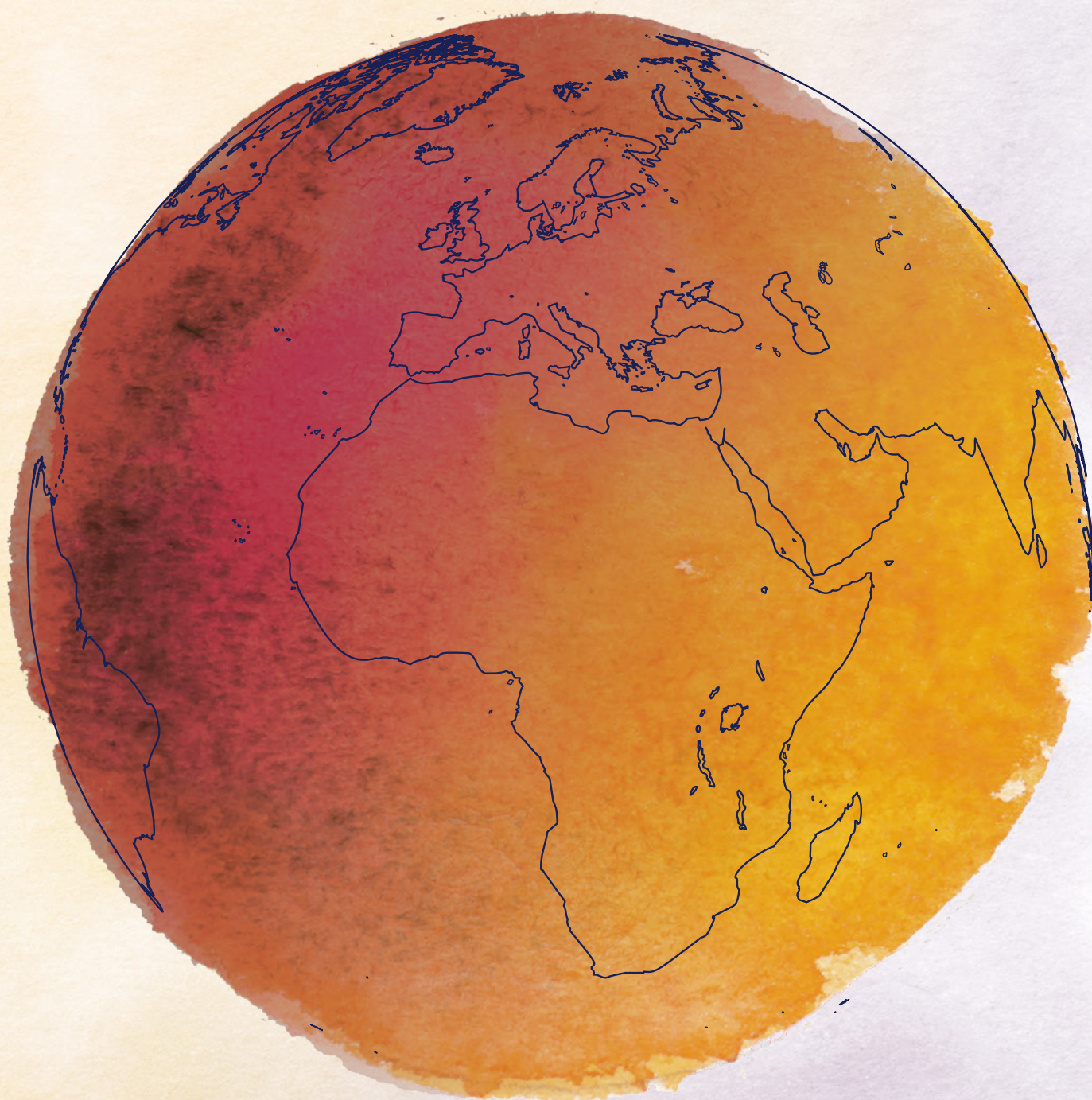




Global Panel  
on Agriculture  
and Food Systems  
for Nutrition

Foresight2.0



# Future Food Systems:

For people, our planet, and prosperity

SEPTEMBER 2020







# Future Food Systems:

## For people, our planet, and prosperity

This report includes important recommendations and advice for leaders at the most senior levels in countries and international organisations. It is also of direct relevance to decision makers, professionals, actors in the private sector, experts and researchers with interests in food systems and diets. Many of these individuals will be directly concerned with the production, processing, trade, regulation, supply and safety of food. However, others may work in wider areas of policy and business, for example relating to: public health and well-being, education, economic development and investment, urbanisation, globalisation and demography.

This report and executive summary are necessarily technical due to the nature of the subject matter. However, they set out the practical steps which are essential for food systems transformation, and the process of change.







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Systems for Nutrition

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# Preface

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It is difficult to envisage a report with more critical implications. By focusing on diets and nutrition across the world, and the food systems that deliver them, it has profound implications for countless millions who endure inadequate diets, and for the world's environmental systems on which every person and every nation depends.

Today, roughly three billion people are unable to afford even the cheapest, locally available, healthy diets. This represents a crisis, not just in terms of health, but also the mental and physical development of children, and the prosperity of families and growth of countries. Worse, it can lead people into lifetime, and even intergenerational, inequality.

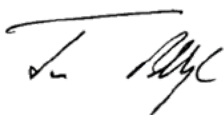
This report shows that the underlying problems run deep. Our food systems are failing to produce the foods essential for healthy diets in sufficient quantity and at affordable prices. They are also driving degradation of the natural environment – soil, water and air quality, biodiversity loss and climate change – and dangerously undermining our future well-being. Since this report was commissioned in 2018, COVID-19 has highlighted just how fragile and precarious the world's food systems have become. The situation is unsustainable.

All of these interlinked crises can be traced back to failures of policy. Put simply, the policies that fed the world in the twentieth century are no longer fit for purpose. Therefore, a key aim of this report has been to set out how to turn the situation around – to promote and protect human and planetary health, and jobs and prosperity. Using the latest science and evidence, the Global Panel sets out clear steps which need to be taken – by governments, the private sector, development partners, civil society, and citizens.

But, while this report is about action, it will fail at the first hurdle without the political will and courage to reform outdated policies and a sustained commitment to act. The Global Panel therefore urges world leaders to capitalise on forthcoming events in 2021 – the United Nations (UN) Food Systems Summit, the Nutrition for Growth Summit, and the 26th UN Climate Change Conference COP. It is essential that these meetings are harnessed to catalyse change. The Global Panel hopes that this report will help contribute to a strong foundation for preparing the critical decisions which need to be agreed at those and subsequent events.



**John Kufuor**  
(Co-Chair)  
Former President of Ghana



**Sir John Beddington**  
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# Foreword

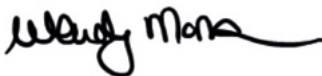
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Today, there are 690 million chronically undernourished people around the world. Nearly 3 billion people are unable to afford a healthy diet and poor-quality diets are linked to 11 million deaths per year. Despite increased interest in nutrition in recent years, progress to reduce malnutrition and to achieve the Sustainable Development Goal targets is still too slow. Undernutrition remains concerning high in the poorest regions of the world, and overweight and obesity are on the rise in almost all countries worldwide. All indications are that the wider impacts of the coronavirus pandemic are exacerbating undernutrition. People who face malnutrition in its various forms are also more likely to be severely affected by COVID-19. We have seen people losing their jobs and incomes, and shifting the quality of what they eat. We continue to see disruptions in the production, supply and sale of nutritious foods, highlighting the inherent weaknesses in global food systems and the need to build these back stronger and more resilient.

Food systems are a major source of greenhouse gas emissions (25%-30% of total) and at the same time, the impacts of climate change will affect the way food is produced and the quality of our diets. A shift towards more sustainable, healthy diets could, for example, reduce GHG emissions by 41 – 74%, while boosting health, productivity, growth and resilience to climate shocks – reducing the number of climate induced diseases and deaths.

The UK remains committed to addressing poor nutrition as part of our ambition to end the preventable deaths of newborns, children and mothers by 2030. We know that healthy and well-nourished people are more resilient to shocks and also more likely to grow into productive members of society. Poor quality diets are a key driver behind all forms of malnutrition and the biggest contributor to the global disease burden.

We welcome the Global Panel on Agriculture and Food Systems for Nutrition's new Foresight Report. It sets out how food systems can be transformed to provide healthy diets for all, while mitigating climate change, boosting biodiversity and delivering new jobs in low- and middle-income countries. We need to build back better post COVID-19 and ensure food systems are delivering triple wins for people, the planet, and prosperity.



**Wendy Morton MP**  
Parliamentary Under-Secretary of State  
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# Acknowledgements

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The Global Panel is also grateful to the many individuals and organisations from across the world who were involved in the detailed technical work and the Project's advisory bodies – some of these are specifically mentioned below. The Global Panel would also like to thank the Representatives of the Global Panel members, staff from the Foreign, Commonwealth and Development Office, and the many other individuals who contributed views and advice, attended workshops in Africa, Asia and Europe, peer reviewed individual papers, and provided other support.

## Foresight 2.0 consultation

Consultation in the margins of the Scaling Up Nutrition (SUN) Global Gathering, Kathmandu, November 2019.

Input by representatives from **Myanmar, Somaliland, Tanzania, Peru, Costa Rica, Scotland, Pakistan, Bangladesh, Zimbabwe,**

**Comoros, Uganda, Indonesia, Nepal, USA, Ethiopia, England, New Zealand.**

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<b>BECCS</b>	biomass, energy with carbon capture and storage	<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>CEMAC</b>	Economic and Monetary Community of Central Africa	<b>LMICs</b>	low- and middle-income countries
<b>CEOs</b>	chief executive officers	<b>NCDs</b>	non-communicable diseases
<b>CHD</b>	coronary heart disease	<b>N4G</b>	Nutrition for Growth
<b>CSR</b>	Corporate Social Responsibility	<b>OECD</b>	Organization for Economic Cooperation and Development
<b>DALYs</b>	disability-adjusted life years	<b>PAF</b>	Population Attributable Fraction
<b>FAO</b>	Food and Agriculture Organization of the United Nations	<b>ppm</b>	parts per million
<b>FAOSTAT</b>	Food and Agriculture Organization Corporate Statistical Database	<b>PPP</b>	purchasing power parity
<b>FBDGs</b>	food-based dietary guidelines	<b>R&amp;D</b>	research and development
<b>GAIN</b>	Global Alliance for Improved Nutrition	<b>RCP</b>	Representative Concentration Pathway
<b>GDD</b>	Global Dietary Database	<b>SDGs</b>	sustainable development goals
<b>GDP</b>	gross domestic product	<b>SI</b>	sustainable intensification
<b>GHG</b>	greenhouse gas	<b>SMEs</b>	small- and medium-sized enterprises
<b>GMO</b>	genetically modified organisms	<b>SSBs</b>	sugar-sweetened beverages
<b>GNP</b>	gross national product	<b>VAT</b>	value-added taxes
<b>HICs</b>	high-income countries	<b>WFP</b>	United Nations World Food Programme
<b>IFPRI</b>	International Food Policy Research Institute	<b>WHA</b>	World Health Assembly
		<b>WHO</b>	World Health Organization
		<b>WRA</b>	women of reproductive age
		<b>WTO</b>	World Trade Organization

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# Glossary

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## Agroecology

The science and practice of applying ecological concepts, principles and knowledge (i.e., the interactions of, and explanations for, the diversity, abundance and activities of organisms) to the study, design and management of sustainable agroecosystems. It includes the roles of human beings as a central organism in agroecology by way of social and economic processes in farming systems. Agroecology examines the roles and interactions among all relevant biophysical, technical and socioeconomic components of farming systems and their surrounding landscapes.

## Agroforestry

Collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence. In agroforestry systems there are both ecological and economic interactions between the different components. Agroforestry can also be defined as a dynamic, ecologically based, natural resource management system which, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels.

## Climate change

A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes.

## Conservation agriculture

Approach to managing agroecosystems for improved and sustained productivity, increased profits and food security while preserving and enhancing the resource base and the environment. It is characterised by three linked principles, namely:

1. continuous minimum mechanical soil disturbance;
2. permanent organic soil cover; and
3. diversification of crop species grown in sequences and/or associations. This covers a wide range of approaches from minimum till to permaculture/"mimicking nature".

## Environment

For this report, the term 'environment' encompasses the macro-scale processes involved in the climate crisis (such as damaging greenhouse gas emissions), and the more local level ecological processes impaired through natural resource degradation and biodiversity loss.

## Food system

Food systems comprise all the processes involved in keeping us fed: growing, harvesting, packing, processing, transforming, transporting, marketing, consuming and disposing of food. They include the inputs needed and outputs generated at each step. A food system operates within and is influenced by social, political, economic and natural environments.

## Pro-poor growth

Economic growth which aims to benefit poor people (primarily in the economic sense of poverty). Pro-poor growth can be defined as absolute, where the poor benefits from overall growth in the economy, or relative – which refers to targeted efforts to increase the growth specifically among poor people.

## Resilience

The capacity of a system to withstand the impact of shocks, while adapting and transforming to continue to fulfil its functions. Resilience building can be described as "helping people, communities, countries, and global institutions prevent, anticipate, prepare for, cope with, and recover from shocks and not only bounce back to where they were before the shocks occurred, but become even better off".



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## **Sustainable**

For the purposes of this report, the term “sustainable” in “sustainable, healthy diets” or “sustainable food systems” is used if the contribution of a place’s food system (which delivers locally-produced but also imported and marketed foods) can be continued without undermining the ability of the natural environment to function in the long term: that is, the system does not drive biodiversity loss, pollution, soil degradation, or climate change.

## **Sustainable food systems**

For the purposes of this report, the term ‘sustainable food system’ is broadly used if the contribution of a place’s food system (which delivers locally-produced but also imported and marketed foods) can be continued without undermining the ability of the natural environment to function in the long term: that is, the system does not drive biodiversity loss, pollution, soil degradation, or climate change.

## **Sustainable, healthy diets**

Sustainable, healthy diets are dietary patterns that promote all dimensions of individuals’ health and wellbeing; have low environmental pressure and impact; are accessible, affordable, safe and equitable; and are culturally acceptable.

## **Sustainable intensification**

A process or system where agricultural yields are increased without adverse environmental impact and without the conversion of additional non-agricultural land. The concept does not articulate or privilege any particular vision or method of agricultural production. Rather, it emphasises ends rather than means, and does not pre-determine technologies, species mix or particular design components.

## **Transformation**

A change in the fundamental attributes of natural and human systems. Societal (social) transformation is profound and often deliberate shift initiated by communities toward sustainability, facilitated by changes in individual and collective values and behaviours, and a fairer balance of political, cultural, and institutional power in society.

## **Transition**

The process of changing from one state or condition to another in a given period of time. Transition can occur in individuals, firms, cities, regions and nations, and can be based on incremental or transformative change.

# Executive summary

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## 1. Diets, health, and environment: the coming decade's critical challenges

**Today's food systems are no longer fit for purpose. Decision makers, particularly governments in low- and middle-income countries (LMICs) and their development partners, need to take urgent action to change the ways in which food systems are currently managed, governed, and used. This is essential to achieve the goal of sustainable, healthy diets<sup>i</sup> for all. These diets are vital for the health of countless millions of people and the health of the planet, and for progress in almost all of the United Nation's Sustainable Development Goals (SDGs), notably those relating to jobs, economic development, and inequalities.**

**The Global Panel's first Foresight report, published in 2016, sounded the alarm that sub-optimal diets were leading to a deterioration in human health and nutrition globally. This second report brings an even stronger light to bear on the deficiencies in our food systems. Progress in addressing malnutrition in all its forms and diet-related ill health is stalling, and food systems around the world continue to operate unsustainably. The serious health and economic implications of the rising levels of malnutrition and diet-related non-communicable diseases (NCDs) are becoming all too clear; low- and middle-income countries (LMICs) and the poor everywhere are most affected. At the same time, the COVID-19 pandemic has exposed systemic weaknesses and fragility in food systems, which were already increasingly threatened by climate change and worsening environmental degradation.**

Given the critical importance of sustainable, healthy diets, it is unsurprising that the achievement of many of the SDGs has been increasingly in doubt even before the coronavirus pandemic. However, despite this bleak outlook, the Global Panel believes that with renewed political will and leadership, the situation can be reversed. However a particular challenge for LMICs in addressing these combined crises is how to address the complexity of the transition process which food systems need to undergo: how to identify priorities for action; how to manage the inevitable trade-offs between competing areas of policy; and how to catalyse massive change across multiple policy domains in a context where resources are severely constrained.

The aim and key added value of this report is to draw on the best available science and evidence to set out a practical way forward which is grounded in the realities of policy development in LMICs. The advice and recommendations offered by the Global Panel are aimed primarily at decision makers in LMICs, but they alone cannot turn global challenges around. In a highly interconnected world, high-income countries also have a vital role to play, particularly where their own decisions have impacts on LMICs. High-income countries (HICs) not only share responsibility for some of the major problems facing us all but are also facing obesity and diet-related disease epidemics of their own. They also have capacity and resources to catalyse necessary collective action. But it is not only governments who have to act swiftly and in a bold and concerted fashion. International organisations and donors, businesses and investors, civil society advocacy groups, and individual citizens all have critically important roles to play. This report makes clear what different stakeholders need to do to play their part in the transition process.

***This report makes concrete recommendations on the practical steps which need to be taken in a process of transition to make fundamental changes to food systems possible. The aim is to deliver a transformed food system fit for the twenty-first century.***

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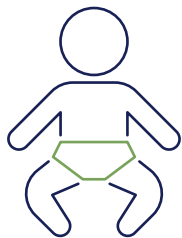
<sup>i</sup> In this report, 'sustainable diets' are diets that are delivered by a 'sustainable food system'. This means that the contribution of any food system (which delivers locally produced as well as imported and marketed foods) can be continued without undermining the ability of the natural environment to function in the long term. As such, such a system does not drive biodiversity loss, pollution, depletion of natural capital, or impaired ecosystem services, nor does it contribute substantially to greenhouse gas (GHG) emissions.



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## 2. Why food systems must undergo a process of transition to deliver sustainable, healthy diets

**Diets and the food systems that deliver them are at the nexus of the challenges associated with malnutrition, human health, natural resource degradation, and climate change.**



More than **200 million** children under five still face a life adversely affected by early years of undernutrition.<sup>3</sup>



The burden of diet-related disease is highest in LMICs; for diabetes alone, by 2030 (assuming present trends) the annual economic impact for East Asia and the Pacific region is expected to reach almost **US\$800 billion**, and **US\$52 billion** in sub-Saharan Africa.<sup>4</sup>



A low-income country with an annual average temperature today of **25°C** could see a fall in national economic growth (Gross Domestic Product or GDP) of **1.2%** for each **1°C** increase in temperature.<sup>8</sup>

**An estimated 26% of the world's population experienced hunger or did not have regular access to nutrient-rich and sufficient food in 2019.** Sub-optimal diets are now responsible for 20% of premature (disease-mediated) mortality worldwide,<sup>1</sup> as well as for 20% of all disability-adjusted life years (DALYs).<sup>2</sup> The outcome is rapidly escalating pressure on healthcare systems which are facing an epidemic of diet-related diseases – including stroke, cardiovascular disease, and diabetes. Affected individuals and families are at risk of becoming drawn into intergenerational cycles of poverty and inequality.

**Most countries are not on track to meet the nutrition targets set for 2025 by the World Health Assembly.**

The goal of cutting child stunting by 40% between 2010 and 2025 is not being met by countries carrying the greatest burdens; no country is on target to achieve a 50% reduction in anaemia among women by 2025; and childhood obesity has nearly tripled worldwide since 1975, and now affects every country on the planet.

**Food systems are locked in a spiral of decline with environmental systems:** they are also major causes of degradation of the environmental systems on which they themselves depend (including biodiversity, freshwater, oceans, land, and soils). They are the largest cause of anthropomorphic greenhouse gas (GHG) emissions (28% between 2007 and 2016)<sup>5</sup>, while agriculture alone accounts for 70% of freshwater use. Even without projected global population growth, food systems are operating well beyond planetary boundaries. The pressures placed on natural resources by food production have left 25% of the globe's cultivated land area degraded, while deforestation for agriculture is recognised as a major and irreversible cause of biodiversity loss.<sup>5</sup>

This situation is simply unsustainable. There is a very substantial risk that the world will irreversibly cross multiple planetary boundaries as a direct outcome of current agricultural and food system practices which are underpinned by often perverse incentive structures. The threat posed by these transgressions to food systems, food security, diet quality, and nutrition in the decades ahead is immense. By 2030, the number of people living in fragile settings is projected to reach 2.3 billion, which includes 80% of the global poor. That represents another 500 million people over today's total.<sup>6</sup> Some projections forecast a doubling in the number of people requiring targeted aid resources of various kinds from around 110 million in 2018 to over 200 million per year by 2050; humanitarian funding requirements after climate-related disasters could increase from between US\$3.5–12 billion to US\$20 billion annually by 2030.<sup>7</sup>

## Four goals need to be met to enable food systems to better protect our planet and nourish the global population:

1. People need to be empowered and encouraged to eat healthy diets which are sustainably produced. Collectively, food purchasers have considerable power to influence food-industry priorities and drive change through the choices they make.

### Box 1: COVID-19: lessons, priorities, and building resilience for the future

**A sharp shock.** The pandemic has been distinguished by its potential to cause multiple shocks simultaneously throughout the global food system. Governments closed down formal and informal retail outlets for food; the movement of agricultural workers was severely restricted; food processing, transport, and trade have all been affected, and many families had access to food seriously impaired over weeks and months. The knock-on effects to diets and nutrition are of major concern, particularly for the nutritionally vulnerable.

#### Mitigating the effects of COVID-19 on food systems and diets:

1. **Ensure that nutritional needs of all individuals are met.** Priorities include: social protection measures, particularly aimed at the poor; promotion of exclusive breastfeeding and appropriate infant and young child feeding; encouraging people to consume foods which are key to healthy diets; and tackling diet-related misinformation.
2. **Protect, enhance, and buffer stakeholders across entire food value-chains.** Small- and medium-enterprises (SMEs) in the food sector in LMICs are particularly vulnerable to disruptions in markets and spending and need to be supported with access to loans, information, and digital technologies.
3. **Kick-start the transition of the global food system by investing in making it better than before.** Food systems need to be re-imagined, financed, and managed in ways that make them more resilient to shocks of all kinds – a key feature of transformed food systems. This crisis presents an opportunity to better understand and intervene to correct the flashpoints which have compromised food systems: inequities in purchasing power, limited physical access to healthy diets for millions of people, political impulses that lean towards traditional trade protectionism, supply chains susceptible to disruption, natural resource depletion making a supply response to higher prices difficult, and a lack of pre-existing social protection mechanisms designed to protect the diets of the poor.

2. Food systems must be better aligned with the aim of supporting sustainable, healthy diets. Major reform is needed at every stage from production through to retail. This will create significant challenges relating to inadequate availability, physical accessibility, affordability, and desirability of improved diets.
3. The impacts of food systems on climate, natural resources, and biodiversity must be significantly reduced. Making the resource base on which all food production depends both sustainable and resilient is both necessary and urgent.
4. Greater resilience must be built into local and global food systems. Many LMICs will be increasingly vulnerable to shocks which affect food production, trade, and prices. Here, specific measures to build resilience may need to reflect the nature of different types of shock. Box 1, for example, specifically considers the case of the coronavirus pandemic.

## 3. Factors impeding necessary progress on policy change

Today's food systems operate against a background of policy distortions. These need to be addressed at the outset of food systems transition or they will impede change:

1. **Powerful actors pull in different directions, motivated by factors unrelated to health or food system sustainability.** The private sector plays a crucial role in feeding the world, but at the same time often promotes foods which are not conducive to healthy diets and profits from a food system that over-exploits natural resources. The benefits accrue mainly to private sector stakeholders while the costs (population-wide ill health, ecological degradation, natural disasters) are mainly borne by the public sector and wider society. That imbalance will have to be addressed during the transition. It is essential that the public and private sectors work together on more clearly articulated common agendas. The private sector must spell out specific, measurable responsibilities for improving diet quality and the sustainability of food systems and be willingly held accountable.
2. **Misaligned policy incentives distort food system goals.** Policy instruments and related incentives and responsibilities shaped by public sector decisions, including subsidies and food-related research and development, must be better aligned to support human and planetary health simultaneously, in ways that capture opportunities for jobs and income growth.
3. **Short-termism and siloed agendas.** The transition of food systems requires a long-term focus and a coherent set of commitments and actions. Dietary patterns, drivers of dietary choice, and sustainability of food system practices (from production through to post-retail waste) must be put at the centre of national dialogues aimed at transitioning food systems from today's expectations,





framed by feeding people cheaply, to nourishing people sustainably. The challenges of malnutrition, health, and the environment are all fundamentally interlinked and can only be effectively addressed together. The current lack of coherence in these areas of policy is an important impediment to progress.

Addressing these policy distortions will only be possible if decision makers demonstrate much stronger leadership

to drive through necessary changes. Governments have not been active enough in confronting the difficult choices which have to be made to reform food systems and influence the drivers of dietary choice. This can be due to competing priorities, where sustainable, healthy diets are viewed as a lesser priority when hunger is still a major challenge in several parts of the world. Many of the problems inherent in the food system are global and, like climate change, can only be tackled at a global level. However, actions are also vital at national and local levels.



## 4. Key interventions in four parts of the food system

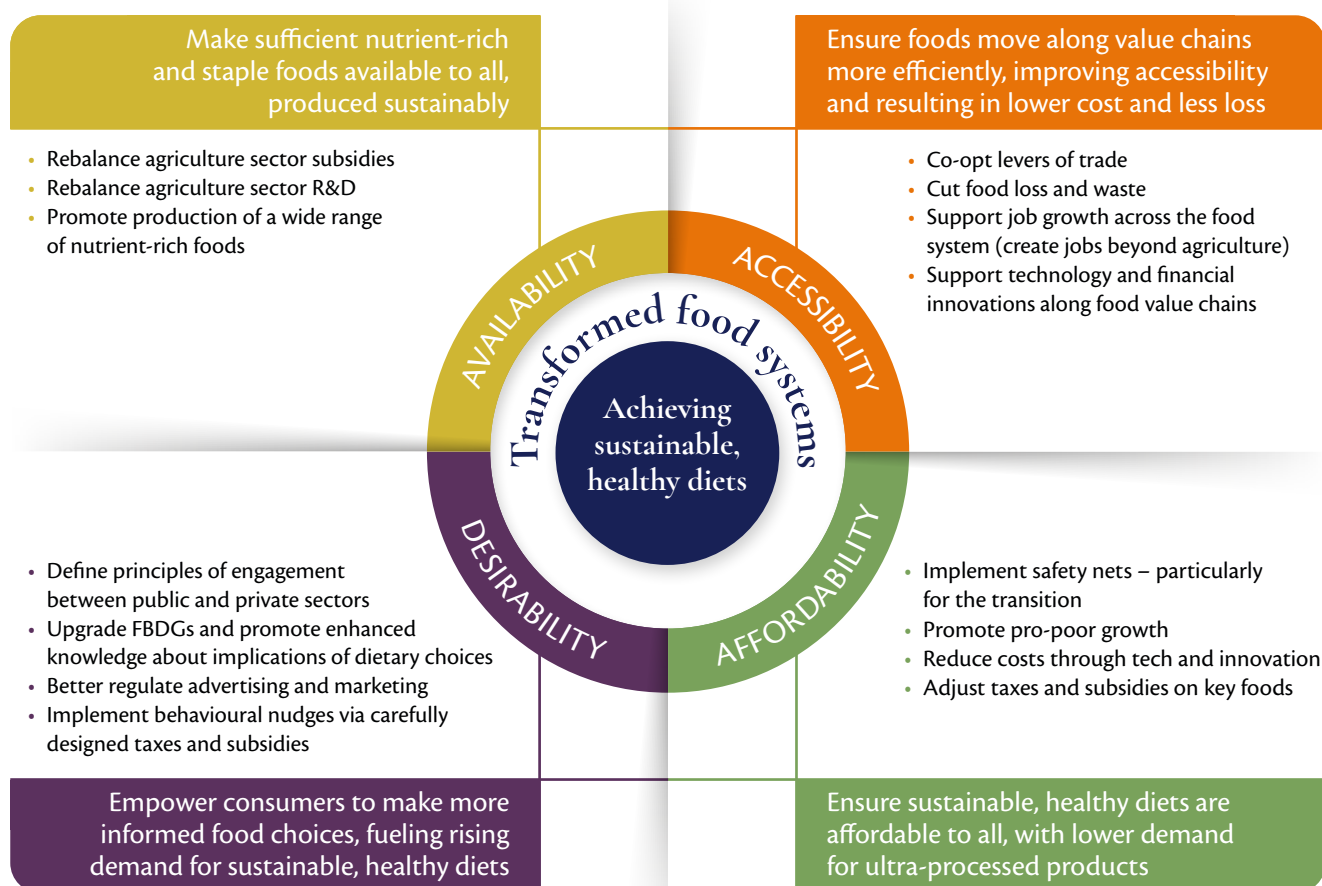
Food systems are comprised of a set of dynamic and interlinked sub-systems. However, the transformation of food systems requires a series of transition steps which can be distilled into four distinct policy objectives: producing the right mix of foods in sufficient quantities to deliver sustainable, healthy diets; ensuring those foods are readily accessible and also affordable to everyone; and ensuring that they are desirable to all consumers (see Figure 1).

