Southern Rhodesian government also acted, this time through the Maize Control Act of 1931, to restrict market access by black small-scale farmers, who were able to produce surplus more cost-effectively than the white-owned commercial farms (Smale and Jayne, 2010). Although maize was by that time well established as the main staple food, land reforms and restricted access to inputs kept small-scale producers well behind commercial growers until independence in 1980. Smallholder maize production in Zimbabwe doubled between 1980 and 1986, backed by strong research and development, plus the post-independence government's investment in extension and smallholder finance (Eicher and Mapfuma, 1997).

Meanwhile, in post-independence Zambia, growing and eating of maize became a political minefield, with maize sector reform a leading issue in the toppling of the three-decade Kaunda government in 1991. The new Zambian government pursued an initial policy of liberalization, but market reform proved difficult (Howard and Mungoma, 1997). Tariffs and export bans are still in the picture 30 years later. The nutritional content of maize meal has also been a source of political friction, for example around the pros and cons of fortification with iron, zinc and vitamin A (Fiedler et al., 2013), though deficiencies of vitamin B3, commonly associated with monotonous maize-based diets, have declined since the 1970s (Viljoen et al., 2018).

Will maize have a place in a transformed future diet of Zambia and Zimbabwe? Its future may not be bright from an agricultural perspective. The crop is highly temperature-sensitive and past climate change has already caused yield failures and declines (Lobell et al., 2011); future climate change may lead to the crop becoming widely unviable across the region (Rippke et al., 2016). At the same time, urban consumers are creating demand for new types of wholegrain *sadza* made from multiple cereals. Chef Gertie Bonzo in Zimbabwe reported that people ate *sadza* made from sorghum about once a month at the turn of the 21st century (Bonzo et al., 2000) – perhaps that figure will grow again as maize’s century-long ascendancy dissipates.



Modern multi-grain *sadza* mix made from maize, sorghum and wheat, on sale in Zimbabwe. Credit: Pippa Mpunzwana-Hill.

Case study 3: Rapid change in Vietnam: migration and smaller households drive healthier eating patterns (Huong Trinh Thi, Brent Heard)

Vietnam is undergoing a nutrition transition, with dramatic changes in dietary patterns during the last twenty years. The nutrition transition in Vietnam is characterized by an increase in per capita total calorie intake, with the consumption of fat and protein rising while carbohydrate intake decreases. This transition aligns with the national nutrition strategy of the National Institute of Nutrition, which defines the “ideal” diet balance for Vietnamese households as 14% protein, 18% fat and 68% carbohydrates. Its 2012 goal was for 50% of Vietnamese households to achieve this dietary balance by 2015 (National Institute of Nutrition, 2012); by 2014, half of the population had a diet balance very close to the ideal (Trinh, 2018a). The increase in per capita calorie intake is very important since the Vietnamese government aims to decrease the proportion of households with low energy intake to 5% by 2020 (Vietnam Ministry of Health, 2018).

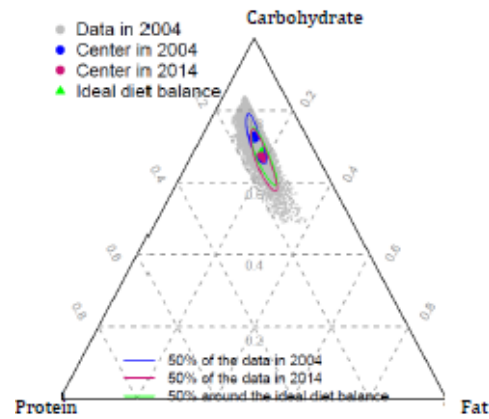


Traditional Vietnamese family meal. Credit: ASIA Green Travel.

Thanks to impressive achievements in the economy and social welfare, both income and food expenditure in Vietnam have increased. However, the proportion of food expenditure is still very high—around 46% of total expenditure—and even higher for poor households (authors’ calculation). Food expenditure has a positive impact on calorie intake, so there is still room for income-based policies to fight malnutrition (Trinh, 2018b) and contribute to action on Zero Hunger in Vietnam (Prime Minister Nguyễn Xuân Phúc, 2018).

A key driver of increasing income is migration, through the transferring of remittances. Particularly, 6-to-12-month temporary migration is found to have a positive impact on food security and diversity in Vietnam (Nguyen, 2011). Urbanization is also associated with decreasing household size, which also has a strong association with shifts in diets (Trinh, 2018c). In 2014, the average household size in Vietnam was 3.8, compared to 4.4 in 2004.

Generally, decreasing household size contributes to an increase in average intake of macronutrients and in the number of households who meet the ideal dietary balance (Hoang, 2009; Trinh, 2018b). In 2014, households with two or fewer people consumed 15% fewer calories per capita from starchy staple foods than households with three people, but 19% more fruit and 26% more vegetables. This may be because smaller households are more likely to be urban and have a higher per capita income, enabling them to access and afford relatively expensive fruits and vegetables.



The Vietnamese dietary shift over ten years. Source: Trinh, 2018a.

2. Strategies to influence dietary choices: lessons from high-income countries

Author: Toby Park

Based on a forthcoming 2019 report by the same author on the application of behavioral insights to promote more sustainable diets.

In principle, a widespread shift in diet is quite achievable: there are no technological challenges to address, and there is little to stop an individual from immediately reducing their meat and dairy consumption, for example, in favor of more plants. In reality, of course, achieving such widespread changes in habit, tastes, culture and norms presents major difficulties. This chapter looks at some of the ways we might begin to encourage those changes, based on public health research and lessons from high-income countries' recent experience in shifting towards more plant-based diets.