Fundamental reform is needed to deliver transformed food systems which ensure sustainable, healthy diets for all, with the added requirement that their accessibility and affordability are an integral part of how food systems function. The concept of transformation characterised in this report is both a vision of the future and a goal requiring specific actions today. But it is essential that all actions proceed in concert across the entire food system. For example, policies



to increase the supply of nutrient-rich foods will fail if individuals are not persuaded to consume them, nor will they be viable without innovation and investment in the storage, processing, and transportation of perishable foods.

**Figure 1: Priority policy actions to transition food systems towards sustainable, healthy diets**



Source: created by authors



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## 4.1 Ensuring the *availability* of nutrient-rich food, sustainably produced

**Agriculture and related food policies are not supporting healthy diets at the most fundamental level – they are simply not producing enough of the nutrient-rich foods needed globally, and they are failing to produce foods sustainably. Unless these shortfalls are addressed, millions more people in the decades ahead will join the three billion people who are unable to access a healthy diet today. Those affected will be condemned to lives blighted by inequality and disadvantage, as the impacts of poor diets affect their health and cognitive development.**

Expanding food production sustainably, including more quantity and diversity of nutrient-rich foods, will be a major challenge, not least because of entrenched attitudes and production practices, vested interests, and the costs involved in the transition. The need for these changes is growing ever more urgent because of population growth, the escalating costs of diet-related disease, the negative impacts of climate change, and the degradation of environmental resources.

**Several principles need to guide the food system transition steps relating to enhanced food availability:**

1. Rebalance *what* is produced to ensure sufficiency of nutrient-rich foods – both quantity *and* quality are important;
2. Refocus on who produces: support and enhance smallholder production and diets in ways which promote their health as well as contributing more to emissions reduction, optimising natural resources use, and carbon sequestration through enhanced agroforestry practices;
3. Redirect food policy agendas from a focus on agricultural output to increasing the efficiency of entire food systems.
4. Renew understanding of *how* crops and livestock are grown through the sustainable intensification of agriculture – improving efficiency, substituting more environmentally beneficial practices for environmentally harmful ones, and redesigning production systems. Novel technologies – including improved agronomy, digital innovations, and new breeding methods – have an important role to play in fostering sustainable productivity growth, diversity, and resilience in agricultural production systems.

Three major policy shifts relating to food production are needed: each will remove a fundamental impediment to progress, while yielding significant economic benefits:

1. Rebalance public sector subsidies to enhance local and global supplies of nutrient-rich foods. Even a relatively modest shift in these subsidies (e.g., 25%) could have a major effect.
2. Rebalance public agricultural research and development (R&D) from a commodity focus to a food-systems focus. Increase funding overall, but especially for actions that increase the supply of nutrient-rich foods through sustainable and resilient farming.
3. Rebalance food production systems to deliver sustainable, healthy diets. Investing in different approaches, goals, metrics of success, and reward systems relating to food production would represent a substantial realignment of investment patterns, market agendas, policy priorities, and on-the-ground activities across the world. This includes a major new focus on sustainable intensification, reforestation for carbon sequestration, and promotion of system-wide efficiency gains over a single narrow focus on productivity gains in individual outputs of agriculture.

*Rebalancing of food production systems would generate substantial rural as well as urban employment opportunities in LMICs. Wider benefits will flow globally from greater GDP growth and addressing income and health inequalities.*

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“ By 2030, assuming current waste levels remain unchanged, sub-Saharan Africa would fail to meet the 400g per person per day threshold [for intake of fruits and vegetables]. ”

D’Croz et al. 2019<sup>9</sup>

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“ ... agriculture and agribusiness together could command a US\$1 trillion presence in Africa’s regional economy by 2030. ”

World Bank 2013<sup>10</sup>

## 4.2 Making sustainable, healthy diets accessible to all

**Year-round accessibility to sustainable, healthy diets means that all consumers can obtain the range of nutrient-rich foods needed to maintain an active healthy life and within planetary boundaries. Since most people do not produce what they eat, the following policy approaches are key:**

- 1. Use trade policy levers more effectively to achieve the goal of sustainable, healthy diets.** Trade mechanisms are not traditionally designed for these goals. While this has been a missed opportunity in the past, trade presents multiple opportunities for the future. Many instruments can help shift the mix of foods available domestically as well as their relative prices, including formal trade agreements, appropriate tariffs, and food safety regulations. Regional strategies, such as Africa's Malabo Declaration on Accelerated Agricultural Growth should be encouraged.
- 2. Governments should resist the imposition of export restrictions at times of sharp food price spikes and look instead to lowering tariffs and value-added taxes (VAT) to encourage trade flows.** Food trade helps to manage price volatility and risks from financial crises, pandemics, or shocks associated with climate change. Protectionist trade policies are increasingly acknowledged to have serious consequences for food and nutrition security. Exports of nutrient-rich foods are not necessarily undesirable and should be considered in the overall context of the nutrient value and affordability of foods available to domestic consumers via their own production and imports.



In **2018**, around **55%** of the world's population lived in urban environments, in **2016** urban residents were already consuming roughly **70%** of the entire world's food supply.<sup>11</sup>



About **25%** of available calories and protein are lost globally, roughly **10–15%** of fats, and **18–41%** of vitamins and minerals, including **23–33%** of vitamin A, folate, calcium, iron, and zinc.<sup>12</sup>

- 3. Support investments in the infrastructure needed to optimise food value chains.** Strategies will be particularly needed to 'feed the cities', especially where urban populations will continue to grow relative to rural settings. Substantial investments in hard and soft 'enabling infrastructure', such as roads, cold storage, electrification, and access to credit, are important for moving food (particularly perishable nutrient-rich foods) from rural to urban markets; these measures have the potential to improve the efficiency, costs, and profitability of smallholder producers and SMEs.
- 4. Generate jobs across the food system, beyond agriculture.** Adding value to food through processing, packaging, and handling is a major potential source of job creation in rural economies in LMICs. It is also crucial for developing regional food-related manufacturing sectors, as well as helping to make nutrient-rich foods available at locations more distant from their place of production.
- 5. Significantly reduce loss and waste to preserve nutrients along the value chain.** Nutrients generated in the food system need to be retained for consumers to benefit. This avoids food having to be 'grown twice'. There is a wealth of potential innovations to be drawn upon by actors throughout food chains. But the choice of where to act needs to take careful account of where in a specific food chain most losses of nutrients occur.



## 4.3 Making sustainable, healthy diets *affordable* to all

**A healthy diet based on today's prices and patterns of consumption is already unaffordable for an estimated three billion people worldwide. The scale of the affordability challenge means that a broad strategic approach is needed, one which takes account of local contextual challenges and opportunities and which addresses both the supply side and the demand side simultaneously. Rising incomes alone will not bridge the 'affordability gap'. Concerted action from both high- and low-income countries, as well as donor agencies, will also be essential.**

Modelling analysis shows that a shift to significantly improved diets in terms of health and sustainability would cost more (at current prices) in 71 countries (with a combined population of 4.1 billion). However, such a shift would cost less (per capita) in 86 countries (with a combined population of 4.2 billion). However, these aggregated figures mask the reality that the poor are still likely to see increased costs.<sup>13,14</sup>

But today's food prices fail to cost in external impacts, notably in respect of climate change and the consequences of inadequate diets for human health. When these externalities are factored in, based on diets that are both more sustainable and more supportive of human health, the price of improved diets could fall by around 4% in LMICs by 2050 and 28% in HICs, mainly due to a rebalancing of plant- and animal-sourced foods. While the cost of diet reductions are significant, the affordability gap for LMICs would still be substantial, which means that key actions need to be taken today to protect food consumption patterns of the poor during the transition phase.<sup>13,14</sup>

However, if policy actions and investments recommended in this report were to be implemented quickly and at scale, their combined effects on prices would be to reduce the cost of sustainable, healthy diets more quickly, *including for most LMICs*. The latter can be achieved if actions were to be taken immediately to reduce food loss and waste by up to 50% from current levels (in line with the SDG target to reduce the cost of current diets by 14% on average) alongside growth policies that include faster rates of poverty reduction, stricter land-use regulation, lower barriers to food trade, and a trend towards lower meat consumption *in high-income countries*. **A strategy to bridge the affordability gap should have the following components:**

1. **Measures to support economic growth, and specifically tackle poverty levels and income inequality.** Roughly 75% of growth in global GDP up to 2030 is projected to accrue to low- and middle-income countries.<sup>8</sup> By 2030, many recently

very poor and disaster-affected countries in sub-Saharan Africa, including Mozambique, Rwanda, and Ethiopia, were (before COVID-19) expected to more than triple the size of their own economies.<sup>15</sup>

2. **Carefully designed consumer-level taxes and subsidies on key food categories – to shift the relative prices of staples and ultra-processed foods versus nutrient-rich foods in ways that make the latter more affordable to more people.** While many initiatives relating to taxes show promise, there remain few examples in low-income countries, although this is changing. Some researchers already conclude that measures seeking to modify the prices of targeted nutrient-rich foods are 'effective in improving population diet by modifying what people buy'.<sup>16</sup>
3. **Refocusing of safety nets to support diet-quality goals.** Income transfers to the poor can be particularly effective: they can promote social protection and greater equity of purchasing power and help protect the most vulnerable in the transition phase of food system transformation, when food price uncertainties may arise. There is a strong case for governments and donor organisations to focus on income-transfer interventions tied to accessing nutrient-rich foods, provided they are well-designed and well-implemented.
4. **Reducing the cost of nutrient-rich products through technology and innovation.** Examples include investments in agricultural research and development to increase the productivity of fruits, vegetables, legume crops, and nuts/seeds; precision agriculture; reduced food loss/waste; and improved storage technologies to better protect perishables along the entire value chain.

## 4.4 Influencing demand: Making sustainable, healthy diets *desirable* to all

**Governments need to do much more to encourage and enable people to make more informed dietary choices, but without being prescriptive or impinging on consumer sovereignty. Merely making sustainably produced, healthy foods available and affordable does not mean that people will choose them.**

- **Influencing dietary choice is important to drive improvements in healthy eating, but it is also critical for addressing the lack of sustainability of food systems.** Today's diets involve negative feedback loops which drive a spiral of multiple dysfunctions in food systems. For example, certain modes of agricultural intensification driven by consumer demand for foods that have the highest environmental

externalities can result in soil depletion, leading to a decline in yields and the need for greater intensification. Similarly, monocropping can exacerbate biodiversity loss relating to pollinators. With pollinator populations in decline, yields are reduced and food supply issues intensified. Understanding these vicious circles, and the role of diets within them, is critical to reversing them and achieving sustainable food systems. Many factors influence food choices: advertising, taste, convenience, social and cultural norms, and nutritional information. Even nutrition-conscious individuals balance perceived trade-offs between long-term health benefits and immediate gratification of tastier but less nutrient-rich food products.

- **People's collective purchasing power, and its influence on food-industry priorities, has the potential to stimulate market growth and be a powerful force to drive food system transition.** Most governments shy away from adopting an active role in influencing choice: this needs to change. The starting point should be to establish a common policy agenda across government, engage with all non-governmental stakeholders in defining desirable scenarios for future food systems locally, and promote much greater consumer awareness of the planetary and health implications of food choices.
- **Behavioural nudges are an important tool, but there is limited evidence for the kinds of interventions that are most effective in LMIC settings.** A way forward here is to trial different approaches and implement what works best.
- **Reduce and regulate advertising to children, and promote more active marketing of sustainable, healthy diets as an aspirational norm for all nations.** Self-regulation in the form of voluntary guidelines has been shown to be largely ineffective in reducing the number of food advertisements promoting foods which are not conducive to healthy diets: ultra-processed foods, snacks, and toy-branded fast foods aimed at children.
- **Define principles of engagement between public and private sectors, and clearly articulate responsibilities in moving towards common goals.** The diverse companies that make up the food industry must align their considerable influence (e.g., through advertising, retail environments) to shift demand in the right direction. Anything else is unacceptable. The guiding questions for policy makers are: what are the appropriate incentives that would 'persuade' commercial food companies and retailers to make the

required changes, recognising their different priorities? And when persuasion is ineffective, is regulation required? Examples of experience in different countries will help inform those decisions.

- **Citizens must be empowered by information: Food Based Dietary Guidelines (FBDGs) need to be substantially improved and used much more effectively.** People need advice which is authoritative and trustworthy, and which cuts through the erroneous, conflicting, and changing advice which is prevalent in the media and on the internet. Three tests for effective FBDGs: are they user-friendly, do they address issues of health *and* sustainability, and do policy makers *across government* use them to inform policy?

## 5. The reality of major policy change in LMICs: practical considerations

Given the benefits that would accrue from achieving sustainable, healthy diets for all, the limited actions taken in recent years represent a missed opportunity. Why has it proved difficult for policy makers to make the necessary shifts in policies, companies to shift their approach to food product development and retail, and food purchasers to shift their dietary choices? Three major factors are at play – understanding these is the first step to their resolution:

1. The complexity of food and environmental systems in a context where policy actions on food, health, agriculture, and climate are generally managed separately – the need for 'joined up' policy is a cliché, but still pertinent. There are no easy answers, although convincing relevant policy makers of the critical importance of sustainable, healthy diets to their respective policy agendas is a first step – but that needs to be followed up by embedding these objectives into their own plans and strategies.
2. Competing priorities for:
  - governments who have to make difficult policy choices,
  - private companies making investment choices on product portfolios or retail strategies, and
  - households making food-purchase choices. The issue of policy trade-offs is considered below.
3. Uncertainty about, and mistrust in, scientific evidence which is sometimes exacerbated by political polarisation. Improvements that are required for research and evidence to better support policy decisions are discussed in Box 2.

**Policy makers seeking to transition food systems must think through how to navigate difficult trade-offs.** Some of these are within the food system, but others go much wider. For example: how to balance resource expenditure between education, stimulating economic growth, and investing specifically in food systems; how to allocate scarce resources

*If FBDGs were redesigned and fully adopted, the economic value of reduced mortality is estimated to be US\$7.2 trillion to US\$8.9 trillion, or equivalent to between 10% and 15% of global GDP.<sup>17</sup>*

between addressing different forms of malnutrition which may affect a population simultaneously, including undernutrition, micronutrient deficiencies, or overweight and obesity; how to strike a balance between investing in agriculture versus other sectors in rural communities; and how to balance avoiding coronavirus-led debt default in the short-term with investing in food system transition to achieve longer-term health and economic benefits.

**Approaches to guide the resolution of trade-offs include:**

mapping out existing policies in relation to new goals and likely trade-offs; understanding the costs and benefits of alternative actions; transparently defining who pays and benefits from alternative strategies; taking a longer term perspective; and ‘getting prices right’. This last point is particularly important as most poor people around the world are already unable to access minimally adequate diets just in terms of calories and micronutrients.

**Priorities when deciding among the many actions required to implement a food system transition:** ensure transparency in decision making, and on costs, benefits, winners and losers where these are known; change should be implemented based on evidence and transparent expectations. And it will be important to establish feedback mechanisms to allow for real-time adjustments to policy and process – the evidence for what ‘works’ specifically in LMICs and in different contexts is not fully developed. A priority should be to ‘do no harm’: there is potential for some producers, traders, retailers, and food purchasers to be vulnerable during the transition. Investing in strengthening institutions and capacity building should be a priority.

## 6. Next steps: managing the transition

Decisions on how to proceed must keep in mind the four overall objectives, relating to increasing the supply of sustainably produced nutrient-rich foods, making those foods more accessible to more people, ensuring that quality diets are affordable to all, and making informed dietary choices highly desirable. Against that background, the following three steps represent important actionable areas which are within reach of the majority of LMICs to launch the process of transition. Bringing people together around these three sets of actions represents a clear way forward – this may require establishing new informal linkages and agreements, or more formal governance and accountability structures.

**1. Resolve policy distortions and incoherence** – or these will continue to impede progress.

- Initiate a government-wide *policy review* to identify:
  - what existing policies, strategies, and institutional mandates support or hinder coherent actions towards food system goals
  - how to resolve policy incoherence across sectors and ministry responsibilities (from the perspective of delivering sustainable, healthy diets), and

- which trade-offs to make where competing goals and interests currently need to be addressed or will need to be addressed in coming years.

- Implement a government-wide *spending review* to determine what public funding and institutional mandates could be:

- repurposed to cover the costs of implementing transition phase actions, and
- realigned to better facilitate one or more of the four transition objectives.

**2. Establish multi-win targets that can be attractive to multiple constituencies.**

It will be important early on to *establish targets for actions* which improve food system functions in ways that deliver multiple benefits simultaneously. That means initiating national and subnational dialogues (involving alternative scenarios discussions) and expert commissions to define appropriate targets which bring clearly defined benefits on several fronts through carefully costed interventions. For example:

- Urgently review and *update national guidance on diets* in ways which are
  - based on the latest evidence,
  - support more informed dietary choice,
  - policy maker-facing to guide strategic and investment decisions, and business-centric, using clear messaging which helps chief executive officers (CEOs) determine how best to support national plans of action relating to both human health and sustainability.

**3. Leverage existing or planned interventions that can be made more food-system friendly.**

In all cases, the role of natural resource depletion or degradation, greenhouse gas emissions, and human health outcomes need to be placed at the centre of problem assessments and defined solutions. For example:

- *Identify policy instruments* that can be expanded in terms of coverage, strengthened in terms of capacity and funding, and better aligned with the goal of promoting sustainable, healthy diets for all. These may include various income transfer programmes (social protection schemes, cash transfers via safety nets, employment guarantee schemes), business promotion initiatives (extending rural finance, tax incentives for SMEs in the food sector, enhanced canteen meal projects) or agricultural extension programmes which also support community-level health messaging. A root-and-branch assessment of the services, goods, and information provided via public sector actions can support the promotion of a more coherent portfolio of investments. These should clearly articulate human and planetary health benefits alongside other goals.
- *Implement bundles of measures* that promote pathways toward multiple wins rather than single actions which only tackle individual problems in siloes. It is important to demonstrate how returns on investment can be determined through costed health and environmental outcomes, not just income growth. This requires identifying where in national food systems an intervention could bring multiple gains. While the evidence base for



such actions is still limited, there are many encouraging initiatives which need to be closely monitored, measured, scaled, and replicated if shown to be cost-effective in achieving the desired, multifaceted aims. There are still untested and under-explored opportunities for innovation to be considered. Trying different options with wide societal engagement and transparency of intent will be of substantial value in starting the transition.

- *From the supply side*, a market assessment can establish which nutrient-rich foods (and ultra-processed foods) are available in which markets at what price relative to the cheapest available staples. This can suggest:
  - actions needed to increase the availability of nutrient-rich foods (realign domestic agricultural R&D, enhance technical assistance to farmers willing to invest in, say, horticulture or aquaculture, incentivise private seed companies to stock and promote quality products beyond staples); and
  - review price, tax, and tariff policies which influence commodity and technology priorities, determine the externalities of current approaches, and promote alternative technologies with measurable reductions in emissions and natural resource inputs.
- *From the food marketing and retail side*, promote greater efficiency along all food value chains, including setting actionable targets for reducing food losses and waste by

identifying market warehousing upgrades; promoting enhanced affordable household-level food storage technologies; setting targets by commodity value-chain; and enhancing rural market access via infrastructure investments, which cut transaction costs.

- *From the demand side*, determine the real nature of the gap between the cost of a sustainable, healthy diet across subnational settings and the affordability of that diet across the income distribution of the local population. This will suggest the imbalance existing in the relative prices of nutrient-rich versus other foods (which suggests actions aimed at price subsidies for nutrient-rich foods and/or taxes on ultra-processed foods), and the scale of income inequality needing to be bridged via pro-poor income growth initiatives over the longer-run and targeted income transfers to the poorest (potentially conditional cash transfers tied to enhanced dietary demand) in the short-run.

Each of these steps is within the purview of national governments; they can all be taken without delay to generate empirical lessons and cost and benefit insights and to build awareness of the urgency of these issues and catalyse public and political support for the actions proposed. None require major new funding or new approaches to policy making, but the potential for much greater policy coherence and impact across the food system is significant.

## Box 2: Improving the support provided by research and evidence to decision makers

**Governments and their development partners, including the UN and other international organisations, should work together without delay to substantially improve and build on existing mechanisms to support science and policy engagement with sustainable food systems transformation. The forthcoming UN Food Systems Summit in 2021 is a critical opportunity to agree upon concrete proposals for the necessary improvements including: the organisational structures that should be established and charged with delivery, any necessary funding and governance oversight, and the intergovernmental backing which will be essential to ensure the resulting science and evidence is acted upon. Preparations for those agreements need to start immediately.**

There is already high-quality research which informs policy development on pathways towards the mitigation of climate change. However, there is considerable potential for the research community to do much better in support of policy makers facing difficult decisions at the intersection of human and planetary health. Policy makers are confronted with rapidly evolving scientific views across multiple disciplines, but there is too much research that either fails to meet the most pressing needs of policy makers (especially in relation to managing policy trade-offs and costs), or which lacks the interdisciplinary perspectives needed to fully address the diversity and complexity of global and local food systems.

Three priorities for action stand out:

1. **Establish inter-governmental and global institutional mechanisms** to better forge credible and authoritative consensus on scientific evidence, resolving controversies

surrounding new research – *conflicting advice translates to indecision and ineffective policies*;

2. **Streamline and improve research efficiency and focus on policy needs** to improve linkages across science regarding climate, natural resources, food, health, and nutrition – *‘joined up’ science is essential to inform multi-sectoral policies*; and identify data and knowledge priorities, and ensure commissioning of necessary modelling – *more research needs to be driven by the specific needs of policy makers*;
3. **Increase the legitimacy of scientific advice through transparency** in a rigorous synthesis and assessment process which fully includes the perspectives and voice of low- and middle-income countries – *confidence in science will translate to science-led policies*. This goes far beyond the remit of any existing science advisory bodies for policy at national or international levels.

## 7. Concluding remarks

When work for this Foresight report started 18 months ago, the world was a very different place. The coronavirus pandemic, and its effect on incomes and diets, is the most recent event to highlight the fragility of existing food systems and the need for transformation.

A fragmented approach to policy making and investment in our food systems remains the paramount challenge. This leads to a lack of focus on the quality and affordability of diets; outdated policies that continue to impede change, or even drive change in the wrong direction; powerful actors pulling in different directions; and a lack of attention to the potential for multi-win policies which support job growth, economic productivity, health, and reduced threats to climate and planetary boundaries.

The window is fast closing for reversing the situation and delivering key international targets such as SDG2, which includes

a focus on hunger and other important international targets concerning planetary boundaries. The outlook is certainly daunting, but this report shows it is not set in stone. By breaking the problems down into their constituent parts, this report has set out both a broad approach and a range of pragmatic and achievable actions, which taken together can constitute a path forward – both for international organisations and actors of all types in individual nations.

Much will depend on the political will, courage, and commitment of leaders of governments, particularly in LMICs and their development partners, UN agencies and other international organisations, and CEOs of food companies to challenge the *status quo*, to act boldly, and to drive a process of transition guided by science, practical evidence, and moral imperative. The way forward is clear (see Box 3). The Global Panel believes that with strong leadership, these new opportunities to improve human and planetary health can and must be secured for today's and tomorrow's generations.



### Box 3: Ten priorities for transitioning food systems to protect human and planetary health

The report contains many recommendations for action by different classes of stakeholders, and which need to take account of local circumstances and constraints. However, the following priorities are considered to be generally applicable:

- 1. Policy makers must build on existing global development targets (such as the SDGs and the Paris Agreement on Climate Change) so they embody the goal of sustainable, healthy diets for everyone as a shared objective.** These targets need to recognise the central importance of sustainable, healthy diets as a key enabler for progress on diverse agendas – equality, economic growth, climate change, the environment, and job creation.
- 2. Policy makers in relevant government departments must address planetary and dietary challenges simultaneously, since they are so fundamentally interlinked.** The approach to date, involving tackling these issues piecemeal and in silos, simply will not work.
- 3. Donor agencies must support LMICs to ensure that the transition of food systems is socially and ethically just.** They have an important role to play to ensure that the poorest are protected during and after a period of food system transition.
- 4. Governments in countries at all stages of development must resolve policy distortions which could fundamentally impede change – or even drive food systems in the wrong direction.** Examples include: taxation and regulation, subsidies, and food-related research and development. The aim is to give much greater weight to the importance of nutrient-rich foods and to better support measures which further both human and planetary health simultaneously.
- 5. Relevant ministries (e.g., agriculture, health, transport infrastructure, environment) need to work together to implement policies to realign production systems so that they support healthy diets in sustainable ways.** Food systems today do not produce enough nutrient-rich foods to meet today's needs, let alone projected demand over coming decades, nor are they producing most foods sustainably. Narrow targets relating to productivity need to be replaced with broader measures valuing efficiency and sustainability.
- 6. Major trans-national businesses and local SMEs must work closely with the governments on more clearly articulated common agendas to deliver sustainable, healthy diets.** While already contributing much, the many diverse commercial actors too often pull in directions that are not conducive to health or to the sustainability of food systems. It is important for governments to incentivise businesses to make a much wider range of nutrient-rich foods affordable to the entirety of 'bottom of the pyramid' families. More generally, a comprehensive framework for food-industry engagement is needed.
- 7. Policy makers in relevant government departments need to prioritise building resilience of food systems – COVID-19 has highlighted their current deficiencies and vulnerabilities.** A broad approach is required which addresses: the causes of lack of resilience within food systems, the root causes of the threats, and mitigation measures which may be needed during times of stress.
- 8. Civil society advocacy groups and citizens need to play their part. The former have a major role in leveraging change in businesses operating across food systems and holding policy makers to account, and the latter have considerable influence to drive change through their purchasing power.** However, shifts in demand in favour of sustainable, healthy diets, will need encouragement and empowerment through information from trusted sources.
- 9. Policy makers in relevant ministries in LMICs should creatively target actions which can create multiple 'wins' across health and sustainability.** Opportunities need to be sought throughout food systems from farm-to-fork. Major projects in sub-Saharan Africa and South Asia have already shown that this is possible, creating substantial and lasting benefits in terms of jobs, equality, and the development and prosperity of individuals and regions. Technology innovations across food systems from production through processing, storage, and retail hold considerable promise.
- 10. Leaders and decision makers should capitalise upon upcoming global fora to agree to new commitments for making food systems more resilient and diets that are healthy and sustainable.** The Nutrition for Growth (N4G) Summit and the United Nations Food Systems Summit are important opportunities to explore the creation of a dedicated Global Financing Facility for food systems transformation and to secure national endorsements for change, including much improved capacity for research and evidence to better support policy decisions. A new vision for sustainable food systems delivering healthy diets for all must be supported through the best science and evidence of what works as informed by practical evidence.





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# 1 Introduction

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**Ensuring sustainable, healthy diets should be a worldwide priority. Yet we are further from achieving that goal than ever before. Instead, multiple crises are unfolding. It is a stark reality that roughly 690 million people are chronically undernourished (a number that may rise considerably during 2020 due to the wide-reaching effects of the coronavirus pandemic), and more than 2 billion people are overweight or obese. Millions of people die every year due to poor-quality diets, which are now responsible for around 20% of premature mortality worldwide. Pressures on healthcare systems are growing inexorably in the wake of an epidemic of non-communicable diseases (NCDs) including stroke, cardiovascular disease, and diabetes. At the same time, the food systems upon which diets rely contribute significantly to climate change and the degradation of environmental resources, upon which they themselves depend. The impacts of the coronavirus pandemic have also highlighted the fragility of food systems to shocks.**

**This report argues that food systems are profoundly dysfunctional at many levels. The long-term goal is a fundamental transformation of the food system. This must be urgently pursued to improve diet quality for all, ensure sustainability, and build resilience. This cannot be achieved overnight, therefore the initial transition steps should not be delayed. This report focuses on pragmatic first actions to get us moving in the right direction. There are signs of growing openness by governments to approach these policy challenges through connected systems thinking, rather than relying on traditional siloed approaches. The opportunities for multi-win actions are real, and courage is already being shown by some low- and middle-income country (LMIC) governments that are willing to engage in national dialogues around possibilities for a different future. The Global Panel urges governments, the private sector, development partners, civil society, and citizens to engage in a food system transition as an absolute priority – by focusing on the first steps needed to make lasting change possible.**

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This report focuses primarily on LMICs but also includes important messages for governments and donor agencies in high-income settings. It builds on a first Foresight report published in 2016, which made the case for much wider and systematic use of a food systems lens in shaping policies across sectors, and sounded the alarm that poor-quality diets were leading to a deterioration globally in human health and nutrition.<sup>1</sup> This second report also distils the latest science, as well as the perspectives of many experts and policymakers from around the globe<sup>2</sup>, to bring an even stronger light to bear on how deficiencies in our food systems profoundly affect both human and planetary health, and how these impacts will only become worse without concerted whole-of-society commitment to changing how food systems function (Part I). The picture

painted by the Global Panel's findings is bleak. Without action, policymakers must expect the situation to worsen considerably. But the Panel has also found that the situation is capable of being addressed, given political will, and decisive action. The goal that frames this entire report is to make healthy diets accessible, affordable, and desirable to everyone, and at the same time, ensure that food systems deliver those diets sustainably (see Boxes 1.1 and 1.2).

The greater part of this report is about action. Part II (Chapters 4-7) distils the complexity down into clear actions which

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<sup>1</sup>A list of people who have contributed to this report and its underlying analysis is provided in the Acknowledgements section at the beginning of this report.



are essential steps in the transition needed to transform food systems, while recognising the need to tailor these to local circumstances. Part III discusses the political and economic realities, as well as the difficult trade-offs which policymakers in LMICs will face when deciding upon the bold reforms which are needed. It also identifies systemic factors which could block change, impede progress, or drive food systems in the wrong direction. These must also be addressed and include, for example, biases in subsidies, research funding and price incentives. Encouragingly, there is evidence that even relatively modest rebalancing of these factors could yield substantial benefits, at little or no cost.

This report also sets out who needs to act. While the focus of the Global Panel is primarily on LMICs, this report's findings constitute a stark warning for every nation. The advice and recommendations offered are particularly important for LMICs where the burden of malnutrition in all its forms is greatest, and where food systems are repeatedly damaged by a multitude of shocks. But many of the recommendations are also relevant for high-income countries (HICs) where food systems are also increasingly fragile and inequitable. Individuals and families suffering from inadequate diets are not restricted to LMICs.

There is a clear role for policymakers to act within their respective countries. But it is also essential for governments and relevant international organisations to work together as part of an integrated and coherent framework for global, national, and local action. Many of the drivers influencing food systems are global in nature, and their impacts cut across geographic boundaries. They include climate change, geopolitical factors, international trade, and the extensive deterioration of many environmental resources, including land, biodiversity, soil, and fresh water. Countries seeking to transform their food systems are likely to achieve much less if they act alone. Worse, in the absence of concerted actions, individual countries engaged in reform may be vulnerable in terms of trade, food safety standards, limitations to available data, as well as a range of humanitarian pressures which can beset LMICs – such as conflict, fragile neighbouring states, and forced migration. The policy change and investment agendas critical to a viable future for global and local food systems need to enjoin all nations.

## 1.1 The many problems affecting today's food systems

### 1.1.1 COVID-19 and the resilience of food systems: a wakeup call

The coronavirus crisis has underscored the inter-connectedness of the world's food system, and its fragility to shocks which can rapidly affect many regions and countries. The economic effects of the pandemic have been far-reaching. Millions of people have been pushed into poverty due to job losses (for example, a survey of 700 businesses in Nepal found that three in five employees lost their salaried job during lockdown).<sup>3</sup> Billions of consumers are worried about how to access food, farms face uncertainty about access to labour, and restaurants face bankruptcy. The crisis has also highlighted health inequalities, as pre-existing health conditions linked to inadequate diets have substantially increased the risk of severe symptoms and death. While some elements of the food system have adapted to the new normal of coronavirus lockdowns (such as pop-up local farmers' markets, farmer-to-customer food corridors in China and Costa Rica, and food supply chains supporting online purchases and delivery), the coronavirus represents just one new challenge to the effective functioning of global food systems. Yet, it has shaken complacency. Current food systems are neither robust to shocks nor delivering the healthy diets that underpin good nutrition for all.

### 1.1.2 Our diet choices and food systems are harming human health – a nutrition crisis

Today, unhealthy diets are responsible for more deaths globally than tobacco, high blood pressure, or any other health risk combined.<sup>4</sup> According to the Global Burden of Disease initiative, one in five deaths is associated with a poor-quality diet. People in every region of the world would benefit from rebalancing their diets by eating more nutrient-rich foods within a diverse diet, and eating less calorie-dense foods and processed products based on ingredients known to compromise health (see Box 1.1).

The 'triple burden' of malnutrition (impaired child growth manifested as stunting, deficiencies in minerals and vitamins, and the growing epidemic of diet-related NCDs linked to overweight

#### Box 1.1: What is a healthy diet?

While there is no single dietary pattern that delivers 'good health' in every society, there is broad agreement on what elements should be included in healthy or high-quality diets. They include a diversity of foods which are safe, and provide levels of energy and key nutrients of all kinds appropriate to age, sex, disease status and physical activity (i.e. nutrient-rich). The World Health Organization (WHO) emphasises the importance of starting healthy-eating habits in early life (notably through exclusive breastfeeding).

It advises people to eat plenty of fruit, vegetables, wholegrains, pulses, fibre, nuts and seeds, fish, and some dairy and lean high-quality meats in moderation.<sup>2</sup> The WHO recommends limiting intake of free sugars, sugary snacks and beverages, processed meats, trans-fats and salt. In this report, the Global Panel is not promoting or endorsing a single or universal diet for all. It seeks instead to promote policy actions across the entire food system to secure a high-quality diet for everyone.

and obesity) hinders progress in other development domains, especially in LMICs such as Indonesia, Bangladesh and South Africa which are successfully reducing undernutrition but at the same time experiencing burgeoning epidemics of diabetes and cardiovascular disease.<sup>5</sup> NCDs are placing an ever-increasing burden on government budgets for healthcare, especially in countries with rapidly growing populations, falling poverty, and shifting dietary patterns. Poor diets and nutrition are also a key factor in pushing people into lifetimes of inequality by impairing children's health, learning and development, and limiting the productivity and prosperity of millions of individuals, particularly in sub-Saharan Africa and South Asia.

The economic costs are vast. The impact on the global economy of all forms of malnutrition has been estimated at US\$3.5 trillion per year. When the impacts of certain agricultural practices that are harmful to the environment are included, this figure rises to more than US\$6 trillion per year in terms of the value of lost productive life alone.<sup>6</sup>

### 1.1.3 Ensuring sustainable, healthy diets for all is contingent on a food system that can deliver required nutrient-rich foods (see Box 1.2)

Sustainable delivery depends not only on what foods are produced, but on how they are produced, how much is wasted, how they are processed, and how incentives for enhanced production efficiency are influenced by consumer demand. Each of these factors is influenced by food system policies. For example, since food prices and marketing strategies do not generally reflect the real costs of food production (where negative externalities are accounted for), the contribution of food systems to greenhouse gas emissions and environmental

“ A child born today will experience a world that is more than four degrees warmer than the pre-industrial average, with climate change impacting human health from infancy and adolescence to adulthood and old age. ”

Watts et al. (2019)<sup>8</sup>

“ Nothing short of a systemic transformation of food systems is required if we are to feed the world's current and future population sustainably under climate change. ”

Steiner et al. (2020)<sup>9</sup>

## Box 1.2: Defining sustainable food systems

For the purposes of this report, the term 'sustainable food system' is broadly used if the contribution of a place's food system (which delivers locally produced but also imported and marketed foods) can be continued without undermining the ability of the natural environment to function in the long term: that is, the system does not drive biodiversity loss, pollution, soil degradation, or climate change. (For a more detailed and nuanced discussion of 'sustainability' in the context of food systems, and how the term is used in this report, see Chapter 3).

degradation has low visibility.<sup>7</sup> It is therefore challenging for governments to give a high priority to policy changes which would drive food system changes which promote planetary as well as human health.

In pursuing the goal of healthy diets, the sustainability of food systems is a critical concern, as their capacity to function effectively is inextricably bound to the continuing depletion or degradation of natural resources as well as to the growing climate crisis. The escalating impacts of weather-related shocks across LMICs is driven by changing climatic patterns, with some of the most severe anomalies affecting producers and consumers in Africa, South Asia, and small-island states. While changes are needed to make local food systems more resilient to climatic shocks, reversing the emissions and natural resource degradation associated with most food production, marketing and processing is both a national and a global responsibility. Individual nations can do a lot, but a transformation of food systems with planetary implications requires all nations working towards common goals. It is not a luxury to seek to enhance food systems in ways that are sustainable, able to protect planetary resources and nurture human health simultaneously. It is a paramount policy priority of the 21<sup>st</sup> century.

The unsustainability of food systems is very costly. Agriculture and agriculture land use already accounted for an estimated 21% of total anthropogenic greenhouse gas emissions between 2007 and 2016<sup>10</sup> and for roughly 70% of global fresh water use. The pressures applied to natural resources by food production have also left 25% of the world's cultivated land area degraded.<sup>10</sup> These hidden costs of today's failing food and land systems – through their impact on health, nutrition and the natural environment – have been estimated at US\$12 trillion a year, rising to more than US\$16 trillion by 2050 if current trends continue.<sup>6</sup>

### 1.1.4 Major flaws in today's food system

Our food systems have achieved a great deal over many years. They have enabled substantial increases in agricultural productivity over the past 50 years, with a threefold expansion in crop production.<sup>11</sup> These gains have been primarily in grain output (rice, maize and wheat), which has increased by almost a billion metric tons since the mid-1960s.<sup>12</sup> This increase in production played a critical role in reducing hunger: the share of people in resource-poor countries

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“Food systems do not provide only food but also jobs, income, infrastructure, skills (socio-economic outcomes) and ecological services (environmental outcomes). This means that food systems can make a significant contribution not only to food and nutrition security, but also to inclusive development and a viable environment for fighting climate change.”

FAO (2019), *Food Systems at Risk*<sup>20</sup>

living with average daily food intakes of less than 2200 kcal fell from 57% in the early 1960s to just 10% by the end of the century.<sup>13</sup>

The challenge of food systems today is not that they are ‘broken’ but that they are no longer aligned with changing global priorities. In particular, food systems today have three major inter-linked weaknesses which are driving today’s nutrition crisis, and which constrain them in delivering sustainable, healthy diets for all. Showing why and how these weaknesses must be tackled is key to enabling the food system transition. Key arguments of this second Foresight report are as follows:

**First, the world’s food systems are outmoded.** They were shaped half a century ago to feed as many people as possible at the lowest cost. Today, food systems need to do more than merely feed people. They need to nourish people in ways that support human health, while ensuring sustainability. Current systems are unable to meet these essential requirements. They produce insufficient nutrient-rich foods to meet today’s needs, let alone future demand (see Chapter 4). What is produced contributes in negative ways to both human and planetary health, and they are also vulnerable to a wide variety of global and local shocks. Food systems that deliver healthy diets sustainably are essential to delivering many of the Sustainable Development Goals. However, most governments accord little priority to the fundamental policy changes which are urgently required, leading to policy stasis which is allowing an alarming escalation of global and local challenges.

**Second, healthy diets today are unaffordable for too many people.** It is estimated that around three billion people today simply cannot afford the least-cost form of healthy diet recommended by national governments.<sup>14,15</sup> Hence the emphasis in this report, particularly in Chapter 6, on making affordability of sustainable, healthy diets a top policy priority globally. If sustainable, healthy diets are to be affordable to all, a wide range of policy instruments must design through the lens of an integrated food system and implemented in joined-up rather than piecemeal ways.

**Third, despite growing calls for food system transformation,<sup>6,16–19</sup> the essential steps in any transition have not been well defined.** Also, the long-term agenda is largely posited without a clear understanding of the trade-offs that will inevitably be involved, and the scale and diversity of benefits that transition steps will deliver. Policymakers must make the challenges and trade-offs transparent, and assess them through political, societal, and economic lenses, facing them head-on.

## 1.2 A new vision for food systems

This report shows that healthy diets for all can *only* be delivered if they are sustainable, and if their accessibility and affordability are an integral part of how food systems function. Food systems and the planet’s natural resources are closely linked. Ensuring that both are nurtured in ways that support sustainable, healthy diets is a key principle. Food systems – from supply to demand – must support *both* human and planetary health, and actions to protect natural resources and mitigate climate change must also support the goal of sustainable food systems.

In the wake of the coronavirus pandemic, policymakers around the world are facing a new reality. While conventional policies, incentive structures and patterns of demand have influenced recent trends in food supply and demand, a fundamentally different approach will be needed if food systems are to be less fragile to future economic shocks, disease outbreaks or climate-related natural disasters.

### 1.2.1 What change is needed in our food systems?

While several conceptual models of food systems are available, they tend to present the food system as a relatively controllable or even static entity which has different components or domains. The reality is very different. A food system, whether global or local, is a dynamic complex system which is constantly changing in response to myriad exogenous and endogenous drivers: demographic shifts, economic growth, changing patterns of consumer lifestyles and demand, shifts in trade patterns and investment, new technology, changes in the natural environment, and more.<sup>ii</sup> The many parts of a food system are thus in constant flux, and for the policymaker this presents substantial challenges in terms of the steps needed to achieve desired changes. The scale and complexity are immense, but at the same time the goals are critical.

In this report, food system transformation is characterised as a long-term goal. The desired aim is a system having a number of key characteristics tied to achievable, positive health and planetary goals which are stable while the system itself is constantly shifting and evolving. To get there, a transition period is essential to enable global and national leadership. Given how today’s food systems are largely based on a 20th century vision of feeding the global population, a new vision needs to be clearly

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<sup>ii</sup> See Figure 1.4 in the first Foresight report<sup>1</sup> for a conceptual diagram of food system functions and domains.



articulated so that different pathways can be harnessed to nourish people in ways that are sensitive to, and reflect, a society's culture, traditions and aspirations.

### 1.3 Framing policy approaches for a food system transition

In 2016, the Global Panel produced a first Foresight report which argued for fundamental shifts in policy in LMICs to enable food systems to deliver healthy diets for all.<sup>1</sup> That publication shone a spotlight on the approach that policymakers must take to ensure complementarity and additionality from food-related policies and programmes implemented across multiple sectors. Adopting a food system lens was advocated then, and it remains important. For example, this perspective urges governments to better trace how a production-focused policy can affect wages or transportation costs, or how a consumer-focused tax may impact food processing and retail companies.

Since 2016, the need for actions to transform food systems has become increasingly recognised within the wider policy community, with many other reports now addressing food systems issues. Yet few have attempted to articulate the socio-political realities which have to be involved in transforming food systems from where they are today to where they need to be. There are undeniable challenges to face. So rather than elaborating even more on the vision of a different future (however important that may be), this report of the Global Panel focuses instead on articulating pragmatic strategies to manage an effective transition.

There is now an opportunity for LMICs to grasp the opportunities present today; to link climate, pandemic,

**“The current food system “must be transformed to one that is safe, sustainable, healthy and fair to all.”**

**Commission for the Human Future (2020)<sup>21</sup>**

**“There is no future for business as usual – we are reaching irreversible tipping points for nature and climate, and over half of the global GDP, US\$44 trillion, is potentially threatened by nature loss.”**

**World Economic Forum (2020)<sup>22</sup>**



economic and health concerns, and mould them into a coherent policy narrative that will support actionable steps in the right direction. Such a strategy will point to a visionary future, but it will be defined by what is currently technically possible, politically feasible, and socially and economically acceptable. High-income country (HIC) governments and their donor agencies have an equal responsibility to act by reforming their own food systems, but also need join with LMICs in making the necessary global changes possible by supporting them through the transition.

Despite the urgency of past calls for action, the world is failing to make the significant changes needed at the scale and pace required to address the inter-linked challenges of unhealthy diets, environmental resource degradation and dysfunctional food systems. While these are systemic threats, it would be a mistake for policymakers to seek merely to mitigate their impacts while shying away from fundamentally transforming food systems. However, the cost of transforming food systems in LMICs, and indeed in all countries, will not be inconsequential.

The cost of ensuring that every individual is able to eat a healthy diet every day will be significant, especially if the world moves towards pricing food in ways that better reflect the 'true' cost of production, processing and marketing.<sup>7</sup> Yet the cost of not acting will be immeasurably higher. Just as there are compounding risks to inaction, there are co-benefits to decisive action in terms of millions of new jobs, a reduced economic burden of ill health and reduced costs to health systems, and substantial gains from avoiding global damage from climate change. Estimates suggest that positive outcomes will contribute trillions of dollars to the world's economy. One recent analysis puts the economic gains from a fundamental food system transformation at US\$10.5 trillion per year by 2050.<sup>6</sup> However, many political leaders remain reluctant to invest for the medium to long term. Therefore, in moving forward, it will be important to ensure transparency on the costs of inaction as well as costs of action, and the benefits to be realised.

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## 1.4 A report to challenge everyone

This new report spells out the value, particularly for LMICs, of embarking on the transition process. Urgent end-to-end action is required by all stakeholders in the food system, from governments to commercial businesses, civil society organisations and citizens (particularly in their universal role as consumers of food). There can be no delay, nor can there be cherry-picking of easy options. The steps needed to bring about a successful and meaningful transition are interlocking and mutually supportive, which requires a coherent joined-up approach to the choice of instruments to use and how they are implemented. A whole-of-society agenda has to be on the table.

### **Part I of this report builds the case for action to deliver change in food systems.**

It identifies the immediate challenges and those in the coming decade and spells out why all nations and all actors involved in food systems need to act decisively and urgently.

- Chapter 2 analyses the links between diets and human health and the somewhat mixed progress in recent years. It shows how food consumption patterns in LMICs are leading to obvious (and some less obvious) nutrition and disease outcomes, and highlights the massive economic and societal costs that these countries will face. It shows how dietary patterns are worsening in many developing contexts, and asks how diets need to change to secure good nutrition and health for all.
- Chapter 3 assesses the relationship between dietary choices, human health, and planetary health. It considers the extent to which environmental systems today are impairing the capacity of food systems to deliver, and the extent to which the situation is likely to worsen in the future. It also makes clear how food systems themselves are contributing to the degradation of so many environmental services on which they themselves depend.

### **Part II of this report focuses on action. It sets out the essential steps of the transition needed to make lasting change possible.**

Since good health and nutrition are heavily dependent on what people eat, a reframing of both public and private investments towards diets that are sustainable and healthy is essential. Four chapters focus on the leverage points where action can support multiple policy outcomes.

- Chapter 4 focuses on food production. It considers how nutrient-rich foods can be made *available* to all food consumers by realigning policy and financial support for staples towards a wider range of foods. This is not to suggest

that most people are not eating well because of supply constraints alone. All aspects of the food system interact to frame what is physically available to any citizen at what price point. But making sufficient quantities of the right foods available is where it all starts. To achieve this, more funds need to flow to secure the supply of staple foods while also significantly increasing the support for non-staples.

- Chapter 5 focuses on how to make these foods *accessible* to all. It considers the best practices and innovations to conserve nutrients throughout the food system while supporting the creation of new employment opportunities through trade, markets and processing, storage retail, and reduced food loss and waste.
- Chapter 6 considers options for making sustainable, healthy diets *affordable* to all. These include consumer subsidies, the realignment of incentives in agriculture R&D and current patterns of commodity support, and investments in value-chain efficiencies to reduce input and market transaction costs. The chapter highlights the need to significantly increase funding by bilateral and multilateral donors as well as domestic agriculture research organisations to support R&D refocused on achieving sustainable, healthy diets and resilient food systems.
- Chapter 7 provides options for making nutrient-rich foods *desirable*. It considers joint efforts involving businesses and governments to promote a step-change in citizens' awareness, education, and ability to make informed choices. This requires considerable effort to shift relative prices, advertising, and marketing strategies more generally, in favour of nutrient-rich food.

### **Part III focuses on political and economic realities of change, and how the strategies set out in Part II can be implemented:**

The transition of food systems is potentially complex and needs to be taken forward against a background of the many constraints and conflicting policy priorities which affect all countries, but particularly LMICs. Deciding where and how to initiate transition constitutes a challenge in itself. Part III provides practical advice on getting started.

- Chapter 8 lays out principles to guide the transition process. It explores the many policy trade-offs that governments face, and spells out how decision makers can navigate a transition from current food systems to where they need to be in the future.
- Chapter 9 sets out exactly who needs to do what. It lays out recommended steps to be taken by global institutional leaders, government policymakers, private sector stakeholders, and civil society, including all citizens.

## PART I

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# Why a food system transformation is critical



# 2

## Diets and human health: an accelerating crisis





## Key messages

**We are in a deepening global nutrition crisis. Malnutrition in all its forms has become one of the most serious threats to global health.** Today, sub-optimal diets are estimated to be responsible for 20% of premature (disease-mediated) mortality worldwide and 20% of all disability-adjusted life years (DALYs).

**Links between diet and disease are increasingly understood as a triple burden of undernutrition, deficiencies of vitamins and minerals, and diet-related non-communicable diseases (NCDs).** This is due in large part to the global epidemic of overweight and obesity. All countries face at least one or all of these problems. Low- and middle-income countries (LMICs) are

disproportionately affected because they carry the greatest burden of undernutrition and micronutrient deficiencies, while NCDs are growing fast. LMICs also have the fewest fiscal and institutional resources to manage such challenges.

**Improved diets would yield substantial and wide-ranging benefits which are integral to universal policy goals.** They will contribute to better health through improved nutrition; promote healthier economies that spend less on treating diseases associated with sub-optimal diets; and engender better educational attainment and labour productivity.

Most countries are not on track to meet most of the nutrition targets

set for 2025 by the World Health Assembly. So much more has to be done, including shifting dietary patterns globally. **In order to deliver sustainable, healthy diets for all, food systems must be fundamentally transformed. They remain profoundly dysfunctional.** Most countries are not on track to meet most of the nutrition targets for 2025 by the World Health Assembly. So much more has to be done, including shifting dietary patterns globally. However, achieving rising incomes in a country will not by itself guarantee better diets – it is more likely to shift the problem as consumer demand shifts towards sugars, unhealthy fats, oils, and red meat.

“Unhealthy diets and maternal and child malnutrition are among the current top risk factors for the global burden of disease and account for about one quarter of global deaths.”

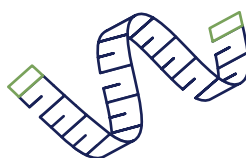
FAO and WHO (2018)<sup>16</sup>



Sub-optimal diets are estimated to be responsible for **20%** of premature mortality worldwide



Roughly **15%** of all live births are **below 2.5kg**



**Since 1975**, obesity has nearly **tripled** worldwide and now affects every country in the world

**What we eat impacts our health. The first Foresight report, published by the Global Panel in 2016, highlighted the risks posed to human health by sub-optimal diets as: “greater than the combined risks of unsafe sex, alcohol, drug and tobacco use.”<sup>1</sup> But in the past few years, evidence supporting these insights and related recommendations has become stronger and more worrisome – most notably in terms of how rapidly diets are shifting in negative ways, and the growing prevalence of associated health problems. The case for urgent action is clear: food systems are failing to deliver healthy diets for all.**

million people going to bed hungry every day.<sup>15</sup> However, meeting minimal calorie intake does not alone resolve or prevent most of the manifestations of malnutrition. Both the quality and quantity of foods consumed matter.

For policymakers, the message is clear. Sub-optimal diets are associated with a wide range of serious health risks, and at least 11 million people die every year from specifically diet-related illnesses.<sup>4</sup> Conversely, diets that are diverse, nutrient-rich and safe support robust health, including enhanced immune systems and better intergenerational (pregnancy and birth) outcomes. The right combination of foods can provide a person’s energy, protein, and micronutrient requirements. A shortfall in any of these nutrients leads to a range of deficiency syndromes which are associated with disease states, including child growth impairment, blindness and high blood pressure.<sup>24,25</sup>

The links among diet, nutritional status and disease are increasingly understood as a ‘triple burden’ threat as described in Chapter 1. Poor-quality diets are important factors in undernutrition, but they also contribute to deficiencies of vitamins and minerals, as well as playing a key role in diet-related NCDs.<sup>26–28</sup> The health risks associated with diet-related NCDs are now manifest globally. Vitamin and mineral deficiencies are also a global problem with large numbers of people in middle- and high-income countries still suffering iron-deficiency anaemia and deficiencies in B12, folate and vitamin D, in particular. The health and mortality risks linked to undernutrition are now mainly found in LMICs, where they continue to represent a significant brake on development, especially where combined with one or other of the manifestations of malnutrition. For example, Nigeria, Egypt and Malaysia are dealing simultaneously with child stunting, maternal anaemia and high rates of adult female overweight. Paraguay and Thailand report co-existing overweight and anaemia, while India and Niger are experiencing a high prevalence of both anaemia and stunting.<sup>29</sup>

In other words, some nutrition challenges are universal, some are context-specific, but *all* countries are experiencing manifestations of these problems.<sup>30</sup>

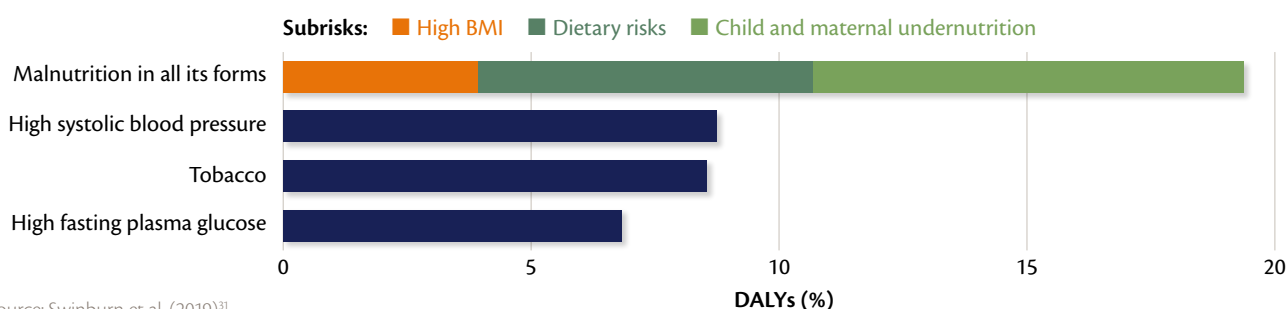
Figure 2.1 shows the considerable burden of malnutrition in terms of a widely used metric – disability-adjusted life years (DALYs) lost to ill-health. Recent Lancet Commission work on the related global challenges of obesity, undernutrition,

## 2.1 Diets and human health: an overview

The World Health Organization (WHO) advises that diets should include a diversity of foods which are safe and provide levels of energy and other nutrients appropriate to each individual (see Box 1.1 in Chapter 1). In that framing, the characteristics of an unhealthy diet include eating too few nutrient-rich foods (including fruits, vegetables, pulses, nuts and seeds, or wholegrains), or too many food products that contain ingredients known to carry health risks (such as high levels of sodium, free sugars, and trans-fats<sup>2</sup>).

Inevitably, achieving food security is one of the most immediate concerns for the 50 or so low-income countries that face structural (multi-year) food deficits.<sup>23</sup> Being seriously food insecure is itself a major health concern for the roughly 690

**Figure 2.1: The global burden of malnutrition in all its forms**



Source: Swinburn et al. (2019)<sup>31</sup>



and climate change suggests that impacts of sub-optimal diets are now responsible as well for 20% of all DALYs.<sup>31</sup> Other estimates suggest that 20% of *premature* (disease-mediated) mortality worldwide could be attributable to sub-optimal diets.<sup>4</sup> One assessment of the drivers of DALY losses in the Economic and Monetary Community of Central Africa (CEMAC) estimated that the triple burden of communicable diseases, NCDs and injuries in 2015 were responsible for lost DALYs with a fiscal value equivalent to 59% of the region's total gross domestic product (GDP).<sup>20</sup>

Worse still, poor nutritional status increases the risk of death from infectious diseases. But there are also non-disease threats to life related to wasting. A recent modelling exercise of the *indirect* effects of impaired access to food coupled with healthcare disruption caused by the coronavirus pandemic indicated that these factors could raise the prevalence of child wasting, mainly in LMICs, which would translate into 18% to 23% additional preventable child deaths.<sup>32</sup>

The links between poor diets and COVID-19 disease outcomes were widely highlighted during 2020. For example, the importance of eating a nutrient-rich diet to supporting improved immune response to disease threats like COVID-19 has been highlighted.<sup>33</sup> The Food and Agriculture Organization of the United Nations (FAO) made a clear statement that “while no foods or dietary supplements can prevent COVID-19 infection, maintaining a healthy diet is an important part of supporting a strong immune system”.<sup>34</sup> Conversely, the World Health Organization's Regional Director for Africa recently underscored the concern that already-malnourished individuals “will find it harder to fight off COVID-19 infection”.<sup>35</sup>

While more research is needed to fully elaborate on these suspected links, the coronavirus pandemic has brought much greater attention to the known role of diets in health, regardless of geographic setting. Wherever a person may live, she or he should be able to eat well. This is not just about supporting choice (consumer sovereignty), since food systems respond to a wide range of incentive structures, policy frameworks, legal regulations, and commercial strategies. Nor is it as simple as supply responding to, or influencing, demand. Food systems deliver food items and products to places and at prices that have been negotiated by many different people and processes. Transforming food systems to be aligned with health and sustainability goals will require a focus not on individual foods or nutrients in isolation, but on how and why foods are chosen and combined in people's diets, and how best to offer them to people in ways which are affordable, nutrient-rich, and sustainable.