Current trends

Some consumers are already leading the way. Retail data suggest a sharp increase in low-meat diets across several European countries. Supermarkets are reporting plant-based products to be their biggest source of growth in 2018 (Waitrose, 2018; Hancox, 2018) and wider industry research reveals that products labelled as 'vegan' have increased by 276% (World Business Council for Sustainable Development, 2018). This is encouraging, but must be put into perspective: these data reflect a small segment of the global population, and are rising from a very low baseline of vegetarians and vegans. As yet, these retail trends have not made a significant dent in the Organisation for Economic Co-operation and Development (OECD) livestock import/export data for the same countries (OECD, 2018b). They also sit against a backdrop of far bigger global increases in meat consumption, with billions across Asia and Africa entering the global middle class and driving an expected 74% increase in demand for meat by 2050 (Ranganathan et al., 2016). We are therefore not at a moment to celebrate or lose our sense of urgency. Instead, the recent rise in consumer interest in plant-based foods is an opportunity to harness.

The limits of conventional wisdom: regulation, taxation and awareness-raising

Historically, we have understood behavior predominantly through the lens of rational choice. Rational choice theory suggests that as consumers we carefully consider our options, and make deliberative decisions which maximize the benefit to ourselves (Scott, 2000). This understanding of human behavior underpins the most familiar tools of policy-makers and campaigners. For instance, regulation, taxation, subsidies and other incentives seek to leverage self-interest by making the ‘good’ behavior more rewarding (or less punishing) than the ‘bad’. Education, awareness-raising, food labels and other forms of information-provision recognize that rational consumers can only optimize their choices if they possess full knowledge. Meanwhile attitudinal campaigns and social marketing aim to alter consumers’ underlying preferences (i.e. to make them care more about the environment) on which their deliberative and rational decisions are based.

Each of these approaches can be effective. In particular, regulations and incentives can be hugely powerful, reflecting the fact that cost *is* important to most food consumers, among other factors including quality/freshness, taste/enjoyment, and to a lesser extent health (environmental concern is rarely mentioned) (Strain, 1997). Labelling and other forms of information-provision tend to be effective only if lack of information is the true barrier to consumers choosing sustainable foods, perhaps where the more and less sustainable product are at the same price point. Evidence from public health research shows that point-of-choice information, e.g. product labels and prompts, tend to be more effective than generic awareness-raising activities, albeit all forms of information provision tend to be most effective among the health-literate and can thus exacerbate health inequalities (Lorenc et al., 2012). We also know sustainability messaging tends to be persuasive to those already on-board with the message (Sunstein et al., 2016). We might therefore expect sustainability labelling on food to be predominantly effective (if at all) among the most environmentally-aware rather than the mainstream – though this is an open question in need of more research.

However, these conventional strategies have limitations. For instance, regulation and taxation may be politically infeasible, and a lack of consumer awareness is often *not* the limiting factor when it comes to sustainable consumption (Diekmann and Preisendörfer, 1992). Indeed, pro-environmental awareness and green values are increasingly common (Steentjes et al., 2017), but evidence of a widespread ‘value-action gap’ shows that other factors tend to dominate our actions (Blake, 1999). These

include competing self-interests (such as for price, convenience and pleasure) which we often prioritize at the point of purchase despite holding seemingly sincere pro-environment beliefs. This apparent hypocrisy emerges through our tendency to rationalize and excuse our own actions, as we adopt various tricks including motivated inattention (simply not thinking about the issue), moral licensing (using previous good acts to justify the bad) and motivated reasoning (reasoning towards the desired, not logical, conclusion) (Paharia and Deshpandé, 2013; Khan and Dhar, 2006).

Even where our intentions to eat more sustainably are absolutely sincere, we can still be thwarted by practical barriers such as poor availability of options or inconvenience, as well as psychological barriers such as lack of willpower, ingrained habit, forgetfulness, or lack of know-how in preparing unfamiliar recipes. These are often exacerbated by biased and automatic processes of decision-making. For instance, we may unthinkingly adopt behaviors perceived as normal to our in-group, whilst ‘present bias’ (our tendency to focus disproportionately on immediate costs and rewards over long-term impacts) leads us to choose the tempting and indulgent option despite longer-term intentions of being more healthy or sustainable.

And so whilst awareness-raising is still important (poor awareness will be the limiting factor for *some* behaviors among *some* consumers; and raised awareness is vital for building public support for policies which have a much larger impact, such as a carbon tax on ruminant meat), it is for the above reasons that information provision is rarely the most effective approach. This is a conclusion shared by a recent meta-analysis of sustainable food interventions (Bianchi et al., 2018a), but also across the wider body of research on sustainable behavior-change (Marteau, 2017; Kollmuss and Agyeman, 2002; Moser and Kleinhüeckelkotten, 2017) and on diet interventions from the field of public health research (Cadario and Chandon, 2017).

Beyond information and awareness: making sustainable food appealing, easy and normal

Providentially, many other strategies are available. A behaviorally-informed approach must recognize that contrary to rational choice models, our food choices are a product of both rational (cognizant) and automatic cognitive processes, and are constrained by the physical, economic and social structure of our food choice environment. That is, in addition to personal tastes our consumption habits are profoundly influenced by the prevalence, layout, cost and salience of options, by biased and non-conscious

decision-making, and by socio-cultural norms and practices. It therefore stands to reason that rather than trying to change people’s conscious lifestyle choices (through greater awareness or environmental concern), we can edit the options they are presented with, attempt to shift products’ socio-cultural associations, and alter the environment in which they are offered. To this end, sustainable food must be made more **appealing** (since concern for the environment is rarely a sufficiently strong motivator, we must harness one that is – such as taste, convenience, enjoyment or cost), it must be made **easy** (i.e. available, prevalent, and where possible the automatic or default choice), and it must be perceived as **normal** (familiar, socially normative and desirable, and aligning with mainstream social identities rather than with niche counter-cultures). The case study below shows one approach to making sustainable food more appealing, by using more enticing language.