The challenge to governments is stark. To improve the health of all citizens (thereby reducing healthcare costs and increasing productivity and economic growth), those citizens need to be well-nourished, not simply disease-free. For a population to be well-nourished, everyone must have access to a high-quality diet throughout the course of a lifetime, and governments must support actions in both the public and private sectors which can effectively manage and prevent the different manifestations of malnutrition.

## 2.2 Malnutrition in all its forms

The Sustainable Development Goals (SDGs) were adopted in 2015 as a set of interlocking targets aimed at improving the development of all nations by 2030. They represent a call for action through global partnerships.<sup>36</sup> The second of the 17 SDGs includes a focus on ending hunger, but also on improving nutrition.

Hunger is not the same as malnutrition. Around one in 10 people in the world ‘go to bed hungry’.<sup>15</sup> This represents roughly 690 million people who were estimated to be chronically undernourished in 2019 (this number is a revision of previous estimates based on new data on population, food supply and new household survey data which enabled the revision of the inequality of food consumption for 13 countries, including China).<sup>15</sup> After decades of decline, that number has been rising in recent years due to armed conflict, recurrent natural disasters, and political instability. The situation is most alarming in sub-Saharan Africa, where the prevalence rate of undernourishment has steadily increased in almost all sub-regions of the continent. Similarly, undernourishment has been rising in parts of South America, such as Venezuela. Successfully ending hunger, let alone all forms of malnutrition, by 2030 seems optimistic under such circumstances, but that goal must remain a priority. The full set of SDGs will not be met without ending hunger and malnutrition.<sup>37</sup> In turn, this cannot be achieved without improved diets being made available through sustainable food system practices.

SDG2 adopted nutrition targets established by the World Health Assembly (WHA) in 2012.<sup>iii</sup> The WHA targets were agreed by Member States of the WHO and aim to accelerate progress globally, not just for a single nutrition outcome, but to “end all forms of malnutrition by 2030”.<sup>38</sup> This meant setting targets relating to the following six manifestations of malnutrition:<sup>38</sup>

**Child stunting:** Around 144 million children under five years of age were stunted (too short for their age) in 2019.<sup>39</sup> While there has been progress in recent years in reducing the global figure for pre-school children who fail to grow to their expected height at a given age, the gains have not been universal (around 30 countries bear most of the burden of stunting), nor fast enough to meet the WHA's global target of a 40% reduction between 2010 and 2025 (see Figure 2.2).

**Child wasting:** In 2019 there were roughly 47 million pre-school children who were wasted (too thin relative to their height). Even moderate wasting raises the risk of disease-mediated premature mortality for these children; acute wasting increases that risk significantly (see Figure 2.2). In Asia and Oceania, wasting currently puts nearly one in 10 children at increased risk of death. South Asia, led by India, is home to more than half of all the world's wasted children (>25 million in 2019).<sup>39</sup>

**Childhood overweight:** Since 1975, obesity has nearly tripled worldwide and now affects every country in the world. Recent analysis from six countries in South Asia found that overweight

<sup>iii</sup> The World Health Assembly is the governing body of the World Health Organization.

and obesity have been rising in rural as well as urban areas, and among less-wealthy and less-educated adolescent girls and women (as well as the wealthier, educated elites).<sup>40</sup> Northern and Southern Africa are regions already dealing with 11-12% of preschool children who were overweight in 2019.<sup>39</sup> The WHA target is aimed at preventing a rising caseload by eliminating further increases in preschool child overweight (see Figure 2.2).

**Anaemia in adult women:** A 50% reduction in the prevalence of anaemia among women of reproductive age (WRA) was set as the global target for 2025. In 2016, an estimated 38% of all WRA globally were suffering from anaemia, rising to over 40% among pregnant women.<sup>41</sup> Asia and Africa have the highest rates of prevalence. Anaemia is a concern for women's health, but it also has impacts on pregnancy outcomes as it is an important risk factor for haemorrhage, which is the leading cause of maternal deaths.<sup>42</sup> No country is on course to achieve the WHA target by 2025.<sup>41</sup>

**Low birth weight:** Roughly 15% of all live births are below 2.5kg, which increases the risk of neonatal complications and adds the risk of physical and cognitive impairment in that child's later development.<sup>43</sup> While a dozen countries are on track to meet the WHA target of cutting low birth weight rates by 30% (by 2025), most are not. The greatest burden of low birth weight falls to families in central and southern Africa (where one in five births fall into this category), but some Asian countries such as Nepal, Bangladesh and The Philippines also post similar statistics.

**Exclusive breastfeeding:** A high-quality diet starts at birth in the form of exclusive breastfeeding. A baby born anywhere in the world requires no other food or liquid than breast milk

for the first six months of life, yet only about 40% of infants globally are given that ideal diet.<sup>41</sup> Most countries in the world do not collect or report data on exclusive breastfeeding, so it is unclear how much progress will be made towards the target of increasing rates up to at least 50%.

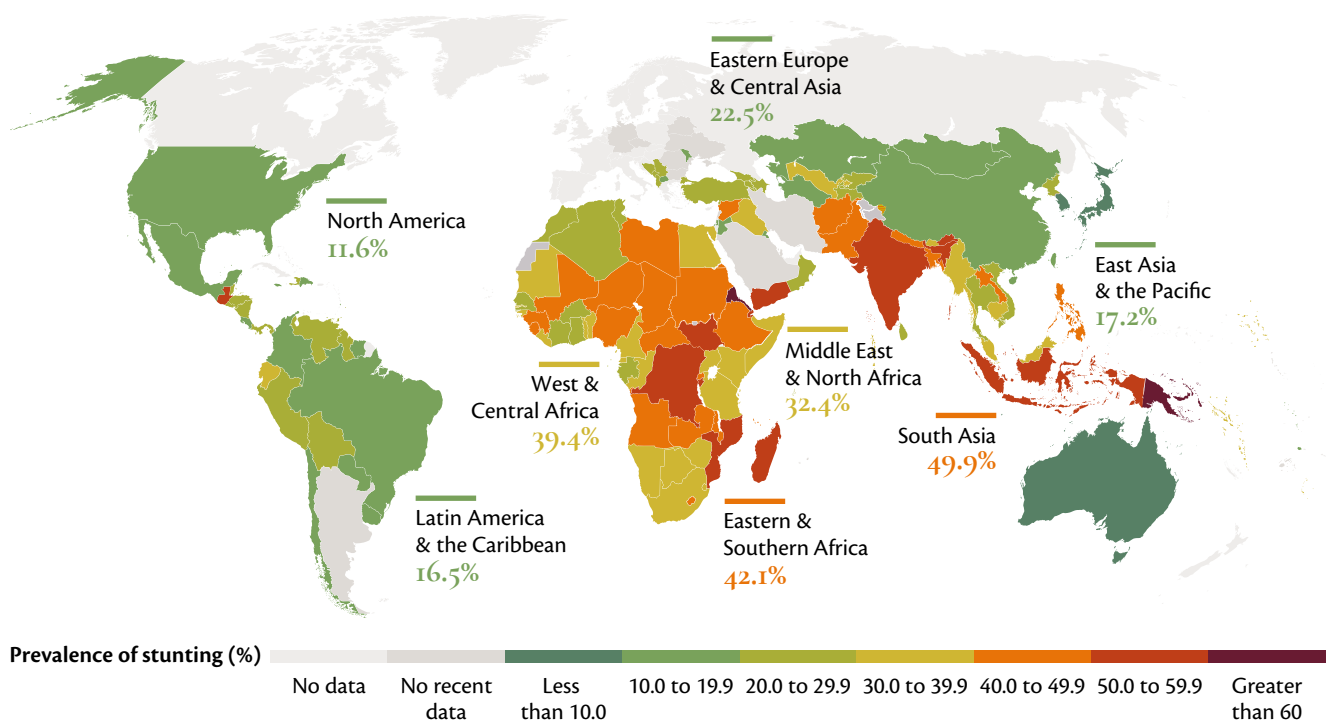
## 2.3 The extra dimension: Diets and NCDs

There is an important additional dimension of the diet-nutrition relationship which is not fully captured in the six WHA targets – that of the escalating impacts of adolescent and adult obesity and associated diet-related NCDs on public health and on national finances (see Box 2.1). One recent study indicates that at least 36 risk factors for the world's disease burden, including most of those related to sub-optimal diets, will worsen by 2040.<sup>45</sup> They include high blood glucose, high blood pressure, high cholesterol and high body mass index.

“More than a quarter of preventable deaths globally have been attributed to imbalanced diets, mostly from diet-related, chronic diseases that also require costly treatment.”

Stanaway et al. (2018)<sup>46</sup>

**Figure 2.2: Prevalence of children under five (%) who are not growing well (stunted, wasted or overweight), 2018**

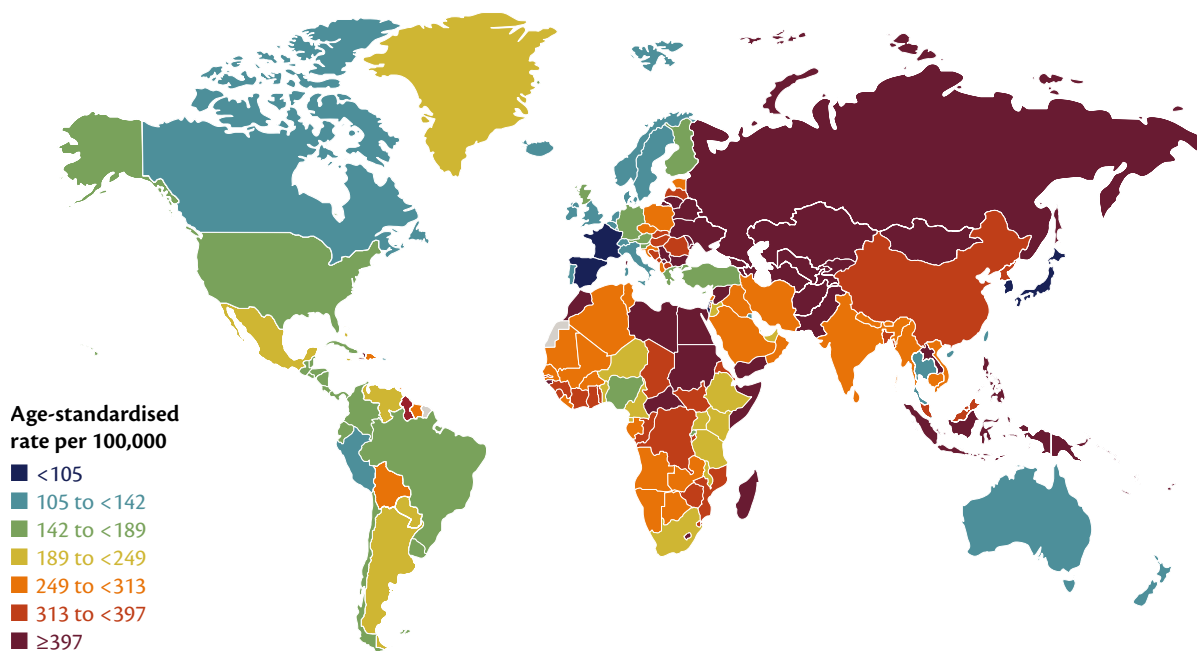


## Box 2.1: Today's burden of non-communicable diseases (NCDs)

According to the 2018 Global Nutrition Report: "The burden of NCDs is significant: 422 million people have diabetes and 1.1 billion people suffer from high blood pressure. NCDs were responsible for 41 million of the world's 57 million total deaths

(71%) in 2016, of which diet was one of the four leading risk factors."<sup>47</sup> Importantly, the diet-related disease burden is highest in low- and middle-income countries (see Figure 2.3), which together account for 85% of all premature deaths from NCDs.<sup>47</sup>

**Figure 2.3: Age-standardised mortality rate per 100,000 population attributable to diet in 2017**



Source: Afshin et al. 2019

Importantly, although by 2040 sub-Saharan Africa will still have a large share of years of life lost due to communicable diseases as well as maternal and young child undernutrition, it will also face rapidly growing healthcare costs associated with diet-related NCDs such as ischaemic heart disease, strokes, and diabetes.<sup>45</sup>

The huge scale of the future health and economic impacts of poor diets can be illustrated by just one diet-related NCD: diabetes. The number of people affected is projected to rise from 451 million globally in 2017 to 693 million by 2045, increasing global healthcare expenditure to almost US\$1 trillion per year.<sup>48</sup> Estimates of the 'full economic cost' of diabetes forecast that the global economic burden of diabetes will rise from US\$1.3 trillion in 2015 to US\$2.5 trillion in 2030, if recent trends continue, with low- and middle-income countries severely affected.<sup>49</sup> By 2030,

East Asia and the Pacific region are expected to carry the largest burden of diabetes (with the highest economic impact, reaching almost US\$800 billion annually for that region alone), while in sub-Saharan Africa, the economic impacts of diabetes are expected to exceed US\$52 billion by 2030.<sup>49</sup>

But the impact of poor diets goes beyond diabetes, particularly in LMICs. The 2019 version of the State of Food Insecurity and Nutrition in the World projected that undernutrition will continue to place a drag on economic growth across South Asia and sub-Saharan Africa, cutting GDP by up to 11% per year<sup>50</sup>. In other words, although LMICs have yet to feel the full economic and health system impacts of diet-related diseases, those impacts are already having effects that compound each other year-on-year.

**“If current trends continue, economic losses in low- and middle-income countries from heart disease, cancer, diabetes, and chronic respiratory disease will reach more than US\$7 trillion over the period 2011–2025, equivalent to about 4% of these countries’ annual output.”**

UNICEF (2019)<sup>44</sup>



In light of these compounding challenges, it is no surprise that malnutrition in all its forms poses “by far the largest cause of health loss in the world”.<sup>31</sup> There is therefore a growing imperative for LMIC governments to understand how diets and their associated food systems contribute to these health losses, and how improvements in both need to be part of the solution.

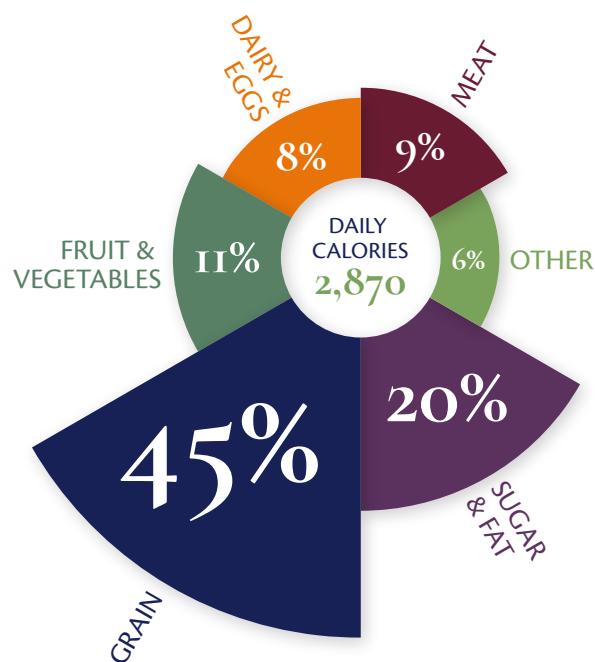
## 2.4 The roles of diets in health

It was recently estimated that more than one quarter (26.4%) of the world’s entire population does not have regular access to sufficient nutrient-rich safe foods.<sup>50</sup> Many more do consume enough calories on a daily basis, but still do not consume recommended levels of many key nutrients (such as iron or vitamin A) or certain types of foods that are important contributors to health (such as whole grains, legumes or nuts and seeds).<sup>51,52</sup>

### 2.4.1 Dietary patterns in LMICs

The poorest households in low- and middle-income countries allocate roughly two-thirds of their spending on food.<sup>53</sup> It is arguably the most important fundamental daily need for billions of people (along with water and shelter). Importantly, even smallholder farmers are typically net purchasers of food, meaning that even when they produce commodities, most farmers still procure food from the market. While the share of spending for food is high in countries across Africa and South Asia, the absolute amounts are low relative to other parts of the world. This means that the bulk of spending on food is used to acquire

Figure 2.4: What the world eats

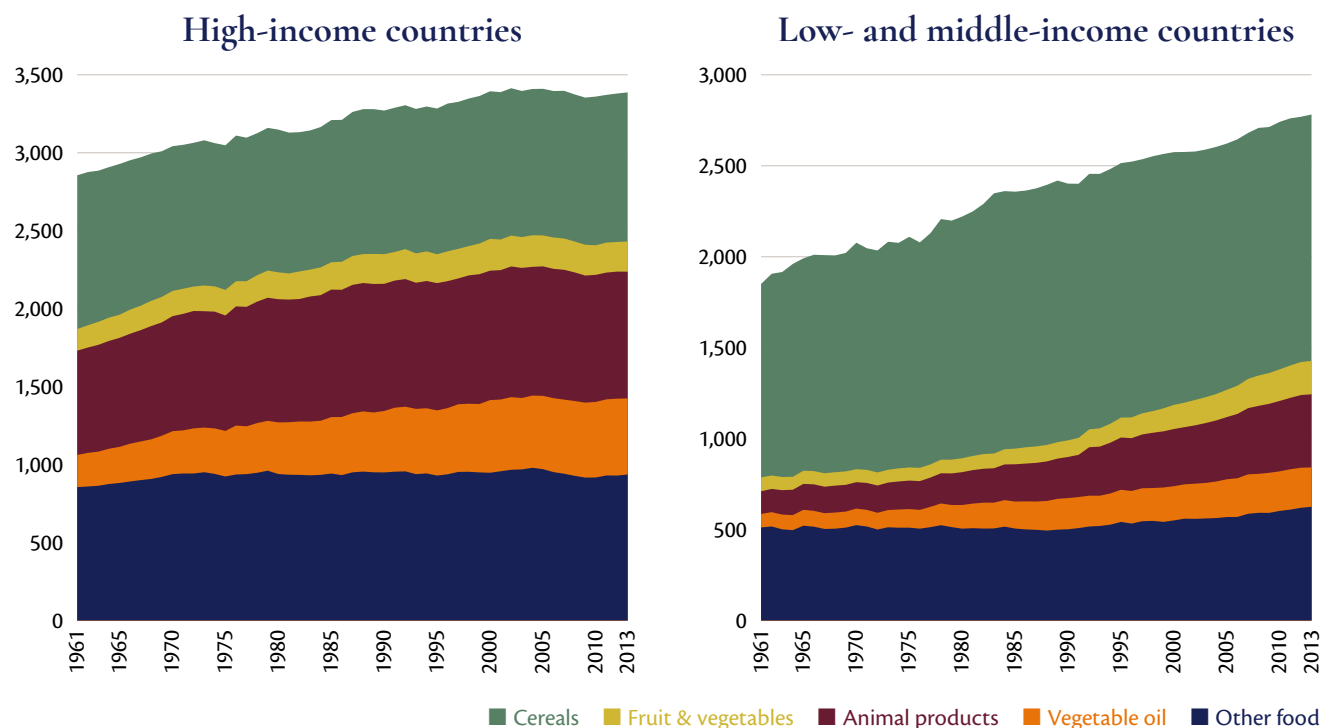


Source: National Geographic (2014)<sup>54</sup>

staples, such as cereals (as grain or flour), or roots and tubers (like cassava or potatoes).

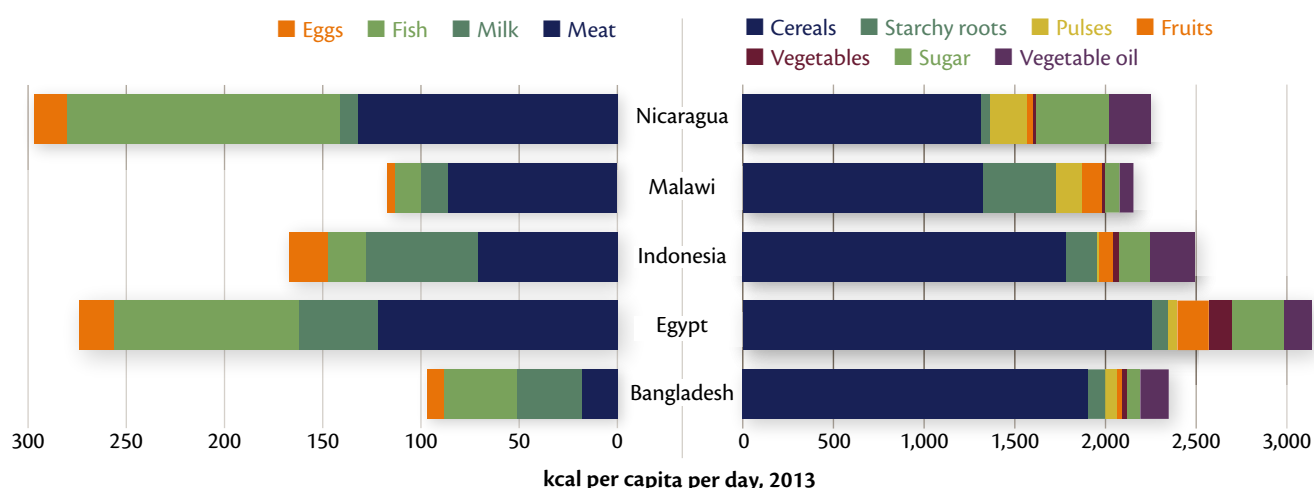
Figure 2.4<sup>54</sup> shows the global supply picture of foods available for consumption in terms of calories per person per day (data from 2011). The largest share comes from grains (rice, wheat and maize), with smaller shares for dairy and eggs, fruits and vegetables (listed as ‘produce’), as well as meat and sugar.

Figure 2.5: Trends in food demand by income group



Source: FAO (2018)<sup>55</sup>

**Figure 2.6: Contribution of selected food groups to calories supplied per capita, five countries across the developing world**



Source: Wiggins et al. (2017)<sup>56</sup>

But in LMICs, the need to buy the cheapest source of calories in the form of staples (home produced and/or purchased) limits the amount that people can spend on other foods. Figure 2.5 indicates how demand has grown differently in high- and lower-income countries

Of course, diets also differ across geographic regions. Figure 2.6 shows that while the contribution of meat and sugar to diets in Egypt and Nicaragua is similar, it is quite different in Bangladesh.<sup>56</sup>

## 2.4.2 How diets are changing

The diets of the poor typically have limited differentiation from one day to the next, lack diversity across types of foods, are limited in nutrient-rich foods (such as eggs or dairy, fish or meat, nuts and seeds, or fruits and certain vegetables), and often carry food safety risks (such as mycotoxins). In general, these diets do not support adequate levels of intake of most important nutrients for the world's most nutritionally vulnerable individuals (children, adolescent girls, and adult women). As such, improving diets must become a critical policy priority where governments are concerned about health outcomes, educational attainment, economic productivity, and societal well-being. Yet, while these areas of policy are all fundamental goals of the SDGs, the importance of improving diets is not explicitly mentioned in the SDG framework as a key enabling factor and a necessary target in its own right.

There are several inherent challenges in bringing about the dietary shifts needed to achieve the ambitions of the SDGs. The first is to resolve poverty-related dietary inadequacy. Securing an adequate supply of staple foods (mainly cereals and tubers), be it through domestic production and/or imports, remains a priority for most governments. This is especially true of low-income food deficit countries; in 2019, these included Afghanistan, Chad and Haiti, all of which are struggling to feed themselves.<sup>23</sup> The essential demand-side equivalence to improving food supply is to reduce poverty in equitable ways which improve the purchasing power of the poorest households (see also Chapter 7).



But that leads to a second challenge. As incomes rise, the world has seen a common pattern emerge in terms of dietary shifts:

1. Growth in demand (much more food required in low- and middle-income countries because it is there where population growth continues to be greatest, and where poverty is also declining steadily;
2. Shifts in demand in favour of sugars, fats, oils, and substantially more meat; and
3. Convergence with high-income countries in food system characteristics such as shopping for fresh foods in supermarkets rather than wet markets, more food eaten outside the home (in restaurants as well as fast-food outlets), and more snacking of highly processed packaged foods and sugar-sweetened drinks.<sup>11,57</sup>

Projections suggest that global demand for food will rise in the next three or more decades roughly in line with projected population growth. Recent estimates are for the global population to reach around 9.5 billion by 2050 and 11 billion by the end of the century.<sup>55</sup> This would lead to a rise in food (calorie) demand of between 49% and 56%, depending on assumptions used.<sup>19,55,58,59</sup> At the same time, demand is expected to grow for animal products (dairy, meat, fish), as well as for vegetable oils, sugar, ultra-processed foods, and high fat and salty snacks.<sup>55</sup> These changes are occurring rapidly across the globe.

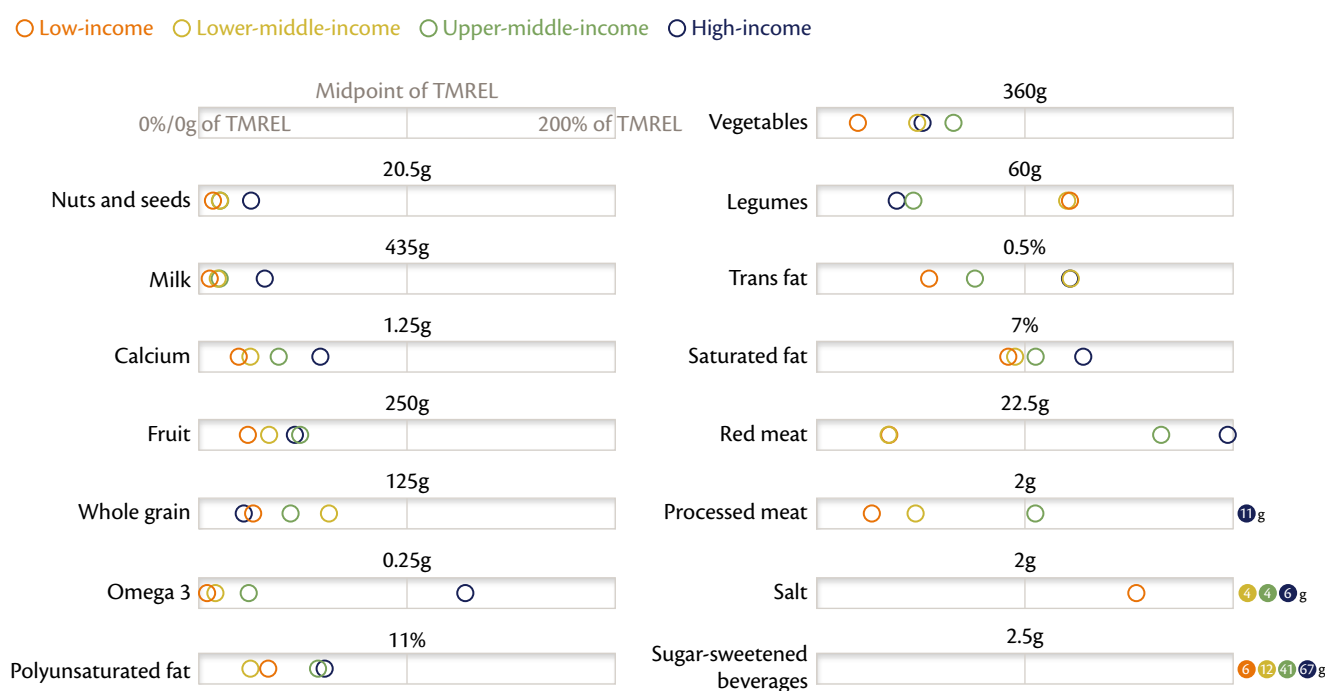
### 2.4.3 Poor diets and NCDs

All countries consume too many sugar-sweetened beverages<sup>47</sup> (see Figure 2.7<sup>iv</sup>). On average, high-income countries (represented by dark blue circles) already consume an excess of processed meats, red meat and salt. Low-income countries, represented by the dark orange circles in the figure, consume lower levels of processed meats and red meat, but they still exceed recommended intake levels of salt, which contributes to high levels of elevated blood pressure in many low-income countries.

For fruits, vegetables and wholegrains, all countries irrespective of wealth fall below the level of intake required for healthy diets. Recent analytical work by the Global Dietary Database (GDD) underscores the consequences of large gaps between the availability of nutrient-rich foods (such as fruits and vegetables) and optimal consumption levels. Low consumption of fruits and vegetables leads to a range of definable disease outcomes which increase preventable mortality – including over half a million deaths due to coronary heart disease (CHD), 1.2 million stroke deaths due to sub-optimal fruit intake (<300g/day), and over 800,000 CHD deaths due to low vegetable consumption (<400g/day).<sup>60</sup> All countries face these challenges: under current food consumption patterns, it has been estimated that diet-related health costs linked to mortality and health effects of NCDs may exceed US\$1.3 trillion per year globally by 2030.<sup>15</sup> The concentration of CHD mortality linked to poor fruit intake in LMICs underlines the importance of governments in those

<sup>iv</sup> Global Nutrition Report 2018 provides a detailed explanation of Figure 2.7.

**Figure 2.7: Consumption of food groups and components across income groups, compared with WHO recommended levels consistent with a healthy diet**

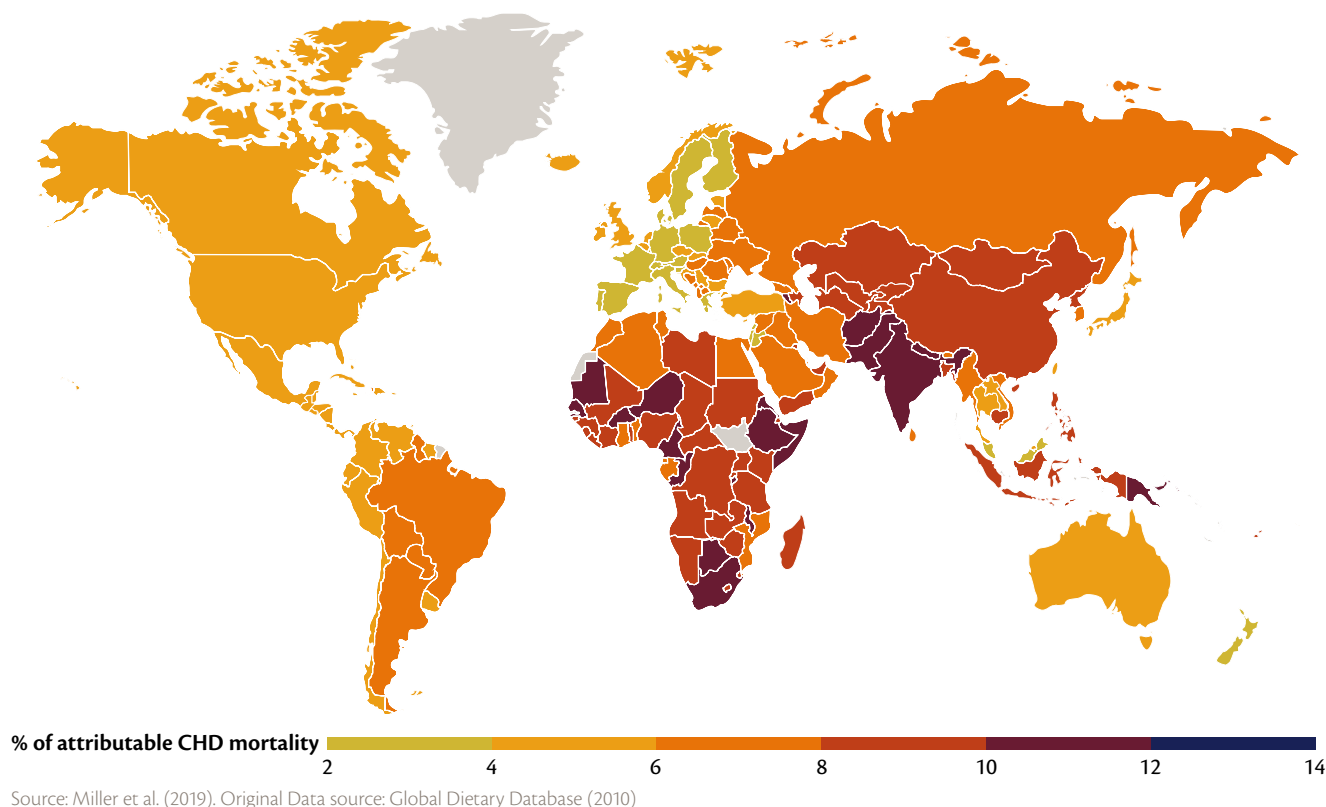


Notes: Men and women aged 25 and older. Chart ordered by mean. TMREL: Theoretical Minimum Risk Exposure Level.

Source: Global Nutrition Report (2018)<sup>47</sup> Original data source: Global Burden of Disease, the Institute for Health Metrics and Evaluation



**Figure 2.8: Proportion of mortality from coronary heart disease (CHD) attributable to suboptimal fruit intake (<300g/day)**



countries to give priority to appropriate policy actions (see Figure 2.8).

Excess consumption of certain food ingredients and products is known to be deleterious to health, and contributes to disease and death across the globe. At the global level, between 1990 and 2010, there has been an increase in consumption of both ‘healthy foods’ and those not supporting healthy diets, with the latter outpacing the former in most regions of the world.<sup>61</sup> While many processed foods can contribute to diet quality, others high in unhealthy fats, salt and sugar do not, including packaged, ultra-processed foods containing high amounts of added sugar, sugar-sweetened beverages (SSBs), and red processed meats.

High levels of processed meat consumption (mainly red meats) contributed to half a million CHD deaths globally in 2010, the highest share of which was found in middle-income countries such as Costa Rica, Panama, and Colombia.<sup>62</sup> Processed meats are also implicated in the rise of diabetes, including almost 100,000 deaths among diabetics globally (see Figure 2.9).

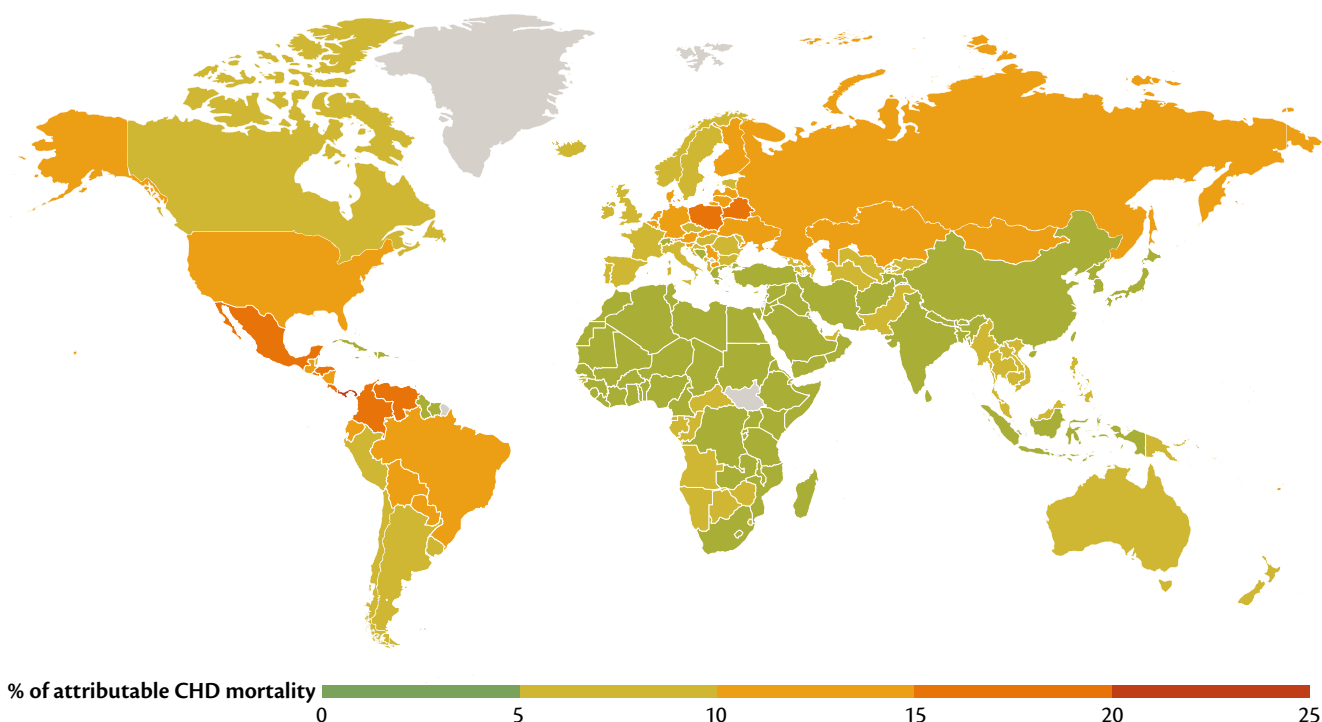
One recent study on the link between diet and diabetes reported that “the quality of evidence was high for the association for increased incidence of type 2 diabetes with higher intake of red meat” as well as for processed meats and sugar-sweetened beverages.<sup>63</sup> Another in 2019 reported a “significant inverse association” between plant-based dietary patterns and the risk of diabetes.<sup>64</sup> In other words, too much of certain clearly defined high-risk foods and too little of well-known beneficial nutrient-rich plant-based foods is strongly linked to the risk of this specific NCD.



Figure 2.9: Proportion of mortality from coronary heart disease (CHD) and type 2 diabetes attributable to sub-optimal processed meat consumption (>0g/day)

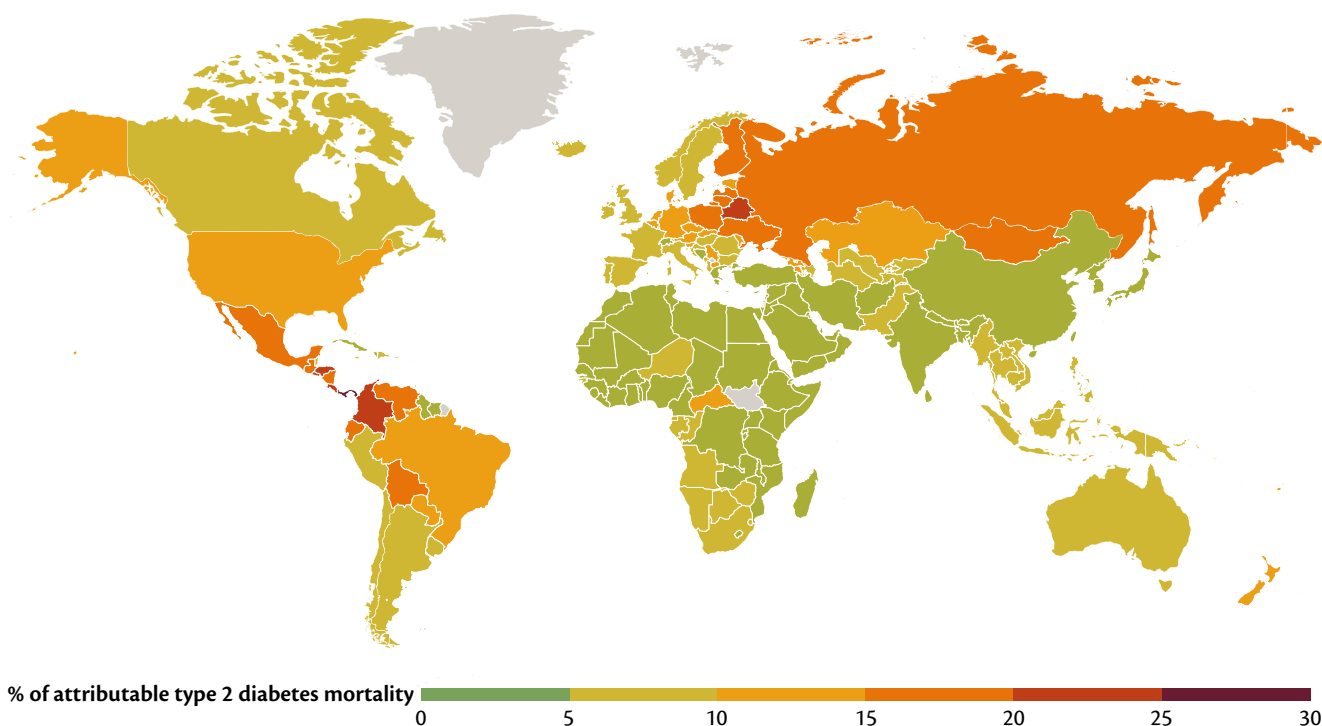
### Coronary heart disease

- 510,214 CHD deaths (PAF=7.3%)
- Highest proportion of deaths in Panama, Costa Rica and Colombia



### Type 2 diabetes

- 86,923 diabetes deaths (PAF=6.9%)
- Highest proportion of deaths in Panama, Belarus and El Salvador



PAF = Population Attributable Fraction.

Source: Karageorgou et al 2019<sup>62</sup> Original Data source: Global Dietary Database 2010



#### 2.4.4 Poor-quality diets and vulnerable populations

An important caveat to all the trends laid out previously is the continuing nutritional vulnerability of low-income families across LMICs, and to some extent also in high-income countries (HICs). There are many high-income families in LMICs, so national averages mask considerable variability in income distribution (discussed further in Chapter 7) and hence in diet sufficiency and quality (lacking diverse, safe, nutrient-rich foods). Some demographic groups are physiologically more vulnerable to nutritional inadequacies and deficiencies, including pregnant and lactating women, infants and young children, and adolescent girls.

For example, poor maternal health and nutrition leads to poor birth outcomes, such as babies born underweight or too small for their gestational age at term, which is associated with new-born and infant mortality and accounts for a substantial proportion of stunting among surviving children.<sup>65</sup> The particular needs of all nutritionally vulnerable people must be understood and prioritised in attempts to enhance the quality and quantity of diets globally, particularly in the context of policy agendas developed in response to the WHA targets and SDGs. However, as noted earlier, these targets do not include healthy diets either as a means of attaining health or environmental goals.

At the same time, millions of people live in extremely fragile situations caused by conflicts, disasters, physical displacement, political discrimination and more.<sup>66</sup> According to the Organization for Economic Cooperation and Development (OECD), by 2030, the number of people living in fragile settings is projected to reach 2.3 billion, which includes 80% of the global poor. That represents another 500 million people over today's total.<sup>67</sup> It is crucial that governments and the food-industry do not ignore the dietary and healthcare needs of people living in refugee camps, remote rural areas poorly connected to markets and services, or in failed states. While these situations pose added challenges to effective policy and programming

investments, allowing them to remain marginalised also allows economic and nutritional inequities to persist.

## 2.5 Summary

Changing patterns of consumption are driving trends in diet-related mortality around the world. It is therefore important for policymakers to consider global trends *and* the patterns that develop across and within countries (for example rural versus urban, and income status).

Policymakers can draw two important points from such data. First, as shown in the first Foresight report, achieving rising incomes in a country will not by itself guarantee better diets. And second, better diets are needed for everyone everywhere, regardless of cultural or religious patterns, or income at either national or household levels. Improved diets will contribute to better health, specifically through improved nutrition, but also healthier economies spend less on treating diseases associated with sub-optimal diets, and secure the benefits of better educational attainment and labour productivity.

The role of diets in the future well-being of almost 10 billion people can no longer be ignored. The need for improved diets provides a key rationale for growing calls to change the world's food systems. But there is a second important reason for supporting a transition process. The food choices (which underpin dietary patterns) and the ways in which foods are produced, together represent major drivers of the unfolding climate crisis and related environmental degradation. And in turn, the deepening climate and natural resource concerns are increasingly challenging the resilience of food systems, and threatening their ability to deliver the foods needed for healthy diets sustainably. Chapter 3 explores this vicious circle and the way it operates on a planetary scale.



# 3 Diets and the planet: an unsustainable relationship

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# Key messages

**Humanity is facing an unparalleled crisis relating to the planet's health.** This is in addition to the policy challenges posed by the ongoing human health crisis linked to poor diets, and strengthens further the case for urgent reform of food systems.

**Planetary and dietary crises are fundamentally inter-linked and must be addressed in a coordinated way.** The climate crisis, soil degradation, rising ocean levels, biodiversity loss, pollution of air, water and land, and depletion of freshwater resources all pose risks to, and are partly driven by, the way food systems work.

**Climate change, in particular, will influence the quality and quantity of food which can be produced and our ability to distribute it equitably.** Climate change and a compromised natural environment threaten food production due to drought, flooding, desertification, or any number of unseasonal climatic anomalies. If more than one environmental effect occurs at the same time, the risks are amplified. Climate change is already having significant impacts on agricultural production.

**There is also a real risk of rapidly escalating humanitarian need.** This could lead to a projected doubling in the number of people requiring aid from around 110 million in 2018 to over 200 million by 2050. This will push humanitarian funding requirements after climate-related disasters to US\$20 billion annually by 2030.

**The most severe economic and food system impacts on crop yields and fisheries will be borne disproportionately by low-income countries.** The reliance of many low- and middle-income countries (LMICs) on food imports is also at risk from simultaneous harvest failures in breadbasket countries, leading to potential supply constraints and food price increases on global markets.

**At the same time, the global food system is transgressing multiple planetary boundaries and may be a major contributor to greenhouse gas (GHG) emissions, producing up to 30% of global GHGs.** It is essential that the global food system be transformed alongside changes in the energy industry and other sectors, if critical targets such as keeping the average global temperature increase below 1.5 degrees are to be met.

**The environmental costs of food systems are strongly affected both by agricultural inefficiencies that permeate food systems, and also by dietary choices around the world.** In the case of the latter, animal-sourced foods in particular, generally require high inputs in terms of land and feed quality, generate relatively high GHG emissions, and are one of the major contributors to natural resource degradation.

**The coronavirus pandemic offers an important opportunity for all countries to assess the links between dietary choices and health outcomes.** It has caused multiple shocks simultaneously throughout the global food system.

**Three urgent priorities to mitigate these effects are:**

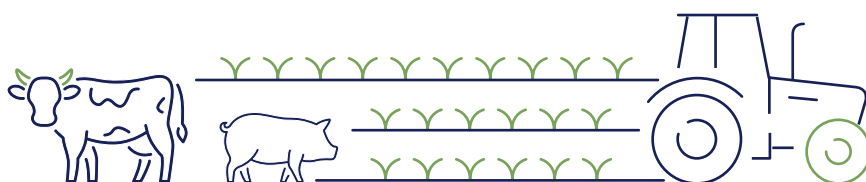
1. Ensure that nutritional needs of all citizens are met.
2. Protect, enhance, and buffer stakeholders across entire food value chains.
3. Invest in local food systems so that they are more resilient to shocks of all kinds, and able to deliver sustainable, healthy diets to 9.5 billion people.

**It is essential that policymakers address these multiple, inter-linked crises by transforming food systems, but they are in an increasingly constrained operating space.** This is partly because of existing shifts in dietary patterns that may not be aligned with improving diet quality and sustainability. Also constraining are the headwinds generated by climate change, and a host of non-food factors affecting water and land scarcity, pollution, and biodiversity loss – all of which threaten the quality and quantity of the food which can be produced.

**Moving forward, a key aim should also be to reverse the 'vicious' cycles which currently operate between the food system and the environment.**

It is possible to promote both human and planetary health simultaneously, through actions discussed in detail in Part II of this report – influencing dietary choices and technology adoption being particularly important.

**A transformed food system would be able to feed a projected future population of almost 10 billion.** Continuing with the current food system would only allow one third of this total to be fed.



The global food system produces around **30%** of greenhouse gas emissions

**As if the policy challenges posed by our growing diet-related health crisis were not enough, humanity also faces a second crisis deriving from the planet's ill-health. Climate change, soil degradation, rising ocean levels, biodiversity loss, pollution of air, water and land, and depletion of freshwater resources all pose risks to, and are significantly impacted by, the way our food systems work. Policymakers are therefore faced with a complex challenge: how to increase the supply of diverse and safe nutrient-rich foods which are affordable and desirable to all, but in ways that are sustainable.**

There are many known, innovative, and emerging technologies to be explored, from production (scaled up integrated pest management, agroforestry designed to include carbon sequestration, a focus on output of nuts and seeds for enhanced diets, and cost-effective conservation agriculture that enhances the use and protection of natural

resources) through processing (enhanced food processing and packaging).

The food system is complex and dynamic, composed of many interlocking sub-systems across agricultural production, markets and trade, retail, and consumer demand and purchasing power.<sup>68</sup> Besides those components which relate to human health, there are also key economic, political and social dimensions to food. In addition, there are the environmental systems which support the global food supply, and which are the focus of this chapter. These systems are also the focus of current planet-wide concerns about issues such as the climate crisis, biodiversity loss and natural resource degradation. Diets must be viewed as the end point of the food system (what people eat or throw away as waste), but the diets that people want can also act as a major driver of how the food system responds.

What individuals eat and what farmers produce are both heavily influenced by interactions between prices and incomes, opportunity costs of time (for shopping, food preparation and cooking – particularly for women), access to established and promising technologies, effective information flows, market access, and cultural norms. This chapter explores the diet-environment links, particularly the negative impacts of current food production, food processing and consumption patterns on diverse dimensions of what can broadly be called 'the environment'.<sup>v</sup> It also considers how the deteriorating state of the planet's environmental systems

<sup>v</sup> For this report, the term 'environment' encompasses the macro-scale processes involved in the climate crisis (such as damaging greenhouse gas emissions), and the more local-level ecological processes impaired through natural resource degradation, biodiversity loss, etc.

### Box 3.1: Sustainable food systems and planetary boundaries

For the purposes of this report, the term 'sustainable food system' is used if the contribution of any food system (which delivers locally produced but also imported and marketed foods) can be continued without undermining the ability of the natural environment to function in the long term. In other words, the system does not drive biodiversity loss, pollution, soil degradation, or climate change. If the system can sustain the production and distribution of the diversity, quantity and quality of foods needed to support healthy diets for all, then a win-win has been achieved (see Box 1.1).

The Global Panel's premise of "maintaining the food system within planetary boundaries"<sup>69,70</sup> assumes that there is a range of environmental and biophysical thresholds below which the planet can maintain environmental integrity, but above which it cannot. While these thresholds apply globally, their impacts manifest locally. In other words, a sustainable food system is one that can continue without undermining the ability of the natural environment to function. For LMICs, sustainability represents a development agenda, not just a few actions aimed at reducing greenhouse gas emissions.

Food systems are non-linear in that they incorporate feedback loops, direct and indirect, with positive and negative effects. All activities across the food system – whether production, processing, retail, or food preparation – have impacts on the environment. Processing, transport, and retail require energy, water, roads, and other inputs such as packaging. Pollution comes from chemical usage and disposal (e.g. from fertilisers, pesticides, industrial processes, and through greenhouse gas emissions), as well as from disposal of plastics and other packaging.

Planetary boundaries include limits in terms of greenhouse gas emissions (and climate change), bio-geochemical cycles (particularly nitrogen and phosphate), loss of biodiversity and arable land, the acidification of the oceans, atmospheric aerosol loading, and so on. The global food system must be seen as 'unsustainable' if it contributes significantly to crossing one or all of these planetary boundaries, but 'sustainable' if it enables these thresholds not to be crossed.<sup>71,18,72,73</sup>



threaten the effective functioning of food systems (see Box 3.1 for a full explanation of what is meant by ‘sustainable food systems’ in this report). This assessment sets up the deeper elaboration, in Part Two of this report, of key actions needed across the global food system to manage a transition toward a transformed food system which generates positive outcomes for human health and the environment, rather than negative ones.

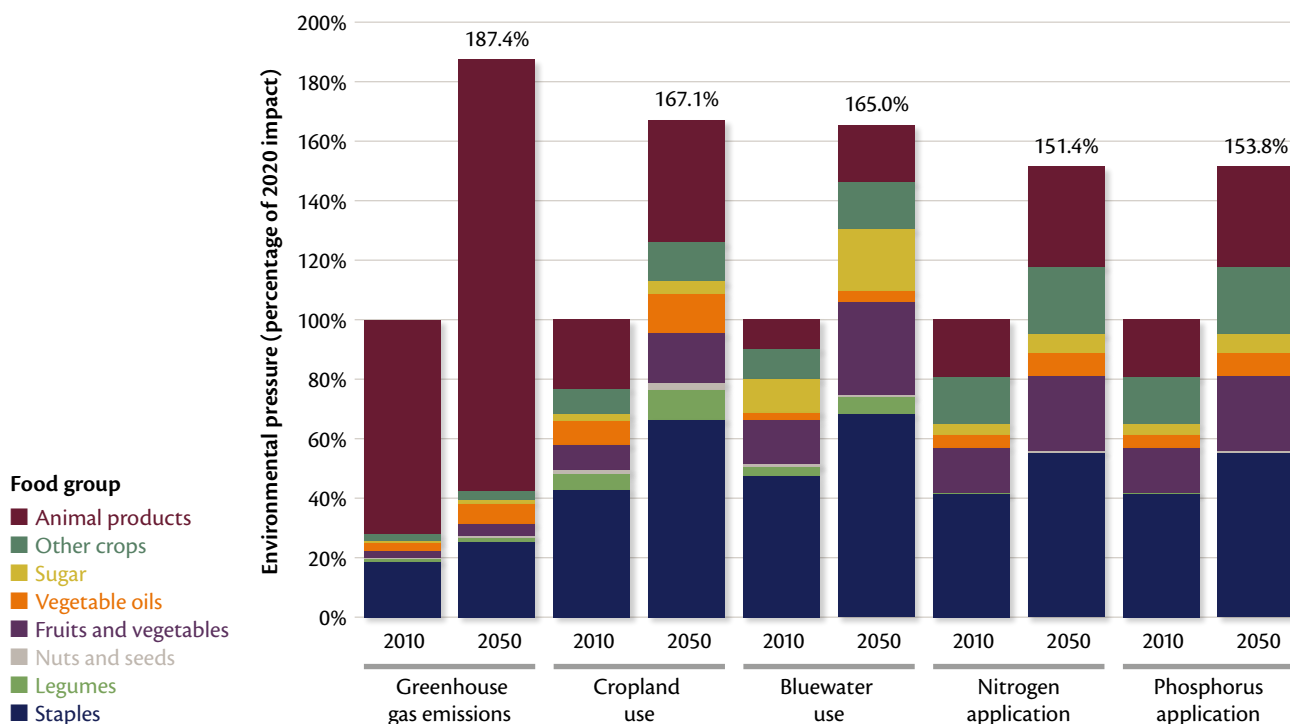
### 3.1 Negative feedback loops between diets and environment

Different food commodities put very different demands on the earth’s natural systems depending on how and where they are produced. This means dietary patterns in one country versus another have very different implications in terms of GHGs and natural resource degradation. A recent study sets out the very different ‘environmental footprints’ of different foods depending on the outcomes measured (see Figure 3.1).<sup>5</sup> For example, animal products (meat, eggs, dairy, or fish) contribute the highest amount of GHGs, and this is projected to increase almost two-fold by 2050. On the other hand, production of staple foods requires large quantities of land and water usage, as well as nitrogen and phosphorus application.

It is also becoming clearer that different production techniques have different environmental impacts for the same type of food



**Figure 3.1: Impacts of different food groups on the environment**



Note: Bluewater is fresh water in streams, rivers, lakes and aquifers.

Source: Global Nutrition Report (2020)<sup>5</sup>

(i.e. the impact of the food-ecosystem relationship is not static but can change if certain products are produced differently). For example, the environmental impacts of aquaculture depend on “the species, and increasingly the strain, farmed due to varying feed requirements, differences in growing method, production intensity, input sourcing, and farm management practices”<sup>74</sup>. The same may well be true of various processing approaches, product innovations and novel technologies used along the value chain after production, but there is as yet limited empirical evidence of such potential gains.

A key question therefore arises: by encouraging shifts in diet composition (i.e. the foods that individuals include in their diets), and adopting alternative approaches to producing, processing and transporting foods, is it possible to improve human health *and* the sustainability of food systems simultaneously?