Case study 4: Making plant-based food more appealing in UK restaurants through better use of language (Vennard et al., 2019) (Toby Park)

A collaboration between the Behavioural Insights Team (BIT) and the World Resource Institute (WRI), this study tested the impact of different language on meat-eaters’ propensity to order plant-based food at restaurants and cafes. Research has shown that healthy food labelled with exotic or decadent phrasing (such as ‘twisted citrus-glazed carrots’ and ‘dynamite chili and tangy lime-seasoned beets’) out-sells the same produce labelled with health phrasing (‘carrots with sugar-free citrus dressing’ and ‘lighter-choice beets with no added sugar’) (Turnwald et al., 2017). The hypothesis is that plant-based food marketed as overtly vegetarian, meat-free or otherwise abstemious will be unappealing outside of a small niche market. In order to entice a mainstream market, more appealing language is needed.

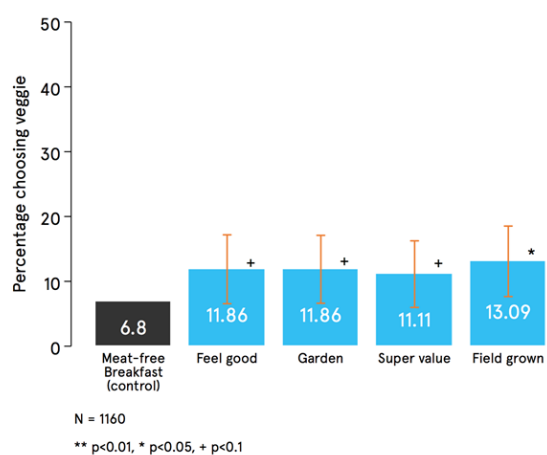


Figure 3: Rates of ordering among non-vegetarians. Source: Data reproduced from Vennard et al., 2019.

2000 online, meat-eating participants were asked to make hypothetical choices from a series of menus. In each case a single vegetarian item was included, and tested under 3 or 4 different names. Drawing general conclusions from the eight dish types tested (each with multiple names), ‘experiential’ and indulgent language (such as ‘mild and sweet’ and ‘comforting’) tended to perform well. The term ‘meat-free’ was consistently a poor seller, with ‘field grown’ being a much more popular alternative. This graph shows the results for one of the dishes tested—a meat-free English breakfast. (*The tested names were ‘meat-free breakfast’, ‘feel good fry-up’, ‘garden breakfast’, ‘super value breakfast’ and ‘field-grown breakfast’*).

That 'meat-free' performed poorly is intuitive: among meat-eaters, the term merely highlights the incompleteness of the meal. We are also sensitive to losses, and so this is fundamentally an unappealing framing in comparison to alternatives which highlight a positive attribute of the meal.

This online study represented the first step in a program of research in which the best performing names are being taken into the field and tested in large restaurant and café chains. Subsequent research has found that over the course of 235,000 meat-free breakfasts being sold in a UK café chain, these results broadly replicate in the field: both 'garden breakfast' and 'field grown breakfast' significantly increased sales (by 12% and 17% respectively) relative to the existing name of 'meat-free breakfast'.

When it comes to cost, behavioral science can help us design more effective incentives and avoid unintended consequences. This applies to consumer purchasing decisions, as well as the activities of others in the supply chain. For example, levies can sometimes backfire by morally licensing the behavior they aim to discourage (paying the price legitimizes the behavior) (Gneezy and Rustichini, 2000), whilst subsidies and payments can unintentionally discourage action by crowding out intrinsic motivations (Frey and Oberholzer-Gee, 1997). One potentially effective incentive may be to target producers, by carbon-taxing produce above certain thresholds of CO₂ equivalent per portion, to encourage re-formulation (for instance blending meat with mushrooms in burgers). A similar approach has been shown to be highly effective to reduce the sugar content of drinks in the UK (Harper, 2018).

We must also recognize the extent to which our eating behavior is driven by factors beyond our conscious awareness and personal tastes. As consummate effort-minimizers, we are sensitive to how the structure of our environment makes certain behaviors easier than others. Moreover, our behavior is largely dominated by rapid and intuitive decision processes including social influence, ingrained habit, emotion, and heuristics (mental shortcuts) (Kahneman and Egan, 2011). These are largely automatic responses to our physical and social setting, and thus by altering the choice architecture of our eating environments we can remove barriers to action and nudge consumers towards healthier and more sustainable food. Though seemingly trivial, such interventions often have a significant influence on our choices. For instance, altering portion size, increasing the number of available sustainable options, changing the ordering of options in canteens and on menus (putting the sustainable options first), and moving their positioning in supermarkets (towards more salient places such as end-of-aisle and eye-height), are all effective techniques (Bianchi et al., 2018b; Dayan and Bar-Hillel, 2011; Rozin et al., 2011). Similarly, substitution is generally much easier than curtailment, so prompting consumers towards blended burgers (part

beef, part mushroom), or even towards chicken burgers, will be easier than imploring them to go meat-free.