It is not just individual foods that matter, but how foods are used together to make up a dietary pattern. Different forms of diets, in diverse geographies, have quite different implications in terms of resource and climate impacts according to their water and soil nutrient usage under prevailing production practices (see Figure 3.2).<sup>10</sup>

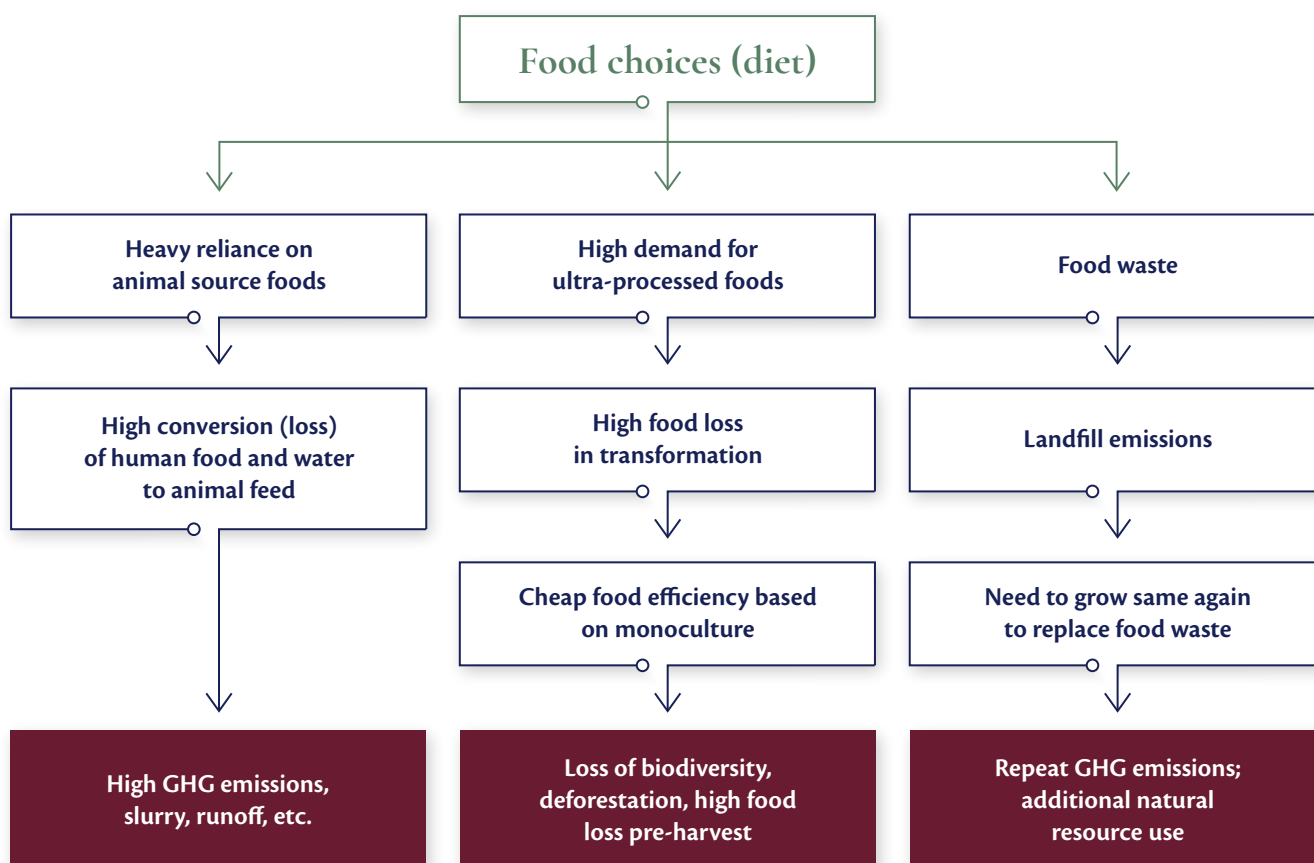
For example, one study modelled the GHG and water footprint impacts of various diets for 151 countries (see Figure 3.3).

It showed that dietary choices vary considerably across countries, largely due to prevailing farm technologies, agriculture-led deforestation, and the intensity of farmed aquaculture. Importantly, diets that included animal products in one meal each day produced fewer GHG-emissions than vegetarian diets (which allow dairy and eggs but no meat at all). This was because of the GHG-intensity and water demands of dairy production. These results demonstrate the importance of taking a nuanced approach to keeping emissions to a minimum.<sup>75</sup> This study also reported that the increased farm production that would be needed to ensure minimum intakes of calories and protein among today's chronically undernourished people would result in net increases in GHG and water footprints that would need to be factored into sustainability targets.

“ The diet-related social cost of greenhouse gas emissions associated with current dietary patterns is estimated to be more than US\$1.7 trillion per year by 2030 ”

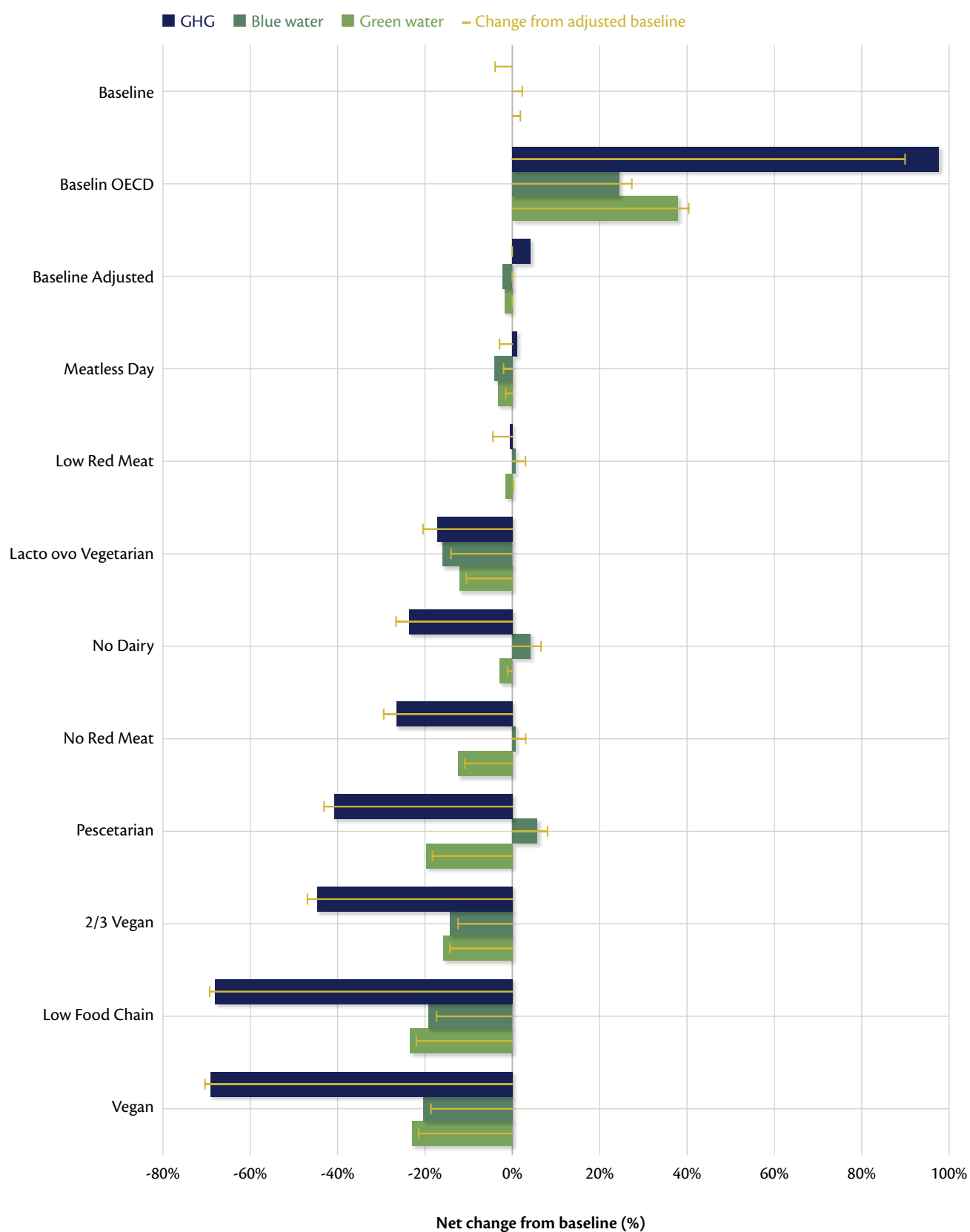
FAO, IFAD, UNICEF, WFP and WHO (2020)<sup>15</sup>

**Figure 3.2: Some of the ways whereby diets impact planetary health**



Source: created by authors

**Figure 3.3: Potential changes in agricultural GHG, blue water and green water footprints associated with dietary shifts in 151 countries**



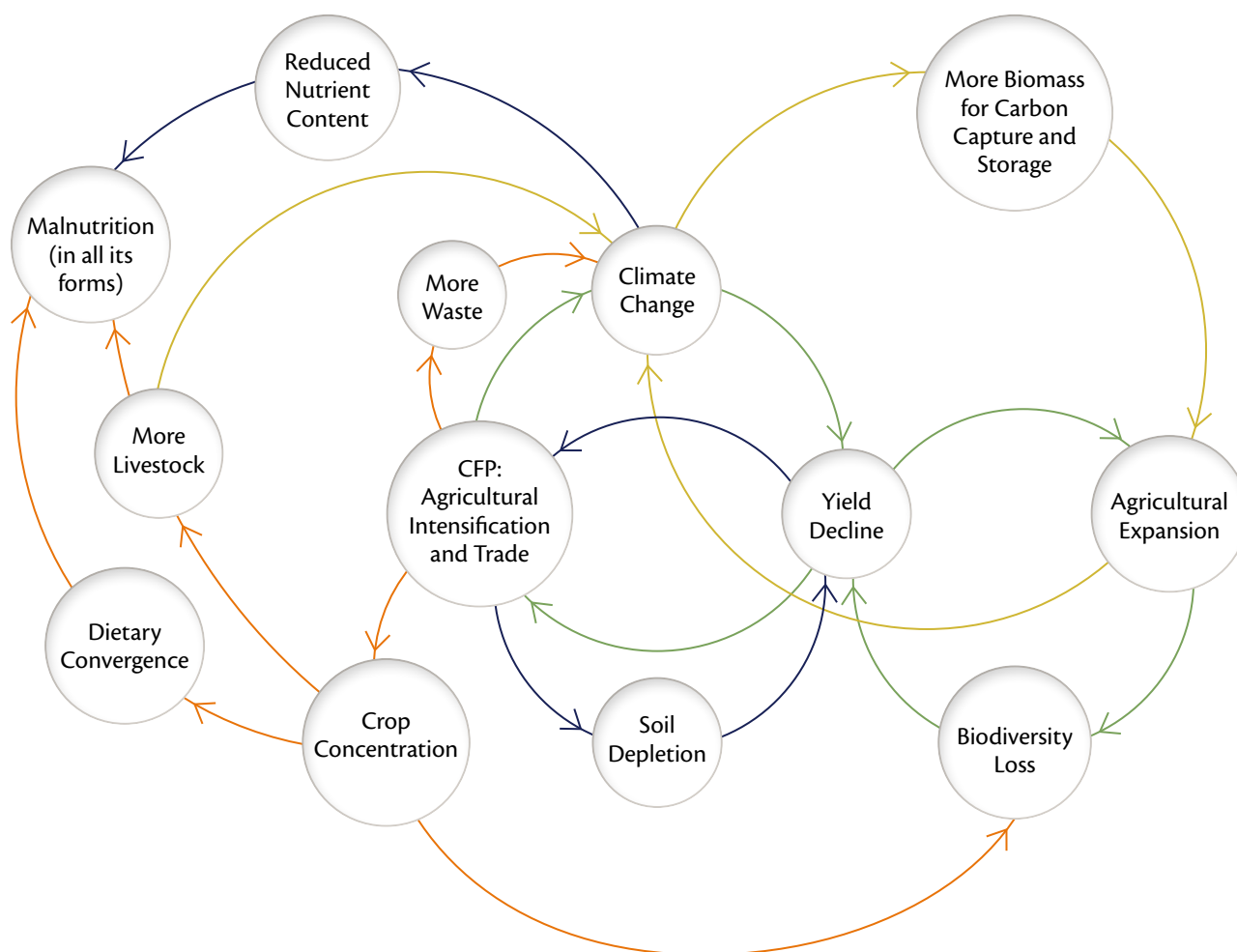
Notes: Potential net changes in agricultural\* GHG, bluewater, and greenwater footprints across all 151 study countries. Shown for the ten modelled diets relative to (a) baseline consumption patterns and (b) an adjusted variant of each country's baseline, scaled to 2,300kcal with a 69g/capita/day protein floor. The adjusted baseline allows for comparisons between plant-forward diets and baseline patterns independent of adjustments for over- and under-consumption, isolating the effects of food substitutions.

\*GHG emissions also reflect agriculture-related forestry.

Source: Kim et al. (2020)<sup>75</sup>



**Figure 3.4: Feedback loops between dietary patterns and environmental impacts throughout the food system**



Source: Adapted from Benton and Bailey (2019)<sup>77</sup>

Dietary patterns also have positive or negative feedback loops in terms of environmental impacts throughout the food system and dietary choice influences the strength of those feedback loops (see Figure 3.4). When there is dysfunction in both environmental and food systems, negative feedback loops can create interlocking vicious circles. For example, certain modes of agricultural intensification can result in soil depletion, which causes a decline in yields, driving up the need for yet further intensification. Similarly, monocropping can exacerbate biodiversity loss relating, for example, to pollinators.<sup>76</sup> The consequential reductions in yield can then encourage further intensification, with for example, increasing emphasis on monocropping. These illustrations show how understanding these feedback loops is essential to identifying effective intervention points for policy and business interventions.

Investment in increasing agricultural productivity, coupled with competition for commodities through the liberalisation of trade, has long been the central pillar of strategies aimed at feeding people at least cost.<sup>78</sup> The reduction of food prices has two nominal public goods outcomes:

1. it increases the availability and economic access to food, and therefore contributes to food security (locally and globally); and

2. by reducing the share of household spending on food, income is freed up for consumption growth in other goods and services which fuels economic activity in other sectors.

However, as rising incomes do not automatically improve the quality of diets (see Section 2.4), increasing food supply and reducing food prices through conventional approaches comes with unintended consequences (see Figure 3.4). A drive towards productivity leads to increasing the intensity and scale of land use, with consequences for soils, air and water quality, appropriation of water and biodiversity loss. The benefits of global markets, and reliance on competitive advantage that rewards economies of scale geared towards monocropping, has led to a global concentration of food into a handful of commodity crops, grown in a few breadbasket regions, traded by a small number of global companies. Grain is sufficiently cheap that large volumes are allocated as livestock feed, supporting growth in the global stock.

As prices reduce, more food is often wasted, creating additional environmental issues. And, as per capita availability of food, including meat, increases, the GHG emissions from the food system (including the impact of deforestation to produce more commodity crops) increases (now around 30% of total human



emissions), driving climate change. Climate change then negatively affects yields and their nutritional quality, creating further pressures to intensify by way of compensation, or to expand land use to produce more food, feed, and fibre. Furthermore, as emissions grow, there is a growing need for land-based mitigation, including biomass production for biomass, energy with carbon capture and storage (BECCS) or afforestation. Thus, by driving climate change, consumption growth drives competition for land, as well as reducing the efficacy of agriculture.

Recent research suggests that the current global food system may already be transgressing multiple planetary boundaries relating to climate change, soil degradation, rising ocean levels, biodiversity loss, pollution of air, water and land, and depletion of freshwater resources. Without changing our food system (i.e. maintaining 'business as usual' production, but making the planetary boundaries real constraints), there would only be enough food for about 44% of the current population (3.4 billion people). However, estimates indicate that a transformed food system that was efficient and minimised waste could sustain over 10 billion people and still operate within planetary boundaries.<sup>79</sup>

The GHGs and other environmental and climate impacts of dietary choice can be traced directly through to individual types of foods. The link between household diets and environmental impacts has been illustrated by a study in the United States which showed that those households which generated the highest levels of greenhouse gas emissions through their dietary choices, spent a "significantly larger share of their food budget on protein foods" (i.e. meat and dairy products) than households with the lowest levels of emissions.<sup>80</sup>

Consumer choice can therefore play a key role in reducing negative impacts on particular natural resources and on the climate, by influencing demand for foods with different environmental footprints. For example, influencing demand for ruminant meat can affect GHGs, and the same applies to monocropping-grown staples and their impact on biodiversity, or the ways in which fish are caught in the oceans, or how fruit is produced (in terms of water uptake).

What, then, are the characteristics of an efficient and low-waste food system which could operate within planetary boundaries while providing healthy diets for all? This key question is addressed in the remainder of this chapter, while the later chapters in Part II of the report turn their attention to the specific actions needed to realise this goal.

## 3.2 The impacts of diets and food systems on climate and natural resources

Two important factors influence the environmental costs of food systems. The first is already well recognised and concerns the many inefficiencies that permeate food systems, including: loss and waste through the food chain, from production through to consumption; inappropriate farming practices and soil management; and inefficient use of agricultural inputs, such as fresh water and pesticides.

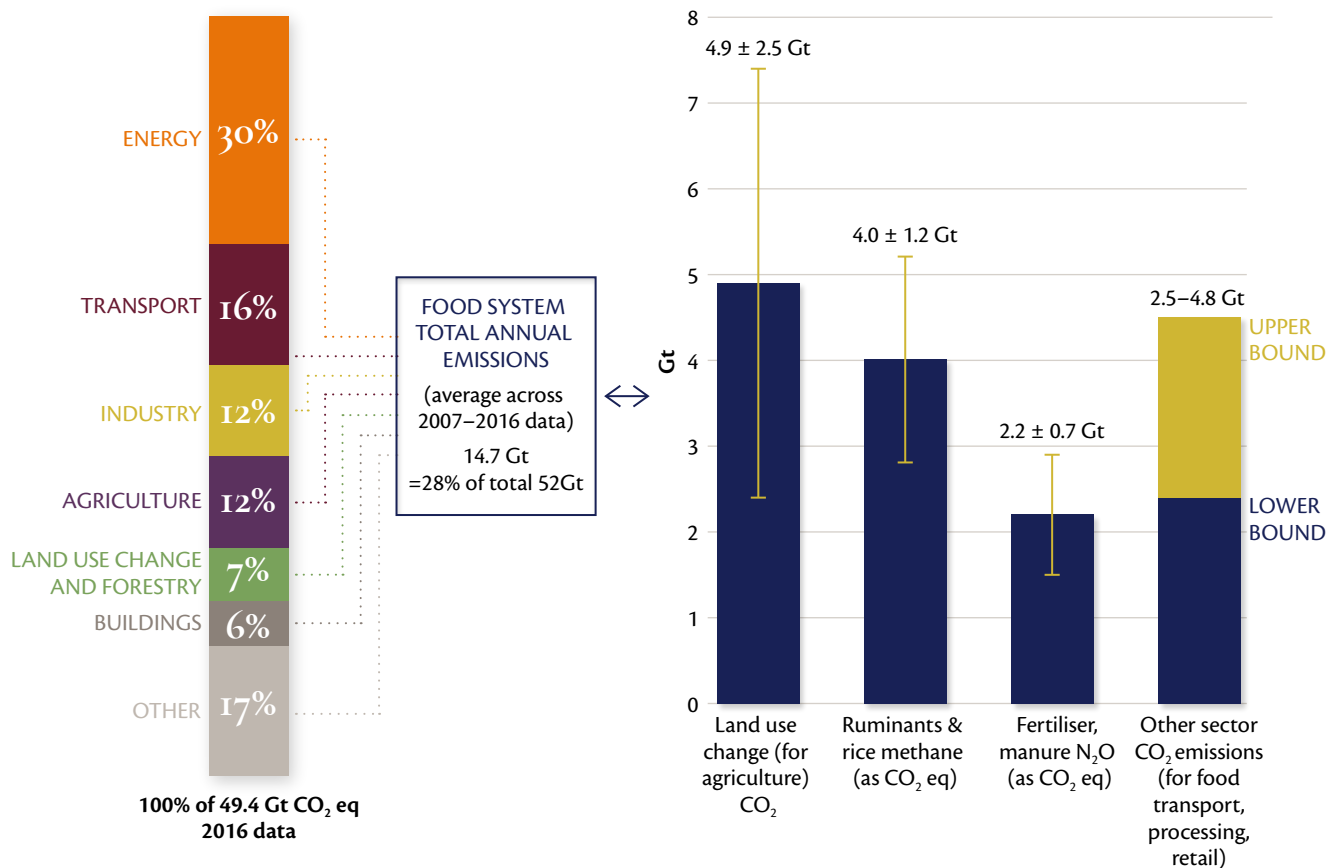
But this report also highlights a second factor: the *dietary choices* made in LMICs as well as in high-income countries (HICs). Consumption patterns around the world largely drive the kinds of food and products produced, the number and type of animals that are raised, and the fish that are harvested from the oceans or farmed in ponds on land. Since each of these has a different environmental footprint, our dietary choices profoundly affect the environment. Thus, both human and planetary health depend in part on our dietary choices.

**“From a dietary point of view, there are three universal challenges: obesity, undernutrition and climate change.”**

**Bradfield et al. (2020)<sup>81</sup>**

The agriculture sector is not the only human sector of activity responsible for natural resource degradation and harmful emissions. As noted, agricultural practices (all farming activities, including livestock production and associated land use activities) are thought to contribute roughly a quarter of all greenhouse gas emissions. When production is coupled with pre-planting activities (such as industrial production of fertiliser) and post-harvest operations (including down-stream activities in food transportation, processing, storage, retail, and reduced food loss

**Figure 3.5: The food system accounts for 28% of global greenhouse gas emissions**



Notes: anthropogenic annual emissions breakdowns by sector (2016 data) and for the food system (average across 2007–2016 data).

Given the different time periods the total emissions differ between left and right panels.

Sources: Created using data from World Resources Institute<sup>485</sup> and Intergovernmental Panel on Climate Change (IPCC)<sup>10</sup>

and waste), global emissions due to food system functions are estimated at a third of the total (roughly 25% from agriculture and the rest from down-stream activities of the food system).<sup>10</sup>

Given this important contribution, reducing the impact of agriculture and attendant food system functions will be crucially important to global climate change goals, namely keeping warming to below 1.5C. That goal was set before more recent studies suggested that a doubling of atmospheric carbon dioxide from pre-industrial levels has a 66% chance of heating the planet by at least 2.6C, and possibly as high as 3.9C.<sup>82</sup> The baseline level in pre-industrial times was 280 parts per million (ppm); by May 2020 it had risen to 417 ppm. In other words, the urgency of taking action to minimise future emissions and warming cannot be emphasised enough. And emissions reductions will only be achieved if changes are made across the food system alongside changes made in the energy, industry and other emitting sectors.<sup>21</sup>

The long-term viability of food systems depends on the transformative change that can mitigate the negative impacts of the climate crisis as well as those associated with natural resource degradation. There are many multi-directional links among climate, weather patterns, natural disasters, and resource availability, on the one side, and the food systems influenced by dietary patterns, on the other. The following section explores a selection of critical feedback loops to highlight the scale of the

challenges faced. The rest of Section 3.2 considers the extent to which agriculture impacts climate and natural resources. Section 3.3 then discusses how climate and loss of natural resources impact food system functions.

### 3.2.1 Greenhouse gas emissions (GHGs)

The Intergovernmental Panel on Climate Change (IPCC) estimates that the food system is responsible for roughly 28% of GHGs<sup>10</sup> (see Figure 3.5). According to the IPCC, between 2007 and 2016, within the global food system, agriculture emitted on average  $6.2 \pm 1.4$  Gt of CO<sub>2</sub>eq yearly (of which two-thirds comes from methane and one-third from nitrous oxide (NO<sub>x</sub>) compounds).<sup>10</sup> Most of the CO<sub>2</sub> was emitted from clearing land to expand agriculture, with slightly less emitted from other food-related sectors (e.g. the manufacture of inorganic inputs, transport, manufacturing, processing, and retail of food). In total, the food system emits approximately 14.7 (likely range 10.7–19.1) Gt of CO<sub>2</sub> equivalent, against a global emission of 52.0 Gt, equivalent to about 28% (as suggested by other analyses).<sup>84</sup>

“Diets are the main determinant of GHG emissions.”

Theurl (2020)<sup>83</sup>



Rising food demand has led to farm expansion at a rate of 10 million hectare (ha) per year for the last decade, including rainforest clearance, which creates emissions from land-use change.<sup>85</sup> Also, besides carbon dioxide there are other significant GHG emissions to be concerned about because of their atmospheric effects, including nitrous oxide from fertilisers (synthetic and manure), and methane.<sup>86</sup>

There has been a significant rise in atmospheric methane since 2000, with the highest ever levels recorded in 2017.<sup>87</sup> Importantly, it is estimated that agriculture and food waste contributed 60% of the increase in methane, fossil fuels contributed much of the remaining 40%, and that the largest increases were seen in these world regions: Africa and the Middle East, then China, and South Asia and Oceania.<sup>88</sup> Significant quantities of methane are produced when paddy fields are flooded for rice due to their soils becoming anaerobic, and by ruminants (less so from pigs and poultry), which further illustrates how diet patterns influence the environmental footprint, and therefore sustainability, of food systems.<sup>86</sup> This growing problem also highlights the fact that food system actions must be prioritised in tropical low- and middle-income countries, not just in high-income countries lying in temperate geographies.<sup>32</sup>

The food system causes emissions which are approximately equal to all personal travel (including domestic car and aircraft journeys), all lighting, heating and air conditioning, and all washing machines.<sup>89</sup> On an aggregate basis, nearly half of the emissions from agri-food are related to the livestock sector.<sup>85</sup>

Governments around the world are challenged by a vicious cycle: the global food system generates GHGs which contribute significantly to climate change, which in turn impacts the food system. Climate change may adversely affect crop yields and the nutrient content of some crop varieties (especially through higher concentrations of carbon dioxide in the atmosphere, as well as higher night-time average temperatures), especially in the middle latitudes (see Section 3.3). Reductions in yields then lead to more land required for agriculture, or more intensification to compensate, in turn driving climate change.



### 3.2.2 Land use and misuse

In 2014, roughly five billion hectares of the world's land was used for agriculture, equivalent to around 38% of the total land area.<sup>11</sup> While there is a "looming land shortage"<sup>90</sup> globally (in terms of productive land needed to meet projected food needs based on current patterns of demand), there is some scope for the expansion of food production. However, the extent to which this is possible is contested due to differing views on the value of land for other purposes, most notably climate change mitigation and the generation of non-food crops such as bioenergy, alcohol, textiles, and the manufacture of commodities and materials.<sup>91</sup> Most additional land for expansion will require deforestation, resulting in substantial costs to the climate and the environment.<sup>92</sup>

**“ The single greatest cause of extinction risk is the habitat destruction that occurs when new cropland and pasture are created. ”**

**Tilman and Frumkin (2020)<sup>92</sup>**

The limited availability of 'new' land, the cost of converting forests to agricultural land for agriculture, and increasing competition for land, have all led many commentators to assume (implicitly or explicitly) that the land footprint of agriculture is unlikely to change.<sup>93</sup> For example, a recent in-depth analysis of the scope for agricultural expansion concluded:<sup>94</sup>

**“ ...first that there is substantially less potential additional cropland than is generally assumed once constraints and trade-offs are taken into account, and secondly that converting land is always associated with significant social and ecological costs. Future expansion of agricultural production will encounter a complex landscape of competing demands and trade-offs ”**

**Lambin et al. (2013)<sup>94</sup>**

In other words, to ensure production meets anticipated needs that mirror past trends, the emphasis will have to be on increasing overall system efficiency leading to higher yields from available land through intensification (see Box 3.2). The choice of food (or other agricultural commodity) produced on a given area of land also needs careful consideration, because this can also affect the land carbon footprint, as well as the quantity of calories and diverse nutrients produced overall (see Section 3.1).