The social dimension of our food consumption also deserves particular attention. As consumers of any product or service, we make our choices partly as an act of self-expression, adopting the norms of our ‘in group’. This is problematic so long as plant-based diets continue to be associated with a minority identity (Greenebaum, 2012), provoking a strong sense of ‘otherness’ among meat-eaters, with associations of weakness and femininity (Rozin et al., 2011). Marketing efforts must overcome the connotations of plant-based food as niche, restrictive and abstemious, by avoiding segregation on menus and in supermarkets and cafes, and avoiding overtly vegetarian branding and language. The normalization of plant-based food is also critical for another reason: wider evidence on environmental behavior shows our willingness to act sustainably depends heavily on our perception that everyone else is also doing their bit (Nowak et al., 2000; Ostrom, 2000; Keser and Van Winden, 2000). Highlighting to consumers the increasing normality of eating less meat has been shown to be effective (Sparkman & Walton, 2017), building on evidence that this ‘social norms’ approach works in many other ‘public goods’ contexts. For example, telling people that most other people recycle (Goldstein et al., 2008), or pay their taxes on time (Behavioural Insights Team, 2014), or use less energy (Allcott, 2011), have all proven effective at promoting those desired behaviors.

Recommended strategies for influencing consumers towards healthy and sustainable food and diets

Understanding the various conscious *and* non-conscious processes described above, and both the psychological *and* situational factors at play, gives us a broader set of tools to draw upon. Ultimately, the biggest impact will likely come from combining these approaches, both motivating the consumer by raising awareness and making plant-based food more **appealing**, but also creating an enabling environment in which it is **easy** and **normal** to eat healthier and more sustainable food. These efforts should reinforce each other, as increased awareness and consumer demand drives the policy and industry changes which further normalize and remove frictions to more sustainable eating. Drawing on these key themes, we summarize below a number of concrete actions which can be taken by retailers and producers, marketers, campaigners, policy makers, and restaurant managers.

| | Principle | Application |
|--------------------------|---|--|
| Make it APPEALING | <p>Healthy food marketed as delicious sells better than the same food marketed as health food (Turnwald et al., 2017). Emerging research suggests the same is likely to be true for vegetarian/sustainable food (Vennard et al., 2019).</p> | <p>Market plant-based options as appealing and delicious, rather than on messages of health, sustainability, or abstemiousness. Exceptions apply <i>if</i> targeting niche markets.</p> |
| | <p>Financial incentives such as differential tax rates can work well, but should be considered carefully: bigger impacts may be feasible if targeted at suppliers (e.g. to incentivize reformulation), where consumer preferences are inelastic or concerns exist that taxation is regressive</p> | <p>Introduce a carbon tax on certain food products (e.g. ruminant meat), or target producers with a tax to incentivize reformulation (e.g. based on carbon footprint per portion). This has worked well to reduce the sugar content in drinks in the UK (Harper, 2018).</p> |
| Make it EASY | <p>We tend to stick with default options (Thaler and Sunstein, 2008; Behavioural Insights Team, 2014), because it is low-effort, because risk- and loss-aversion favor the status quo, and because defaults are taken as an implicit recommendation or norm. For instance, defaulting energy consumers into renewable tariffs (with freedom to opt out) increased their uptake tenfold (Ebeling and Lotz, 2015).</p> | <p>Make plant-based options the default choice at catered events, on flights, or in school and hospital canteens. Similarly, high-street coffee shops could default the use of soy or oat milk unless the customer requests cow's milk.</p> |
| | <p>We are highly sensitive to hassle factors and small amounts of friction or inconvenience (Behavioural Insights Team, 2014). There is therefore often disproportionate benefit from removing small frictions (or introducing them to discourage undesirable behaviors). Many opportunities for this exist.</p> <p>One specific example is to promote easy substitutions, which are easier to adopt than curtailment of a habit, or wholesale adoption of new behaviors (for instance, adopting e-cigarettes is far easier than quitting smoking, and thus the electronic cigarette has become a popular quitting device (Hajek, 2013)).</p> <p>Another approach is to provide timely prompts and reminders, which help overcome forgetfulness, procrastination, or weak intentions.</p> | <p>Help consumers familiarize themselves with new plant-based foods, and overcome lack of recipe repertoire, by providing recipe cards in supermarkets.</p> <p>Give timely prompts and reminders, for instance by promoting product substitutions (beef burgers for chicken or bean burgers) at the point of check-out during online grocery shopping.</p> <p>Producers should provide simple substitutions to high-impact and high-volume food items such as minced beef. This maintains familiarity, and overcomes the hassle of learning new recipes or significantly altering the weekly grocery shop. For instance, this might include 'veg and bean mix' as a direct substitute for, and sold adjacent to, minced beef for use in pasta dishes and chili-'non'-carne.</p> <p>Introduce frictions to wasting food. For instance, several studies show that removing the tray from canteens (requiring patrons to return to the serving area for second portions, multiple deserts and side-dishes) can reduce food waste by as much as 40% (Lipinski et al., 2013).</p> |

| | | |
|--|--|---|
| | <p>We are sensitive to the choice architecture of options in supermarkets, restaurants and canteens. For example, increasing the availability of plant-free options in canteens and on menus, putting sustainable options first in menus and canteens, and dedicating more shelf space (and more salient locations, such as that at eye-level and on aisle ends) are proven strategies to shift food purchases (Arno and Thomas, 2016; Rozin et al., 2011).</p> | <p>Increase the number of plant-based options in menus, canteens and supermarkets.</p> <p>Make these options more salient by putting them at the end of aisles and allocating them more shelf space.</p> <p>Put plant-based options first in canteens and on menus.</p> |
| <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Make it NORMAL</p> | <p>We mostly stick to familiar options, and make choices which ‘fit’ within our concept of self / social identity.</p> <p>Food segregated in shops or menus, or heavily branded as specifically vegetarian, is often ignored by meat-eaters as it gives a signal of ‘otherness’ akin to allergen free or other ‘special’ food for other people. Particularly when facing many options (e.g. a menu or sandwich shop) we adopt rapid choice-elimination strategies. Segregating the meat-free options encourages meat-eaters to immediately rule them out.</p> | <p>Avoid segregating produce in shops, cafes and on menus. For instance, Pret (the global café chain) found that having ‘veggie only’ refrigerators in their sandwich shops reduced sales compared to integrating the produce across all refrigerators (Schlee, 2017). Similarly, the World Resources Institute have found that segregating vegetarian items on a restaurant menu reduces ordering rates by 56% (Holzer, 2017). Likewise, putting soy milk (which does not require refrigeration) in supermarket fridges with the cow’s milk increased sales.</p> <p>Avoid overtly vegetarian branding or labelling which may alienate meat eaters.</p> <p>Challenge associations of weakness and femininity in marketing and branding, and address preconceptions that meat is necessary for good health and strength (Bianchi, 2018c).</p> |
| | <p>We are greatly influenced by the norms of our social group, for a number of reasons. We tend to conform to norms partly out of peer pressure and desire to fit in (<i>normative social influence</i>), partly because we use others’ behavior as a source of information, e.g. we infer food which is very popular to be delicious (<i>informational social influence</i>, or <i>social proof</i>), and partly because we adopt the norms of our social group through a process of self-definition and expression (Cialdini and Goldstein, 2004). Moreover, when it comes to pro-social behavior for collective benefit, we are more willing to contribute to the collective good when other people are also doing so (Keser and Van Winden, 2000; Nowak et al., 2000)), i.e. to reciprocate (Ostrom, 2000).</p> | <p>Highlight the social norm (for example, the majority of UK residents report having reduced their meat consumption in the 12 months to July 2018 (Intel, 2018)).</p> <p>Where the current norm is not a majority, it may be more effective to highlight the dynamic norm (e.g. “more and more people are reducing their meat consumption”), or to target high-meat-eaters with social comparisons highlighting that they eat more than most. Each of these techniques has successfully increased sustainable behavior, e.g. in energy use (Allcott, 2011), hotel towel-reuse (Goldstein et al., 2008), and meat consumption (Sparkman and Walton, 2017).</p> |

3. Strategies to integrate dietary change into food system transformation

Authors: Sonja Vermeulen, Colin K. Khoury, Huong Trinh Thi, Brent Heard and Bee Wilson

Abundant evidence on strategies and tactics for promoting healthy and sustainable diets at national, regional and global levels is now available (e.g. Afshin et al., 2014; Keats and Wiggins, 2014; Garnett et al., 2015; Hawkes et al., 2015; Ranganathan et al., 2016; Fanzo et al., 2017; Mason and Lang, 2017; Popkin and Reardon, 2018; Vermeulen et al., 2019; Willett et al., 2019). The purpose in this section is not to condense or repeat this wide range of guidance, but rather to highlight some of the key principles and underplayed areas for action.

People are at the center of change

'It seems obvious that, in an ideal world, food should be a source of pleasure and a delightful part of life, yet sustainable diets can easily tap into motives that could be interpreted as anti-pleasure—a hair-shirt tendency.' (Mason and Lang, 2017)

The recent history of global diets shows how large-scale, society-wide shifts can happen within a generation or two (section 1). However, almost without exception the direction of change has been towards richer food: a nutrition transition away from monotonous consumption of grains and starchy staples and towards more fruit and vegetables, but also more animal products, fats and sugars, often beyond healthy levels. The challenge that we are only beginning to address globally is to modulate this nutrition transition towards a healthier and more sustainable pattern of eating. For many people, this will involve expansions in some dietary choices (a greater quantity and more variety of nuts, pulses and vegetables) but contractions in a wide range of currently preferred foods (meat, dairy, salt, refined carbohydrates, added fats and sugars).

People seek appealing, easy and normal food (section 2). Eating is both one of our greatest sources of pleasure and something mindless and habitual (Chandon and Warsink, 2012). Keeping this paradox in mind, strategies and policies to create better eating patterns should aim to make healthier and more sustainable diets the preferred

and pleasurable choice, and at the same time the convenient, cheap and socially acceptable choice (Hawkes et al., 2015). As far as possible, we need to build on both pleasure and ease in new ways of eating, for example as in the Korean and Japanese models (Case study 1 in section 1), rather than on denial and restriction.

Behavioral sciences are providing new insights into how to lower the barriers and raise the incentives for any individual to make the healthy and sustainable choice (section 2). In addition to the immediate cues in our food environments, learning and establishment of eating preferences from earliest childhood play a major role. Research shows that we are not hard-wired to prefer fatty, sugary or salty foods; our preferences are learnt as children (Wilson, 2015) and the brain's reward systems remain plastic into adulthood, open to being trained to respond to healthy over unhealthy foods (Mozaffarian, 2016). Strategies with potential to influence the early learning of food preferences include programs for food literacy and enjoyment among parents and children, design of school meal services, regulation of marketing and advertising of food to children and youth, and subsidies that promote affordability of healthy food for low-income parents (Evans, 2012; Hawkes et al., 2015; Wilson, 2015). An important opportunity for future healthy and sustainable diets may be the very young populations in many countries, open to developing new habits and forging a new direction for the nutrition transition.