## Box 3.2: Past agricultural production and crop yield developments

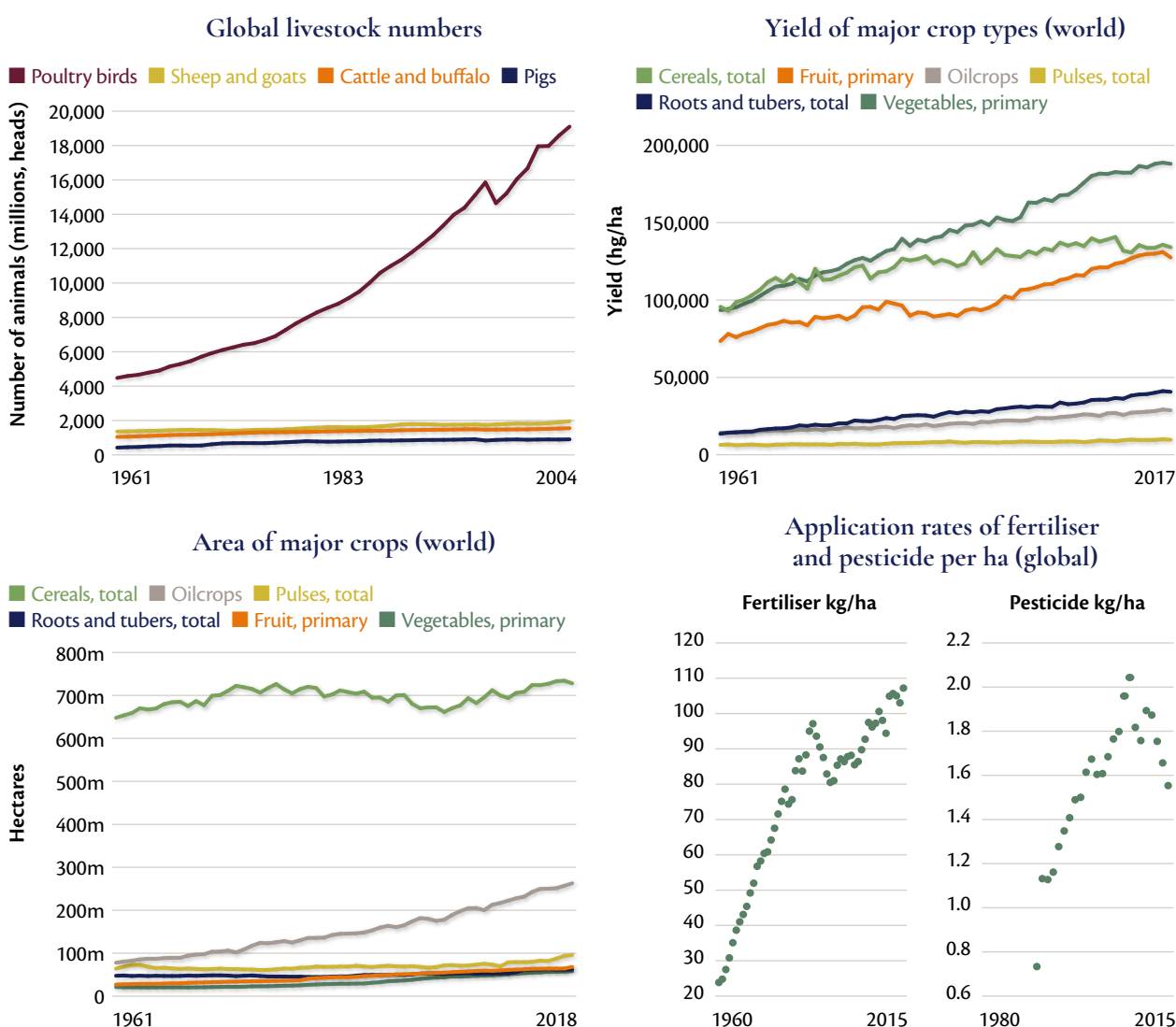
Global agricultural output has risen enormously since the 1960s. From 1961-2005, the world's population increased more than two-fold while cereal production rose nearly 2.5-fold (see Figure 3.6b), and meat production 3.6-fold.<sup>97</sup> During that same period, the number of livestock increased four-fold (from seven billion to 28 billion, mainly through more chickens – see Figure 3.6c).<sup>98</sup> The rate of growth in cereals output was faster in low- and middle-income countries than in high-income settings.

As the land used for agriculture increased only by around 10% globally during that period (see Figure 3.6a), the output-growth rose primarily through intensification with a five-fold increase in fertiliser use from 1961-2014 and a 3.5-fold increase in pesticide usage from the mid-1980s (see Figure 3.6d). Intensification arises from a range of factors including new varieties bred for increased yield, density of planting, mechanisation and

scale, use of inputs (fertiliser, pesticides, liming of soils, concentrated nutrition for livestock, antimicrobials in the livestock sector), and irrigation technologies.

The intensification of agriculture has not been uniform across the globe, reflecting variable access to inputs, technologies, and markets. One way of expressing the productivity of agriculture is by the size of the gap between the best achievable yield and that achieved in a given place. This 'yield gap' (see Figure 3.7) reflects factors related to technology (including genetics, inputs, weed control, management, harvesting, water management etc.). Improving productivity has two potential components: raising the achievable yield (the 'yield ceiling') and closing the yield gap. In many parts of the world, the yield gap is substantial. However, there are interventions in LMICs that offer insight into how yield gaps can be reduced or closed.<sup>100</sup>

**Figure 3.6: Past trends and projections in world agriculture**



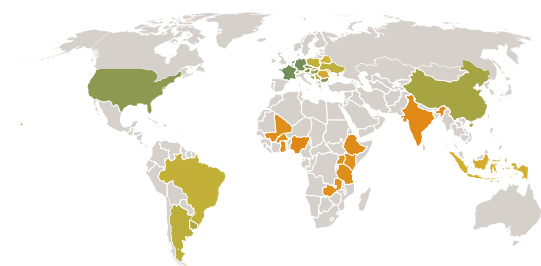
Source: FAOSTAT (2017), updated in 2020<sup>99</sup>

### Box 3.2 Continued

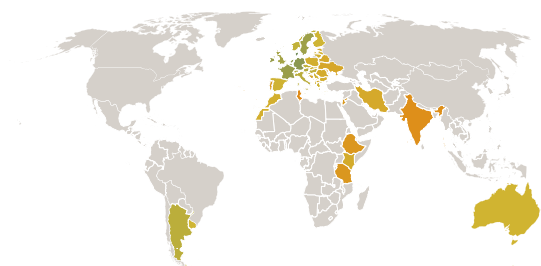
**Figure 3.7: Estimates of yield gaps (as achieved yield as percentage of the possible yield) for different crops**



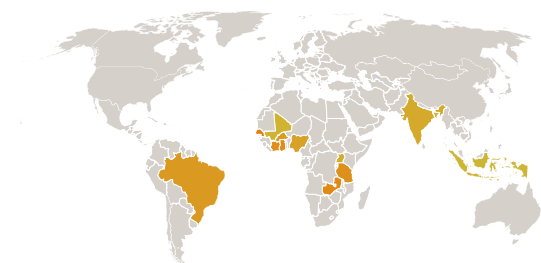
#### A: maize



#### B: rain-fed wheat



#### C: rain-fed rice



Source: Yield Gap (2020)<sup>101</sup>

One way to increase efficiency is via economies of scale, which also lead to concentration of production in areas that support the scale – the ‘breadbaskets’. From a farming perspective, large-scale operations create efficiency, but they also create homogeneity and therefore increase the risk of pests and diseases. For example, the World Organisation for Animal Health has estimated that 20% of global livestock production is lost to animal diseases (at US\$300 billion per year), while the World Bank puts the economic losses caused by just six international incidents of animal disease in the first decade of the 21st century at US\$80 billion.<sup>102</sup> Animal diseases can also affect humans: over 60% of human diseases originate in animals and the expansion and globalisation of livestock agriculture creates risks of newly emerging diseases.<sup>11</sup>

“ To sustain further yield gains will likely require fine-tuning many different factors in the field: better understanding of genetic potential, improving soil quality, relaxing biotechnology regulation and improving the sustainability of cropping systems. ”

Editorial comment, *Nature Food* (2020)<sup>95</sup>

The need for careful consideration of how national agriculture, trade and price policies influence what is grown where and how are particularly pressing for LMICs in semi-arid or mountainous regions, many of which are structurally in food deficit. Spreading agriculture into marginal or forested lands and/or pursuing unsustainable intensification are short-term solutions with only short-term gain, but they carry long-term threats to the natural resource base and to the climate. Indeed, soils need to be treated and managed as a scarce and fragile non-renewable resource. For example, across China the yield penalty due to soil degradation varies from 4-25% in different areas.<sup>76</sup> Nutrient depletion and broader organic loss (including carbon, potassium, nitrogen and phosphorous) occurs through leaching, over-intensification, and uptake by crops without adequate replacement by manure and/or fertiliser. Rising temperatures and carbon dioxide concentrations may deplete the density of certain micronutrients in some grain crops, which would have important implications in LMICs where those effects would be most felt and where the affected crops play a significant role in local food systems.<sup>96</sup>

In resource-constrained contexts there are large benefits to be had from supporting new technology adoption, working with regional and donor partners to boost investment in value chain innovations, and consciously shaping incentives for commercial activities which support enhanced *efficiency* of activities across the entire food system rather than relying on traditional supply-side maximisation strategies.

### 3.2.3 Loss of biodiversity

The scale and intensity of agriculture in many countries creates homogenous landscapes and reduces non-cropped areas for wildlife habitats, with a major impact on biodiversity.<sup>103</sup> Agricultural inputs are also important: for example, recent studies highlight the potential role of neonicotinoid pesticides in the recent declines of honey bee and wild bee populations.<sup>104</sup> The loss of biodiversity from land-use change is also significant, including forest loss driven by market demand for livestock and its feed (soya) or for plantation-based palm oil.

Already the population sizes of mammals, birds, reptiles, amphibians, and fish have declined by over 50% since 1970, and an estimated one million species now face extinction,

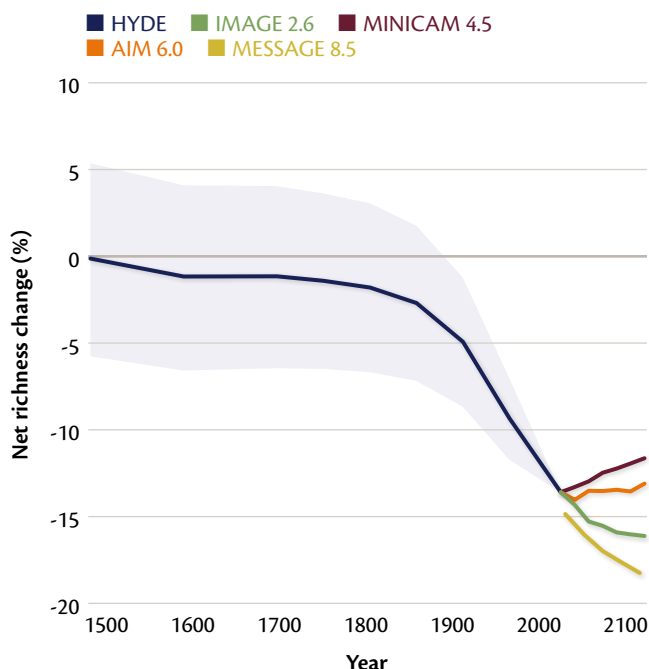


many within decades.<sup>106</sup> On average across the world, species diversity is estimated to have declined by 14% and total abundance by around 11% compared with estimates modelled without human activity (see Figure 3.8). The economic costs of biodiversity loss are massive: the global annual loss of pollinating insects alone is estimated to cost US\$235-577 billion.<sup>107</sup> Equally important is the growing realisation that biodiversity loss linked to resource depletion and climate change will increase the negative impacts of both over time, and that diet quality may well suffer as a result of lost agroforestry, aquatic and other biospheres.

### 3.2.4 Loss of pollinators

A study using data from 200 countries found that fruit, vegetable or seed production for 87 of the leading global food crops depends on pollinators, and that 35% of global calorie supply derives from pollinator-dependent crops.<sup>108</sup> The loss of pollination services also affects global health because pollinator-dependent crops contribute a disproportionate share of critical micronutrients in the diet, including vitamin A, folate, calcium, and many others.<sup>109</sup>

**Figure 3.8: Projections of diversity loss compared to a baseline world without human land-use change, with a range of potential future projections based on IPCC RCP scenarios**



Notes: The number in each acronym indicates the level of climate warming expected under each Representative Concentration Pathway scenario (given as the level of radiative forcing in Watts/m<sup>2</sup>, i.e. 2.6, 4.5, 6.0 and 8.5). For more details about these pathways please see Newbold et al 2015.<sup>105</sup> The global average projection for MESSAGE 8.5 does not join the historical reconstruction because that scenario's human population projections start in 2010 and because human population and plantation forest extent have not been harmonised among scenarios. The blue line is roughly Paris-compliant pathway, and the red is 'business as usual'.

Source: Newbold et al. (2015)<sup>105</sup>



In 2015, on average **284g** of pesticide active ingredient was used per person on the planet,<sup>99</sup> as well as **9g** of antimicrobials in 2010,<sup>114</sup> and **15kg** of nitrogen fertiliser<sup>115</sup>

Dietary patterns modelled across the populations of 152 countries showed that a 50% reduction in pollination services could lead to 700,000 excess deaths annually from micronutrient deficiencies and increased mortality from heart disease, strokes, and certain cancers.<sup>110</sup> By experimentally increasing wild pollinator density and richness, investigators were able to close this yield gap by 24% on average.<sup>111</sup> These findings, replicated across many different crop systems and geographical regions, suggest that the globe is already suffering from a 'pollinator gap' that reduces the yields of nutritionally important food crops. Biodiversity also has a crucial role in enhancing crop yields through the effect of soil biodiversity on soil fertility, and the 'natural enemies' that control pests.

### 3.2.5 Water and air quality

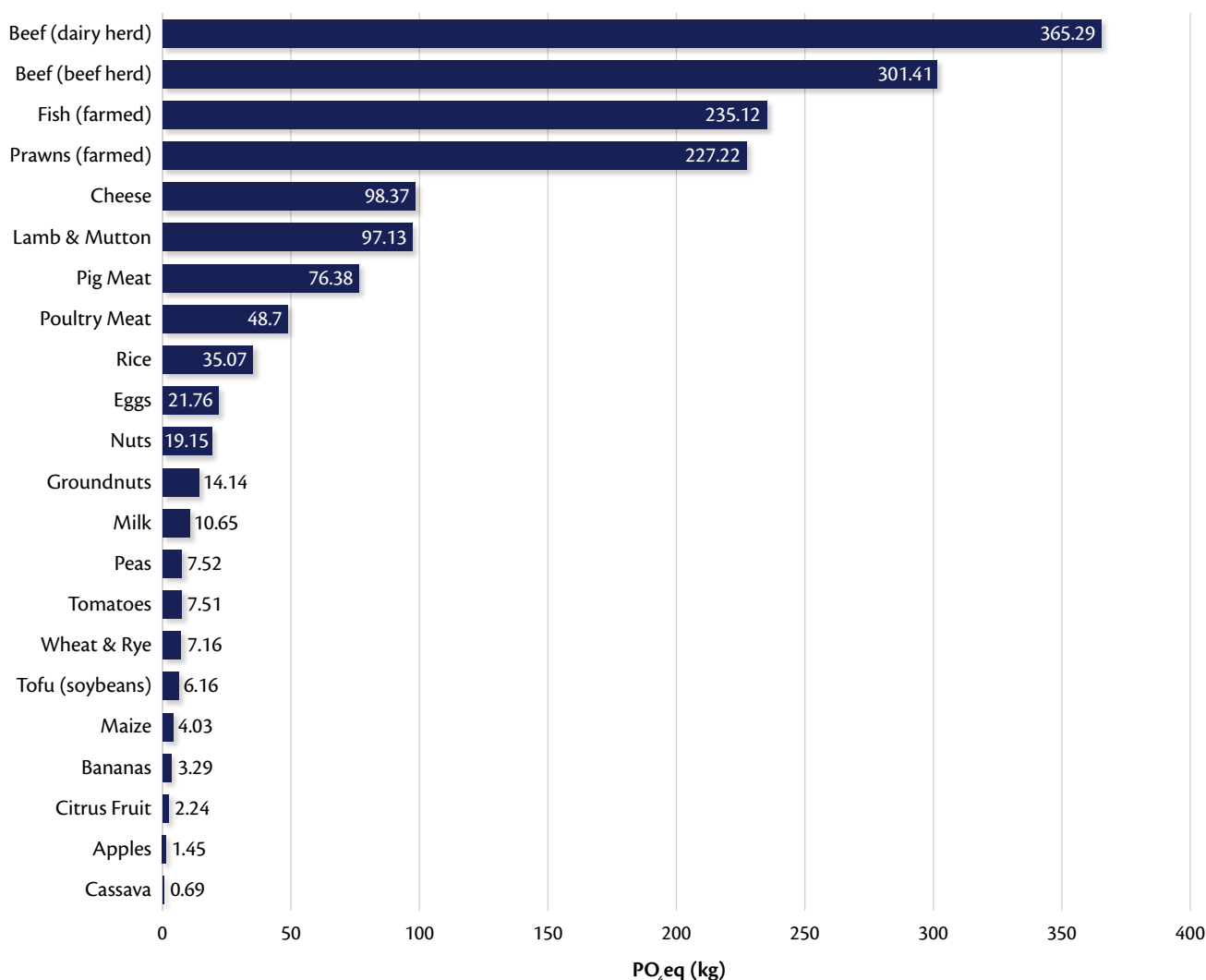
Over recent decades, the impact of pollution from rainfall runoff carrying fertilisers (nitrates and phosphates), biocides and herbicides, and veterinary antibiotics, has become much more apparent.<sup>112</sup> These have an adverse effect on the natural aquatic environment. Toxic algal blooms are widespread in many rivers, including in LMICs (see Figure 3.9).

Poor management of land and soil increases sediment loads to rivers and reservoirs, reducing carrying and storage capacity, respectively. It also speeds up runoff, and increases flood risk, for example, by reducing vegetation cover and compacting soil. Low water retention in soils from intensive agriculture and loss of topsoil also reduces summer flows, and where compaction occurs, or hard pans are formed, groundwater recharge is reduced.

Antibiotics discharged from municipal wastewater treatment works, and excreted from treated livestock, are a growing threat and run the risk of increasing resistance in bacteria in the environment and transferring resistant genes to humans. For every person on the planet in 2016 (7.5 billion), FAOSTAT data indicates on average the use of 284g of active ingredients of pesticides. Excessive use of pesticides clearly has implications not only for biodiversity, but for contamination of land, water, and human health. Another area of growing concern is the use of antibiotics in livestock.<sup>114</sup> These are used as growth promoters and prophylactically for maintaining herd health in some intensive farming systems. The global usage of antibiotics in livestock farming in 2010 was 63,151 ± 1,560 tons, which is the same as 9g per person across the world: equivalent to

**Figure 3.9: Eutrophying emissions per kilogram of food product**

Eutrophying emissions represent runoff of excess nutrients into the surrounding environment and waterways which affect and pollute ecosystems. They are measured in grams of phosphate equivalents (PO<sub>4</sub>eq).



Source: Our World in Data.<sup>113</sup> Original data source: Poore and Nemecek (2018)<sup>72</sup>

a standard course of antibiotics. The use of antimicrobials in livestock production is projected to increase by 67% between 2010 and 2030, to 105,596 ± 3,605 tonnes.<sup>114</sup> This may contribute to emerging antimicrobial resistance, with huge implications for human disease treatments.<sup>116</sup>

### 3.2.6 Aquatic food resources and the ocean environment

The warming of oceans associated with climate change is having important impacts not only on the viability of coral reefs, but on the stock and quality of many species of fish globally.<sup>vi</sup> This has significant implications for the diets of many millions of people, as well as for the livelihoods of those involved in fish production or catch. Although climate effects are wide-ranging depending on location, water temperature and quality (especially acidification) are expected to cause significant changes in stock productivity,

which will affect potential yields and profits. This will also affect the geographic distribution of that stock (which determines where fish can be caught and who can benefit from such catch). Depending on the underlying assumptions of various climate models, between 40% and 91% of the stocks of some species could disappear (become extinct), even if other species would benefit and increase.<sup>117</sup>

**“ Today, 31% of commercially important assessed marine fish stocks worldwide are overfished... At risk are hundreds of millions of people who depend on fisheries and aquaculture for their livelihoods, food security and nutrition. ”**

FAO (2016)<sup>122</sup>

<sup>vi</sup> In this report, the term ‘fish’ indicates fish, crustaceans, molluscs, and other aquatic animals, but excludes aquatic mammals, reptiles, seaweeds, and other aquatic plants.

One assessment of potential revenue loss in global fisheries associated with a high CO<sub>2</sub> emission scenario suggests that revenues would drop 35% more than the projected decrease in catches even by 2050.<sup>118</sup> This would come on top of the falling catch and revenues already seen in recent decades. Wild catch of fish peaked in 1992 and has been falling by 1%/year on average ever since. Roughly 90% of monitored fisheries are being exploited up to, or beyond, maximum sustainable yields.<sup>119</sup> Warming ocean temperatures add an additional challenge, and are expected to drive smaller fish sizes, smaller fisheries, and significant migration of fisheries away from the tropics and toward the poles.<sup>120</sup> The loss of many nutrients (not just protein or omega 3 fatty acids) would be critical for large numbers of people in LMICs where so much production takes place.<sup>121</sup>

### 3.3 Climate crisis and environmental impacts on food systems

Climate change and a compromised natural environment can result in a heightened threat to food production due to drought, floods, desertification, or any number of unseasonal climatic anomalies. Also, if more than one environmental effect occurs at the same time, the risks are amplified.<sup>19</sup> Climate change is already having significant impacts on agricultural production.<sup>10</sup> For example, some regions, mainly in the tropics and sub-tropics, continue to experience deteriorating land quality, loss of topsoil, loss of soil nutrients and loss of organic matter. The highest levels of land degradation are manifest in the lowest-income countries which already have relatively low agricultural productivity and are often chronically food-deficit countries (see Figure 3.7).

#### 3.3.1 Climate change and food production

The world is not only recording global temperature increases – with dry areas getting drier and wet areas getting wetter – but local weather patterns and associated agroecological conditions are also changing. Extremes are becoming more extreme in many locations, causing increasingly unprecedented weather conditions, such as extreme heat, drought, rainfall and storm intensity, especially in LMICs.

As the climate crisis unfolds in coming decades, these factors will influence the yield and volatility of food production globally.<sup>10</sup> Figure 3.10 illustrates the possible effects on crop yields if 3C of warming were to occur.<sup>123</sup> A convergence of recent modelling suggests that “human-caused climate change will influence the quality and quantity of food we produce and our ability to distribute it equitably”.<sup>96</sup> There is a real risk of rapidly escalating humanitarian need, leading to a projected doubling in the number of people in need of aid from around 110 million in 2018 to over 200 million by 2050. Humanitarian funding requirements after climate-related disasters could increase from between US\$3.5-12 billion to US\$20 billion annually by 2030.<sup>124</sup>

“Climate change is already reshaping our food systems by redistributing crop and fishery potential and through extreme event disturbances.”

Gephart et al. (2020)<sup>74</sup>

These economic losses are manifest largely through impacts on agriculture and related food systems. For example, one meta-analysis considered more than 1,000 studies focusing on future productivity of wheat, maize, and rice under various climate change scenarios. It found that average yields would decline, particularly yields of wheat and maize, which were predicted to fall by 1-2% per decade.<sup>125</sup> This may be a realistic assessment given other recent research which looked back at the effects of changing climate on global agriculture since 1961; that work showed that anthropogenic climate change reduced productivity in agriculture by roughly 21% since the early 1960s, a slowdown that is equivalent to losing all of the productivity growth since 2011 up to the present day.<sup>126</sup> The conclusion is that agriculture has already grown more vulnerable to climate change, and that this will likely get worse in future.

While the negative effects of climate change will be felt all over the globe, the most severe economic and food system impacts will be borne disproportionately by people in low-income countries, particularly in the tropics and Southern Hemisphere subtropics which are “projected to experience the largest impacts on economic growth due to climate change”.<sup>127</sup> Indeed, the above study on past climate change impacts on productivity in agriculture<sup>126</sup> found those negative effects to be much more severe (a reduction of roughly one-third in productivity growth) in sub-Saharan Africa and Latin America and the Caribbean.<sup>126</sup>

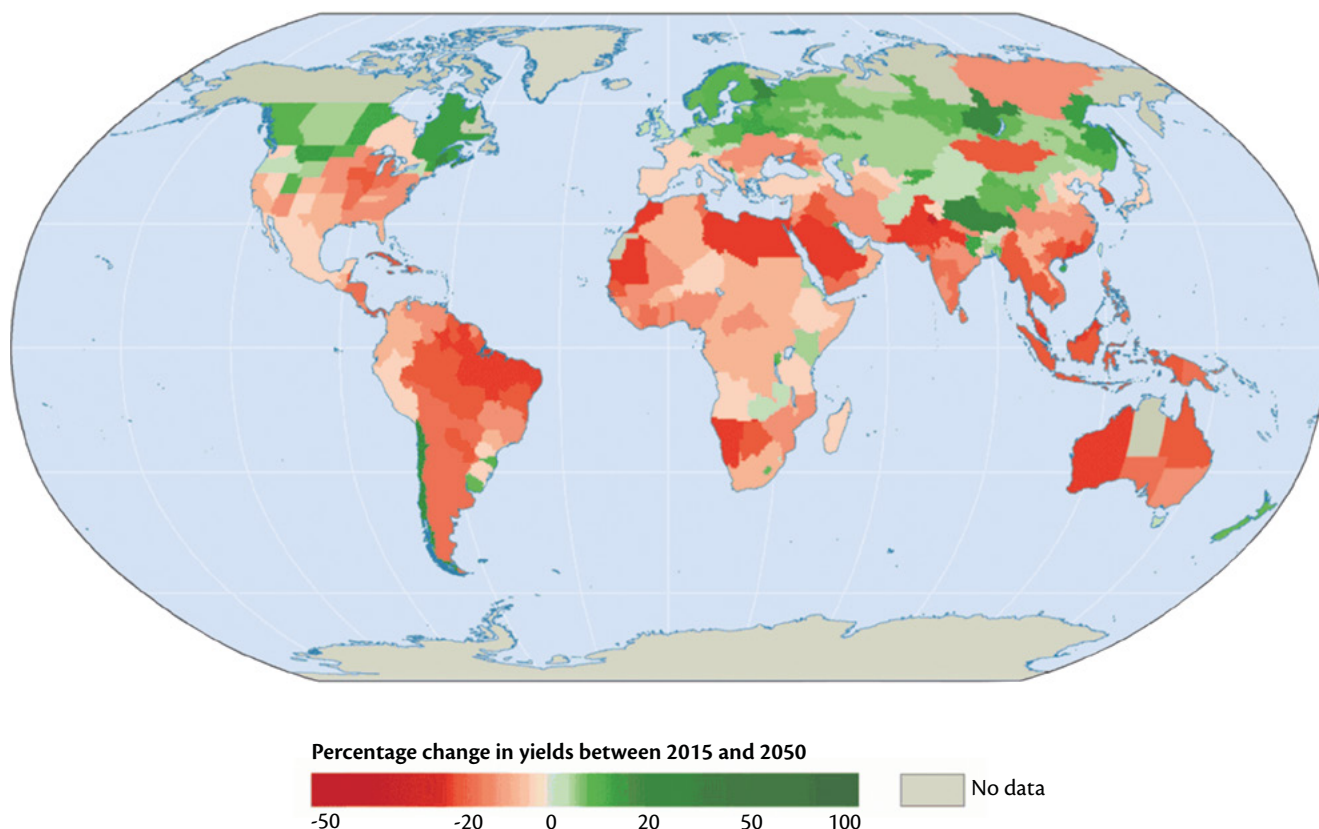
“Climate-driven reductions in fisheries production and alterations in fish-species composition will subsequently increase the vulnerability of tropical countries.”

Lam et al. (2020)<sup>128</sup>

The disproportionate impacts on crop yields will be exacerbated by equally skewed impacts of ocean warming on fisheries, with steep reductions in wild-harvested fish projected in the tropics and increased fish catch closer to the poles. At the same time, many LMICs rely on food imports to meet local demand, but climate change is projected to increase the risk of multiple simultaneous harvest failures in breadbasket countries, which would lead to important supply constraints and food price hikes on global markets for which LMICs are ill-prepared.<sup>121</sup> Building the resilience of food systems in these contexts will be a key facet of national and global actions to ensure healthy diets for all.



**Figure 3.10: Projected yield impacts of a 3C warmer world by 2050**



Source: World Economic Forum (2016)<sup>123</sup>

A further study has estimated that such effects will broadly equate to 1% global GDP loss per year for each 1C increase in global temperatures, but with increasing economic impacts above a 3C rise.<sup>129</sup> Others have posited a range from less than 1% to over 5% GDP per annum losses depending on the scenario – although low-income countries suffer the most damaging outcomes in all models.<sup>130</sup> For example, reporting International Monetary Fund calculations, the World Meteorological Organization notes that a low-income country with an annual average temperature today of 25C will see a fall in national economic growth (Gross Domestic Product) of 1.2% for each 1C increase in temperature.<sup>131</sup>

The mainly tropical and sub-tropical low-income countries whose economies are most likely to be significantly impacted in this way accounted for only 20% of global GDP in 2016; but these same countries are expected to be home to around 75% of the world's population by the end of the century.<sup>131</sup> Similarly, FAO finds that LMICs in tropical areas would bear the brunt of climate impacts on crop yields, while HICs in temperate zones could benefit.<sup>132</sup>

**“Resilience is more than just a buzz word; it has real implications for development and policy making.”**

**Fan (2014)<sup>133</sup>**

Hence the paradox “food production shifting to the poles just as food consumers are concentrating near the equators”.<sup>96</sup>

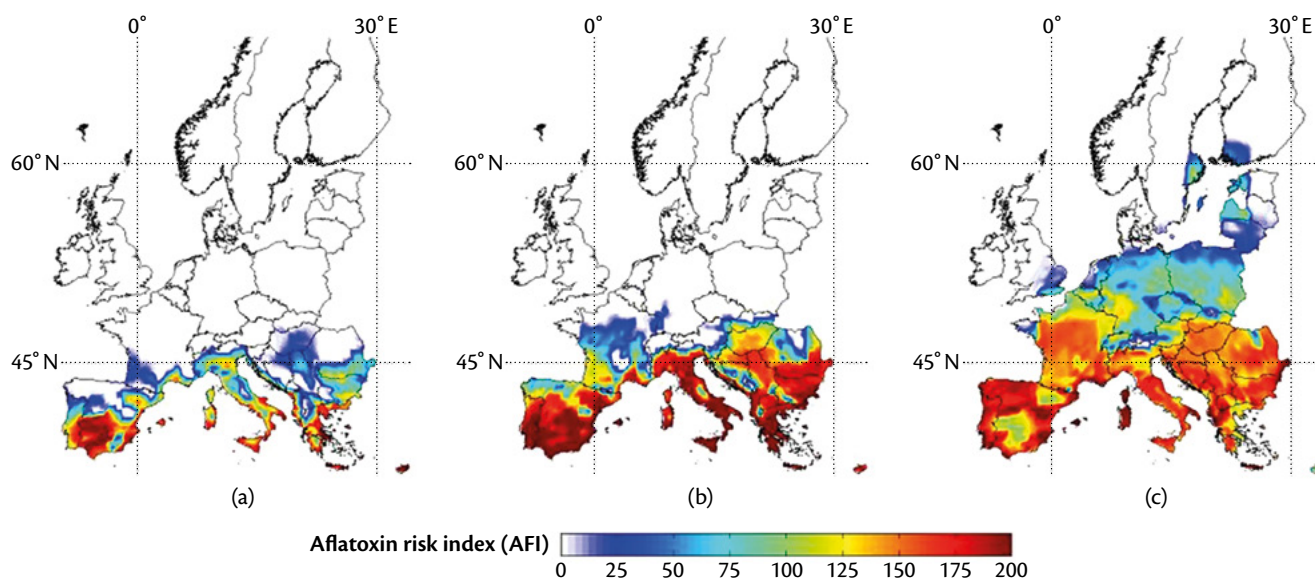
### 3.3.2 Pests and pathogens

Warming temperatures will increase the winter survival of insect pests which impact crops and livestock, not just those directly affecting human health.<sup>134</sup> One modelling study suggests that rising population growth and metabolic rates among insect pests would increase yield losses of rice, maize, and wheat by 10-25% per degree Celsius of warming.<sup>135</sup>

Changing temperatures will also shift the geographic range of crop pests and pathogens. Among 612 species of pests and pathogens, investigators have observed an average poleward shift of 2.7km per year since 1960.<sup>136</sup> Crops often lack defences against non-native pests and pathogens that are moving into their non-traditional agroecological range. Ongoing breeding and management efforts are therefore needed to address new threats.