But food production and manufacturing determine the choices possible for consumers

'Dietary change may be effected by changing people (their habits, beliefs etc.) or by changing food (composition, price, marketing). The accumulated experience from nutrition education and health promotion research strongly suggests that it is faster and more feasible to change food.' (Mela, 1999)

'When the private sector, policymakers and scholars find a way to make healthy eating as we now understand it much less expensive, less time intensive and also tasty, we will see the popularity of this type of diet explode.' (Popkin and Reardon, 2018)

A meaningful shift towards healthy and sustainable diets that are compatible with the SDGs requires supply to change in tandem with demand, increasing access to (including affordability of) better foods to prompt consumer demand at the same time as responding to that demand. In terms of basic supply from agriculture, we are far

from a pattern that would support health and sustainability. While farming and fisheries already produce food in excess of global needs for human nutrition at the macro level (Berners-Lee et al., 2018), for fruit and vegetables supply is only 42% of need across low-income countries, and 72% of need across all countries (Siegel et al., 2014). A global shift towards healthy and sustainable diets would involve a transformation of land use for agriculture, depending on crop suitability. An analysis of land use to deliver a healthy diet to everyone calculated that land under cereals, oil crops and sugar crops would decline by 150, 105 and 30 million hectares respectively. Land under vegetables and fruits would increase by 170 million hectares, while the trajectory for land to produce livestock would depend on the balance of plant and animal proteins in the diet (Bahadur et al., 2018).

Turning to the post-farmgate functions of the food chain, while some analyses emphasize the superiority of fresh, minimally processed foods in delivering health outcomes (Pollan, 2008; Garnett, 2016), food processing is likely to play a role in future food system sustainability. The highly processed foods that make up substantial proportions of current diets are predominantly unhealthy (Poti et al., 2015; Dunford and Taylor, 2018). But, if used well, processing can increase longevity, palatability and nutrient availability of foods (Augustin et al., 2016) while providing consumers with the convenient, consistent and affordable foods that they often prefer. The ‘third stage’ of the nutrition transition, following the first stage of traditional foods and second stage of industrially produced unhealthy processed foods, is likely to be industrialized but healthy processed foods, such as plant-based packaged soups and bars that are high in fiber and micronutrients. These are currently only a small niche market in most countries, but able to grow rapidly (Popkin and Reardon, 2018). Brands of healthier processed foods are growing most quickly in high-income countries (section 2), but are also profitable in low-income countries, as Case study 2 on wholegrain *sadza* in Zimbabwe shows.

Technological innovation in food is a probable game-changer for healthy and sustainable diets (Herrero et al., 2019). The world has moved quickly from conjecture to highly visible and successful start-up companies creating lab-based meats, edible insect products and algal feed sources. Examples such as Danone’s expansion into plant milks and Tyson’s investment in Beyond Meat (and similar companies) signal a move from the periphery to the mainstream for alternatives to animal-source foods. Production costs, and hence consumer prices, of alternatives to ruminant meat is currently prohibitive for the mass market, but are falling very rapidly (Heingartner,

2018) and have potential to become less expensive than ‘real’ meat, so that consumers can be leveraged on cost to eat more sustainably.

More generally, affordability of food is central to broad-based dietary change. Price changes, mediated by taxes or subsidies, are shown to raise consumption of healthy foods like fruit and vegetables and to reduce consumption of unhealthy foods like sugar-sweetened beverages (Afshin et al 2017; Hyseni et al., 2017). Health outcomes associated with food prices are more pronounced in low-income than in high-income countries (Muhammed et al., 2017). Optimally, food prices should include the environmental and health costs of food production and consumption (Willett et al., 2019); current low food prices distribute those costs to producers, to the general public and to future generations (Carolan, 2018). Yet there is a delicate balance between economic benefits to consumers and to producers, as all food producers are consumers too, and many of the poorest of farmers are net buyers of food (Aksoy and Hoekman, 2010). If we are to achieve healthy and sustainable diets, securing better wages, and subsidizing poorer consumers through various forms of social protection may be a better alternative than subsidizing production of cheap, under-nourishing food.

Wider changes, importantly women’s empowerment, may be powerful drivers

*‘Family planning, education (of women and men) and socio-economic development are mutually reinforcing, and should be pursued together.’
(Bongaarts, 2016)*

Socio-economic and policy drivers beyond the food system may outweigh changes within the agrifood sector in driving dietary change (see in introduction). Investing in women’s health and education, and in family planning, may provide more long-term opportunity for achieving global adoption of healthy and sustainable diets in line with the SDGs than reforms directed at agriculture, food processing and food retail or service sub-sectors. Statistical analysis of historical national successes in reducing malnutrition and improving diets indicates that the most significant factor has been women’s education, which is even more important than household income (Smith and Haddad, 2000). Improving access to voluntary family planning has also proven successful in improving nutritional outcomes for mothers and children, increasing educational and employment opportunities for women and adolescent girls, and

empowering women with more decision-making power over their own lives (Starbird et al., 2016).

From the perspective of climate change and planetary health, a critical co-benefit of improving women's access to family planning, health and education services is the deceleration in population growth (Bongaarts and O'Neill, 2018). Roll-out of voluntary family planning programs that enable women to avoid unwanted births have shown rapid and large reductions in fertility rates, such as a fall over a decade from 5.6 to 2.6 births per woman in Iran, and from 6.1 to 4.6 over five years in Rwanda (Bongaarts, 2016). Countries that achieve reductions in fertility rates reap a 'demographic dividend' in terms of an increase in GDP and household budgets, as the ratio of earners to dependents is higher and public infrastructure and services more able to meet the needs of a smaller population (Bongaarts, 2016).

Radical and tame versions of 'transformation'

'We argue that the inclusion of multiple framings of transformation, particularly from those who are skeptical of the notion, is essential for ensuring that transformative research and practice engages with the root causes of unsustainable practices, social inequality and injustice.' (Blythe et al., 2018)

Achieving sustainable and healthy diets clearly requires (and is essential to) transformation of the whole food system, but different commentators have contrasting views of the changes in governance and power relations that such a transformation might entail (Geels et al., 2015). Some authors recognize the ability of the private sector to innovate and adapt, and focus their recommendations on mechanisms, such as financial or fiscal incentives, to re-orient the marketing strategies, business models, product formulation and research and development of industry (Chandon and Wansink, 2012; Moss, 2013; Ranganathan et al., 2016; Popkin and Reardon, 2018). For other authors, transformation is not possible without addressing deep structural inequities (Weis, 2007; Pelling et al., 2012; McKeon, 2015; Holt-Giménez, 2017). As Holt-Giménez succinctly puts it, the food system is 'structurally designed for profit rather than need, speculation rather than equity, and extraction rather than resilience.' For many of these authors, food system transformation requires nothing short of dismantling capitalism. Yet other authors take a middle ground, in which disruption and significant change are possible within the prevailing global economic regime, but not without addressing issues of political economy at multiple levels (Gladek et al.,

2016; Mason and Lang, 2017; Oliver et al., 2018; Vermeulen et al., 2019; Willett et al., 2019).

Visions of a (post-transformation) sustainable food system also differ tremendously. People hold values that determine the relative weight that they give, say, to animal welfare, wilderness, workers' rights, or reducing hunger (Garnett, 2016). Yet conversations across strongly held opposing positions are possible, based on sympathetic analysis of how each side frames the issues, and efforts to find blended approaches or new configurations of the problem to unlock a more constructive dialogue (Geels et al., 2015; Mockshell and Kamanda, 2018). Sustained engagement with plural definitions of, and approaches to, sustainability and transformation may be key to practical progress—especially to ensure that the agendas of the most vulnerable producers and consumers are not marginalized (Blythe et al. 2018).

Social movements shorten the distance for public policy and business strategy

'There is no one-size-fits-all in designing a food policy and it all depends on the local context of the society.' (Dwiartama et al., 2017)

In principle, bottom-up and top-down approaches to dietary and food system transformation should be mutually reinforcing. Citizen-led, social media and social movements can create new social norms and sow the seeds of widespread behavioral change, shortening the distance with more top-down policies. Similarly, policies that enable or encourage new behaviors shorten the distance for changes in consumer habits.

Recent progress on plastic waste in several countries is a good example of this interplay, and also demonstrates the power of both traditional media and social media in galvanizing change. Awareness of the issue of plastic pollution in the ocean—largely due to drink bottles and other food packaging—boomed in 2018, driven by evidence-based advocacy organizations like the Ellen McArthur Foundation, but perhaps more impactfully by the television show *Blue Planet 2* (Attenborough, 2018), watched by vast global audiences including 80 million people in China, and by a biologist's video of a plastic-affected turtle serendipitously going viral (Figgenger, 2018). The social interest generated by these traditional and social media have eased the pathway for business strategies and public policies such as bans or levies on single-use plastics.

While the power of celebrities and individual champions to vitalize action receives much attention, more broad-based social movements and organizations arguably have more tenacious impact. Civil society roles in system transformation include: representing and raising the voice of under-represented communities, holding businesses and governments to account, demonstrating new ways of producing and consuming, developing resilient local economies, providing services to under-served community members, defending people's rights or protection of nature, advocating for different priorities or politics, and promulgating new social norms (World Economic Forum, 2013). But the separation between civil society and business is blurring (World Economic Forum, 2013), noticeably in the food sector. It has long been difficult to categorize many farmers' organizations as either civil society or business groups (McKeon, 2009), and new online platforms for social organization are softening this distinction further. For example, Case study 5 from Indonesia shows how food activists in Bandung use their online platforms for both marketing and for community organization, while 'prosumer' movements in high-income countries are getting consumers more closely involved in design and production of food and farming systems (Connolly, 2018).

Several commentators recognize the city as a key level of governance to unlock food system transformation (Garnett et al., 2015; Gladek et al., 2016; Vermeulen et al., 2019), and here we see new collaborations between civil society and local government. For instance, C40 Cities, a global network of mayors of 96 cities that account for a quarter of global GDP, works with civil society organizations in four areas (Bailey, personal communication): food production (urban agriculture to supply fresh vegetables but also to mitigate urban heat island effects), food procurement (a large city like Sao Paulo supplies 3 million public sector meals a day, in worker canteens, hospitals, schools and prisons), food distribution (largely municipal markets) and food waste (working with community groups to redistribute food, or to use it for animal feed or composting). Cities such as Bandung (Case study 5), Turin and Cusco cherish – and capitalize on – their global reputations for citizen-led sustainable food movements.

The limits to the power of social movements and social media to drive transformation are their typically ephemeral nature—spikes in society-wide interest dissipate as quickly as they emerge—and a tendency not to penetrate beyond a niche young, urban, middle-class membership or audience (Boerwinkel and Paath, 2018). Yet, as the recent experience with plastic waste suggests, a short-term spike among a

sufficiently large group that listens and cares, may be enough of a hook for more durable responses by governments and businesses.

Case study 5: Civil society stirs up new food futures in Bandung and other Javanese cities, Indonesia (Sonja Vermeulen)

In the last five years Bandung in West Java, with a population of 2.5 million, has emerged as a hub of social movements and civil society activity around sustainable and healthy diets – with its innovations quickly reaching other cities across the island of Java. The *Komunitas 1000 Kebun* (1000 Gardens Community), established in 2014 by community activists, is now a network of over 300 initiatives engaged in community gardening. Examples include the Hydroponic Learners Club, the Indonesian Organic Community, the *Kebun Belajar* youth permaculture garden, and Gardening Bandung, which has subsequently grown into Gardening Indonesia. The initiatives range from community development and self-sufficiency gardens in less wealthy communities through to experiments with new foods and farming systems (Dwiartama et al., 2017).

Keen to market excess produce, vegetable and fruit growers in the city started an informal online market. This soon precipitated establishment of physical markets for city-grown produce. Known as *Pasar Sehat* (healthy markets), these run out of school car parks and similar venues across the city, selling seasonal, local and—above all—safe and hygienic produce. This provides an alternative to the traditional wet markets, which are considered convenient but dirty by consumers. Local food activists are now working to enhance these wet markets, to conserve the market shopping tradition in the city and to promote high consumption of fruit and vegetables (Dwiartama et al., 2017).

A parallel initiative, The Indonesia Food Change Lab, started in Bandung in 2015 to tackle the long-standing conflict around street vendors, who supply as much as 80% of the food eaten daily by a typical working Bandung resident. As well as helping the vendors to organize themselves to negotiate with city authorities, the Food Change Lab has brought in students from the Bandung Institute of Technology to develop prototypes of innovations for street vendors to try out. Successful prototypes include a water-saving dishwashing device, *Kumbah*, which can be used by three vendors at the same time, and a customer rating system for food stalls, based on hygiene and taste. (Boerwinkel and Paath, 2018.)

The city of Jakarta has tested a similar approach. A crowd-sourced map of street vendors with customer ratings, #KAKI5JKT, was built into a scheme in which vendors that achieve safety certification can get approval for food delivery through online ordering platforms such as Go-Food, enlarging their markets in return for meeting hygiene standards. Potentially a scheme like this could also include nutritional or environmental standards (Vermeulen et al., 2019).

Social movements around food have reached scale in Javanese cities. For example, the ‘Clean & Green’ campaign in the city of Depok reaches over 100,000 households with a program on segregation and recycling of food and other waste, with strong support from its mayor. Indonesians are keen users of social media, with over 100 million active users. One popular app among young Indonesians is ‘Snapfood’, on which users share not only their delicious meals but their empty plates—building a social norm against food waste (Vermeulen et al., 2019).

What will be the wake-up call from policy timidity?

'In fact, policies on diets have been so timid to date that we simply do not know what might be achieved by a determined drive to reduce the consumption of calories, and particularly the consumption of fat, salt and sugar, in OECD countries.' (Keats and Wiggins, 2014)

We cannot say that dietary change in the interests of human and planetary health is too difficult when it has not yet been seriously attempted. A start is being made: an emerging set of civil society initiatives, collective declarations, and public or private policy frameworks are providing the space for new conversations on diets and food systems. Examples include social movements on food across the Americas, Europe, Asia and Africa (Andrée et al., 2019; Dwiartama et al., 2017; Warshawsky, 2016), France's Circular Economy Roadmap (2018), the Nordic Council of Ministers' solutions menu for food policy (Halloran et al., 2018), and the World Economic Forum's Shaping the Future of Food Initiative (WEF, 2019). At the international level, the 10-Year Framework of Programmes on Sustainable Consumption and Production (2012-2022) is a global commitment to deliver on SDG12 by accelerating the shift towards sustainable consumption and production in countries across the income spectrum, is being implemented via the One Planet Network.

Yet many national governments still show lethargy and lack of political will to take action on sustainable and healthy diets beyond information-sharing and awareness-raising. There is little evidence to date that governments are swayed by the climate change costs, or other environmental costs, associated with unsustainable diets (Willett et al., 2019). While some governments, such as Mexico and Germany, are beginning to apply regulations and taxes to address diet-related non-communicable diseases, such regulation is still far from the norm. In the meantime, there is global policy lock-in to systems of producer subsidies, along with trade tariffs and quotas, aimed at maintaining national food-baskets, export competitiveness and low food prices for consumers, instead of regulating to internalize environmental or health costs.

One strategy proposed to break through food system lock-ins is to seize windows of opportunity—for example moments of major policy review or of society-wide concern—and unleash well-coordinated action on multiple leverage points (Oliver et al., 2018). Policy entry-points may need to go beyond prevention of non-

communicable diseases and the environmental impacts of farming to other societal concerns that are likely to increase in coming years, perhaps children's nutrition, or decent jobs versus automation (food is the largest employer in the manufacturing sector, even in Europe, as well as providing substantial numbers of service jobs). Future ratcheting-up of the nationally determined contributions to the Paris Agreement could possibly be a lever for incorporating dietary change into climate policy.

Perturbations or shocks may provide a trigger for public sector action towards food system transformation; arguably a simultaneous climate-related failure of harvest across several of the world's major breadbaskets would be a wake-up call for governments that are currently reactive rather than proactive. In the longer-term, national food security concerns may provide a stronger motivation for action on diets than either public health or environment. For example, countries with high dependence on imported livestock feeds, such as China, may move to moderate meat consumption on food security, self-sufficiency and sovereignty grounds, particularly in the face of escalating trade conflicts.

Looking forward not backwards

'The future is already here – it's just not evenly distributed.'
(William Gibson interview, 1993)

As authors we come from different disciplines, yet our different experiences and worldviews have drawn us to a similar optimistic view of the potential for positive change in diets among both wealthy and poorer communities and countries. While there are substantial countervailing forces—including highly successful business models that benefit from poor dietary choices, and governments not yet ready to consider diets a social issue rather than an individual one—the history of dietary change combined with growing awareness and concern among social movements and food system participants suggest to us that transformation is indeed possible.

A final word is that the future will be new. Food systems will not achieve human and planetary health by a wholesale return to past ways of eating, cooking, farming, or shopping, however attractive this might be for a minority of consumers and producers. History itself shows us that we need to look to modernity rather than a return to the 'traditional': embracing convenience and eating out of the home, welcoming healthier processed foods, and exploring novel technologies and food sources like lab meats

and algae. Alternative non-animal foods may come quickly to the ‘center of the plate’; for example, they are expected to account for a third of the growth in European demand for protein in the next five years (Rabobank, 2017). Our future diet is already among us, growing in new forms every day.

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