An oft-ignored potential negative associated with climate change is the likely spread of food-borne diseases, including aflatoxins across the food supply.<sup>137</sup> While the World Health Organization notes that biological pathogens are the biggest drivers of food-borne disease, the significant role of aflatoxins in poor birth outcomes and impaired child growth in LMICs is only now being fully recognised through recent studies.<sup>138</sup> Aflatoxins are naturally

**Figure 3.11: Projected aflatoxin contamination in maize and wheat crops across Europe baseline (2016 – a), 2C degrees (b), and 5C (c) degrees warming scenarios**



Note: The scale 0–200 refers to the aflatoxin risk index (AFI), from the predictive model: the greater the number, the greater the risk of aflatoxin contamination.

Source: Battilani et al. (2016)<sup>141</sup>

occurring toxins which occur through mould growth on a wide range of food crops in the field or in storage, mainly in tropical countries. Consumed at high levels or for long periods of time, aflatoxins are known to be carcinogenic, but are now also acknowledged to contribute to undernutrition via babies being born small for their gestational age or stunted at birth.<sup>139</sup> The role of poor diet quality in exposure to aflatoxins is increasingly of concern to LMIC governments, such as Nepal.<sup>140</sup>

Expected shifts in agroecological conditions associated with climate change are likely to increase the rates and coverage of contamination into temperate regions. For example, modelling of aflatoxin contamination in maize and wheat crops across Europe under a +2C and +5C climate change scenario has predicted that aflatoxin will become a food safety issue in maize in Europe, especially in the +2C scenario (which is the most probable scenario of climate change expected for the next few years) (see Figure 3.11).<sup>141</sup> In tropical LMICs, where most consumers are already widely exposed to aflatoxins, the incidence of high intake with potential for increased acute public health crises are both likely to rise.<sup>141</sup>

### 3.3.3 Emerging zoonotic diseases

Climate change, and changing land-use patterns, have been linked with the geographical expansion of zoonotic diseases (ones that affect human health but originate from wild animals), and the emergence new ones.<sup>142</sup> A long-standing estimate is that around 60% of emerging human pathogens have animal origin.<sup>143</sup> The complex interface of human-animal interactions that lead to zoonoses is strongly influenced by the effects of climate change<sup>144</sup> and the natural environment more generally. For example, increased risk of transmission of rodent-borne diseases has been identified in South-East Asia as a result of biodiversity loss and agricultural intensification.<sup>145</sup> At the same time, it has been argued that since climate change is a driver of shifts in agricultural systems



across the Tropics, there is a real danger that new emerging diseases will be “deadly in impoverished and immunosuppressed societies undergoing rapid growth in degraded environments”, as is found in much of sub-Saharan Africa.<sup>146</sup>

The most notable recent global zoonotic disease outbreak has been COVID-19 (see Box 3.3). At the time of writing, the 2020 coronavirus pandemic continues to have significant repercussions for national and global food systems. While the coronavirus is only the latest zoonotic disease outbreak to cause havoc to the world’s economic outlook and to its food systems, its impacts have been far reaching.<sup>147</sup> Swine flu and bird flu pandemics in recent years were also linked to patterns of dietary choice and to weak regulations associated with wild meat hunting and sales, and food safety in open informal markets.<sup>137</sup> As such, the coronavirus experience offers an important opportunity for all countries to carefully assess the links between dietary choices (and the retail of live animals) and health outcomes. The renewed focus of attention on food system functions should include a critical rethinking of how such systems are designed and managed in relation to intended (and unintended) outcomes.



### Box 3.3: The coronavirus pandemic: safeguarding food systems and nutrition

**A sharp shock to food systems.** Epidemics are not new, but the recent pandemic has been distinguished by its potential to cause multiple shocks simultaneously throughout the global food system. Governments closed down formal and informal retail outlets for food; the movement of agricultural workers was severely restricted; food processing, transport and trade have all been affected, and many people had access to food seriously impaired over weeks and months. The knock-on effects to diets and nutrition are of major concern, particularly for the nutritionally vulnerable. The many negative effects exposed the fragility of current food systems. In some countries, the reaction has been, as it was during the world food price crisis of 2007/08, to restrict or ban exports of foods, which disrupts trade and price signals and makes measured collaborative action aimed at keeping trade open very difficult. It is the poorest consumer who suffers most.

**Three urgent priorities to mitigate the effects of the pandemic on food systems and diet quality are:**

**1. Ensure that nutritional needs of all people are met.**

Social protection measures (e.g. cash transfers, small loans, voucher programmes and more) should be designed, funded, and implemented in ways that protect the poorest and most nutritionally vulnerable. All protection measures should seek to ensure that benefits are sufficient to allow for access to diets which include nutrient-rich fresh produce. Effective behaviour messaging is needed to promote exclusive breastfeeding and appropriate infant and young child feeding. Institutional and other in-kind feeding activities must include demand for adequate nutrient-rich foods (i.e. not just starchy staples or grains). People should be informed and encouraged to consume foods which are key to healthy diets, and to moderate intake of ultra-processed products and foods high in unhealthy fats, sugar, and salt. Tackling misinformation is important; governments should swiftly prosecute the purveyors of products falsely claiming protection against COVID-19, counter unproven claims that certain foods can treat the virus, and refute hoax claims that some fresh foods are implicated in its spread.

**2. Protect, enhance, and buffer stakeholders across entire food value chains.**

Farms, food transporters, traders, wholesalers, processors, and retailers are at risk of collapse across the food system. Rapid government and business interventions are needed to buffer demand, bolster food-related employment, open lines of credit to food-related small- and medium-enterprises (SMEs), use institutional procurement to avoid food loss and waste until markets are functional, and ensure the supply of agricultural inputs for the next production season. The food system has not broken down, but its functioning is damaged. Food sector SMEs in LMICs are particularly fragile and vulnerable to disruptions in markets and

consumer spending. They need to be supported with access to loans, information, and digital technologies.

**3. Kick-start the transition and make food systems function better than before.**

Policy makers need an eye on the future, and life after the pandemic. Food systems must be financed and managed in ways that make them more resilient to shocks of all kinds, able to deliver healthy diets to 9.5 billion people in ways that are sustainable in the long run by being less damaging to the planet in the short and medium-term. Just like the coronavirus, climate threats, economic threats and natural resource shortages all cut across borders. So must the solutions to the linked crises of human health and planetary health. Trade in food must be made more friction-free, the public goods benefits of agricultural research and development (R&D) and technology innovation should be accessible to all, and the best science and lessons from practice must be openly accessed, discussed and applied regardless of geography.

This crisis presents an opportunity to better understand and intervene to correct the flashpoints that have made food systems buckle under pressure: inequities in purchasing power, limited physical access to healthy diets for millions of people, political impulses that lean towards traditional trade protectionism, supply chains susceptible to disruption, natural resource depletion making a supply response to higher prices difficult, and a lack of pre-existing social protection mechanisms designed to protect the diets of the poor. Now is the time to initiate steps in a transition towards sustainable, healthy diets.





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## 3.4 From challenges to solutions

Policymakers are finding themselves in an increasingly constrained operating space defined by:

1. Rapidly rising global demand for nutrient-rich diets;
2. The need to sharply reduce the ecological impacts of producing these diets; and
3. The headwinds generated by climate change, water and land scarcity, pollution, and biodiversity loss, all of which threaten the quality and quantity of the food that can be produced. Producing more nutrient-rich food with much greater efficiency becomes imperative.

A combination of dietary choices and food production approaches can together influence the quantity and type of emissions produced, as well as the environmental footprint in a given setting. Low efficiency in production systems coupled with a degrading production base leads to predictable negative outcomes: yield or productivity constraints; periodic large-scale losses of food harvest/output; depletion of natural resources with further acceleration of the degradation; potential impacts on the vitamin and mineral content of certain cultivars under conditions of higher concentrations of carbon dioxide in the atmosphere; water acidification leading to loss of fish and other aquatic outputs, and more.<sup>96,137,148</sup>

The first three chapters of this report (Part I) have spelled out the challenges and made the case for why appropriate public sector and commercial actions must be taken urgently for the sake of both human and planetary health. Part II of this report spells out what needs to be done. The following four chapters address four critical domains of the food system:

- **Making more of the right foods available to support sustainable, healthy diets for all.** This means being able to supply enough of the diversity of nutrient-rich foods that can populate diverse dietary patterns around the world (see Chapter 4). As highlighted previously, insufficient nutrient-rich foods are currently produced globally to supply the needs of everyone today, let alone future demand.

- **Making sustainable, healthy diets accessible to all.** It is not enough for the world to produce enough food to provide healthy and sustainable diets for everyone. Those foods must also be accessible (within reach) of all citizens of all countries (see Chapter 5). That means that the physical distance between producers and consumers has to be overcome, nutrients have to be protected as they move through the food system, food loss and waste must be significantly reduced along all value chains, seasonality appropriately managed, and retail systems enhanced.
- **Making sustainable, healthy diets affordable to all.** Diets of a high quality are today unaffordable to many people around the world. Even minimally adequate diets (in nutrient terms) are out of reach economically for billions of people. The challenge is to make sustainable, healthy diets affordable to all (see Chapter 6). This requires a rebalancing of relative prices across foods, reducing the cost of delivering nutrient-rich foods to all markets (optimising efficiencies across the entire food chain), and increasing incomes and purchasing power, especially of the poor.
- **Making nutrient-rich sustainably produced foods desirable.** It is not enough to make sustainable, healthy diets available, accessible, and affordable. It is also important to promote and inspire the desirability of such a diet (see Chapter 7). People need to be persuaded to choose them. But if they do, consumers themselves can become a key driver of change through food systems, and across the commercial activities of food industry stakeholders.

These four sets of required actions are inter-linked to a greater or lesser degree, and actions in one domain must take account of actions and outcomes in the others. What is needed is an integrated and coherent approach for achieving these goals individually and collectively.

## PART II

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# Ways forward: Transition steps



# 4 Ensuring sufficient availability of sustainably produced, nutrient-rich food

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# Key messages

A pre-requisite for universal access to sustainable, healthy diets is that there be sufficient availability of appropriate foods. Today, agriculture and related food policies are not supporting healthy diets at the most fundamental level. They are simply not producing enough of the foods needed for healthy diets globally. Supply constraints are not the only problem: all aspects of the food system interact to determine what is physically available to a consumer at a particular price point. But it is essential to ensure that sufficient quantities of nutrient-rich foods are available to everyone. To achieve this, more funds need to flow to secure the supply of staple foods while also significantly increasing the support for non-staples.

**Guiding principles for action.** The following represent important actions to frame the transition:

- 1. Policy needs to rebalance *what is produced to ensure sufficiency of nutrient-rich foods*.** The quantity of foods produced will continue to be very important. But in the future, any food supply agenda must be coupled with an equivalent food quality agenda so that the world has more food than at present and more nutrient-rich foods produced in sustainable ways.
- 2. Enhancing the role of smallholder farms.** It will be important for governments and their development partners to find ways to support and enhance smallholder production and diets in ways that promote their health as well contributing more to emissions reduction, optimising

natural resources use, and even carbon sequestration through enhanced agroforestry practices.

**3. Refocus on *how things are grown: the sustainable intensification of agriculture*.** Three steps are involved in achieving this:

- **Step 1:** Improving efficiency. New agricultural technologies will continue to be important for food security, poverty reduction and efficiency gains in the use of scarce natural resources. But new directions in the types of technologies will be required.
- **Step 2:** Substitution. This goes beyond doing more with less. Rather, it involves substituting less environmentally harmful practices for more environmentally beneficial practices.
- **Step 3:** Redesigning the production system. While efficiency gains and substitution are typically additive and create marginal changes within current production systems, a realignment of food systems towards sustainable, healthy diets would entail the most transformative changes across systems.

**4. Refocus food policy agendas from a focus on agricultural output to increasing the efficiency of entire food systems.** Food systems remain inefficient from many perspectives.

**Three major policy shifts are needed.** Each has potential to distribute huge economic benefits.

**1. Rebalance subsidies to enhance local and global supplies of nutrient-rich foods.**

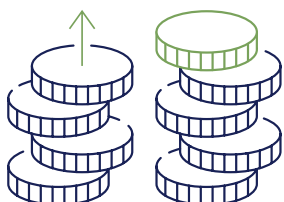
Most subsidies today keep supply and relative prices out of balance with the food patterns needed to support sustainable, healthy diets. Even a relatively modest shift in subsidies (e.g. 25%) could have a major effect.

**2. Rebalance agricultural research and development (R&D) from a commodity focus to a food system focus.**

Increase funding overall, but especially for actions that increase the supply of nutrient-rich foods through sustainable and resilient farming systems.

**3. Rebalance production incentives to deliver sustainable, healthy diets.**

Investing in different approaches, goals, metrics of success and reward systems relating to food production would represent a very substantial shift in investment patterns, market agendas, policy priorities and on-the-ground activities across the world. This includes a significant renewed focus on sustainable intensification, reforestation for carbon sequestration, and promotion of efficiency gains over a single narrow focus on productivity gains. The potential exists to generate massive rural as well as urban employment opportunities in low- and middle-income countries (LMICs) in particular (for which agriculture and related sectors and services still represent a significant share of economic activity).



A **25%** shift in agriculture subsidies could have a major impact on the availability of nutrient-rich food

**Part I of this report argued that food systems are failing in two ways. They are not supporting healthy diets for everyone across the world, and the way that food systems currently function means that they will not be able to sustain healthy diets in the future. The sustainability of food systems is itself threatened by climate change impacts and the degradation of natural resources.**

**Part II focuses on actions required across food systems to allow for an effective transition to a different, transformed future. This chapter starts by focusing on how food is produced today. It then sets out why there needs to be a major shift towards more nutrient-rich foods and fewer energy-dense crops used as ingredients for ultra-processed products, livestock feed or fuel. In addition, food production must refocus on becoming efficiently sustainable rather than just profitably productive. These steps are essential to ensure that sustainable high-quality diets are available for all.**

The discussions in Part I made the case for change, while guiding policymakers on the actions needed in a transition process. As Chapter 3 emphasised, unless all countries commit to giving the sustainable production of food much greater priority, environmental degradation and climate change will drive the vicious circles which make it ever harder to deliver what is needed. Building on the conceptual pillars of food security, this chapter looks at how to deliver sufficient *availability* of food (with its root being the production of food from agriculture), while subsequent chapters look at other pillars: *accessibility* and *affordability*. This chapter begins by taking a backwards look at the drivers which have led to the current food systems, before looking ahead to define what transformed food systems may look like. It then lays out principles for action which are essential both globally and in LMICs to achieve the goals of a sufficient supply of food that is both nutrient-rich and sustainably produced.

The goal of this chapter is to identify the priority actions for agriculture needed to ensure availability of the right foods – and the right mix of foods – to deliver sustainable, healthy diets for the future.<sup>vii</sup>

## 4.1 Trends in agriculture

Agriculture and food systems have been shaped by a diverse range of cultural, political, and economic influences. In particular, agriculture is increasingly seen as an important vehicle for producing goods to drive economic growth, including the production of commodities for export.). In many countries, agricultural and trade policies are somewhat distanced from policies related to nutrition, health, and environmental quality.

<sup>vii</sup> Trade in food commodities can influence 'local' availability as well as production. The focus of this chapter is on production. For a discussion on trade, see Chapter 5 on *Accessibility*, and also the Global Panel policy brief: Rethinking trade policies to support healthier diets (February 2020).



Looking back, perhaps the focus has been too much on increasing yields rather than ensuring a sustainable supply of food to deliver health through nutrition (see Box 4.1).

#### 4.1.1 What is agriculture incentivised to produce today?

Food systems are driven by agriculture and trade policies (which influence producer costs and incentives) as well as by commercial and consumer demand, typically mediated through farm gate prices (see Box 4.2). The benefits that some types of crops and commodities experience relative to others is determined by various factors, including government subsidies, trade promotion and restrictions, technological developments,

increasing scale and intensity of agriculture, population and income growth, changing dietary preferences and lifestyles, and more. Food companies have been developing new processed foods using ever-larger quantities of staple cereals, sugar, and vegetable oil as ingredients. Unsurprisingly, some of the largest land area expansion in past decades has been dedicated to starchy grains (such as wheat and maize) and oil crops (such as soybean, sunflower, palm oil, rape, and mustard) for use as food and livestock feed. The commodities that saw the largest relative and absolute abundance in national food supplies (on a per capita basis) were the world's major cereals: rice, wheat and maize.<sup>55,152</sup> Thus, the global expansion of land area for farming was largely for commodities associated with diets that were calorically rich but relatively poor in micronutrients.

#### Box 4.1: Limitations in how we typically interpret the functions of agriculture

The success of agriculture is usually evaluated according to narrow criteria focused on productivity (particularly yield per unit area of land).<sup>148,149</sup> That approach has driven substantial increases in calorie supply globally since the 1960s. As discussed in Chapter 3, it has also been accompanied by an insufficient supply of nutrient-rich foods (in relation to need), degraded natural resources, and a significant contribution to climate-threatening emissions. Yield increases

in recent decades have allowed growing demand to be met without increasing the conversion of natural habitats into agricultural land, and the potential GHG emissions and biodiversity loss associated with that.<sup>150,151</sup> However, the increasing intensification of production contributes to other environmental problems: for example, the over-application of synthetic inputs, degradation of soils, and homogenisation of landscapes leaving little space for nature.

#### Box 4.2: Food and agricultural policies affect what foods are available

Globally, 70% of the total food energy consumed comes from only three food groups – starchy staples, sugar, and oils and fats – which are all cheap sources of calories. To some extent, this narrow focus on a few calorically rich commodities is driven by food and agricultural policies that both HICs and LMICs have implemented during the last 50-70 years.<sup>153</sup>

Historically, food security policies were mainly concerned with improving poor people's access to affordable calories. These policies took different forms. Public agricultural research concentrated on productivity increases in a few staple grains, such as wheat, rice and maize.<sup>152,154,155</sup> In many developing countries, staple grain production was further incentivised through market procurement programmes, infrastructure support, irrigation, credit, and input subsidies tied to these crops.<sup>153</sup>

Many LMICs also provided consumer subsidies for staple grains. For example, India has a large public distribution system for subsidised rice and wheat. Egypt had a subsidy programme for wheat bread and other staple foods.<sup>156</sup> To avoid disincentives to production, some countries implemented price support schemes for grain-producing farmers. In China, national self-sufficiency in rice is still

an important food security goal and is fostered through a minimum support price policy for rice. The Philippines has also implemented market price support systems for producers.<sup>157</sup>

In high income regions – such as North America and Europe – most farm price support schemes that had existed for several decades shifted in the 1990s from subsidies to direct income transfers to farmers, decoupled from specific commodities.<sup>157</sup> However, the policy focus on a few grains, sugar, and oilseeds in these regions over decades (from the 1950s to the 1990s) contributed to a relatively narrow production base and low levels of agricultural diversity.

These policies helped to increase grain output, which also supported rising livestock production and improved the availability of calories. However, the same policies may also have slowed the process of dietary diversification to include more nutrient-rich foods, especially in LMICs. The focus on cheap calories also distorted the relative prices of foods so that the consumer price of staple grains fell relative to the prices of fruits, vegetables, and other nutrient-rich foods. Fostering more diverse food production and consumption patterns will require changes in the focus of agricultural and food policies.

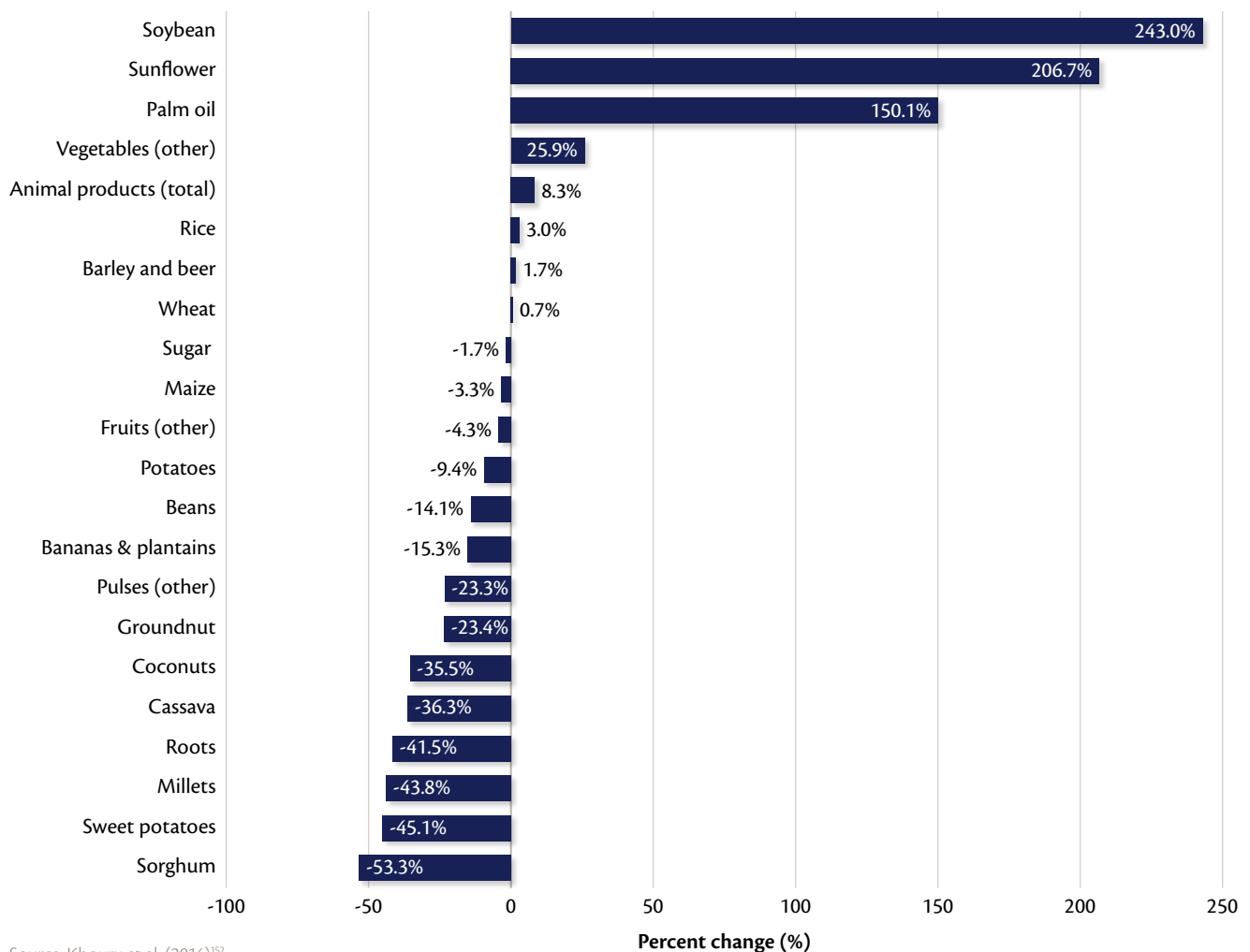




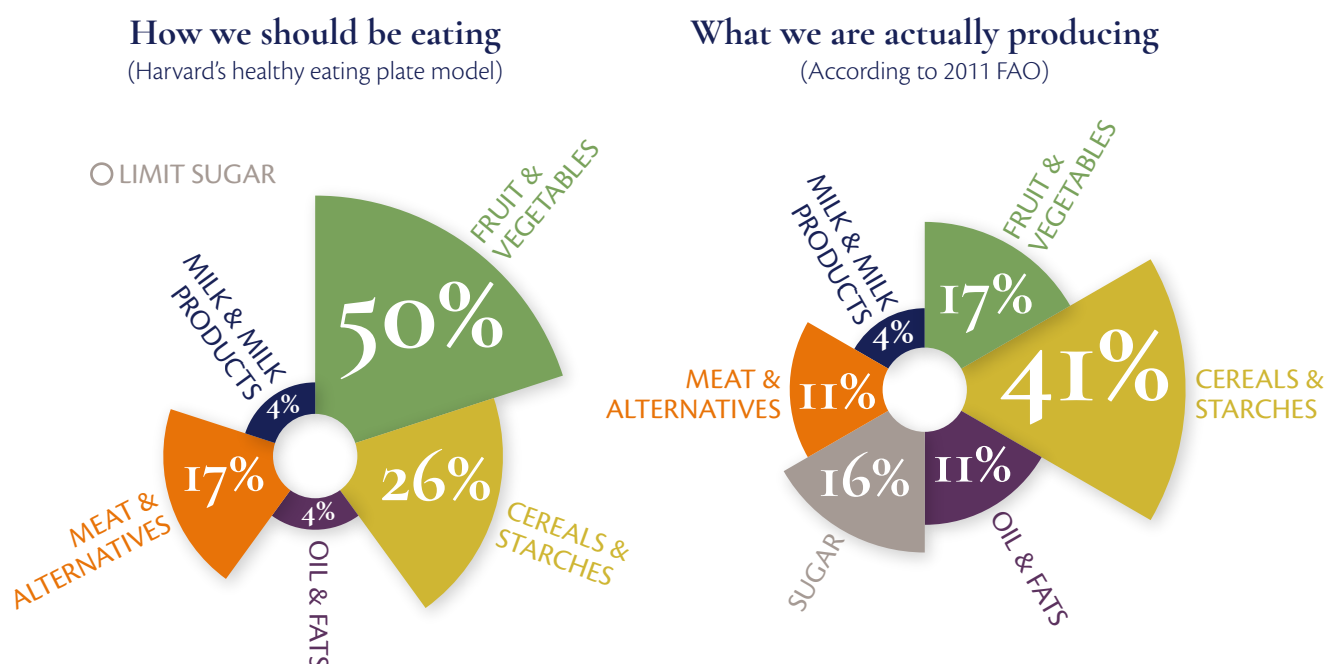
Figure 4.1 illustrates changes in the relative shares of crops in the five decades from 1960, in terms of total energy (calories). This shows that some crops which declined in abundance relative to the total supply were nutrient-rich whole grains like millets, oats, and sorghum, as well as fruits and vegetables (including sweet potatoes, bananas, pulses, dates, grapes, and coconuts). While some other fruits and vegetables increased in abundance, they did so at lower rates than the major calorically rich commodities. Figure 4.1 therefore paints a mixed picture. The crops that have been increasingly incentivised to be produced are typically calorie-rich, whereas many nutrient-rich crops conducive to healthy diets have declined in relative importance.

Today, if everyone were to try to access all the foods needed for high quality, nutrient-rich, diets – including fruits and vegetables, or fish, nuts, or pulses – they would not be able to do so. The world does not produce enough to meet that notional demand (set in this case using one example of a reference diet proposed by Harvard University focused solely on enhancing human health (see Figure 4.2). The implication could not be clearer: existing agriculture and related food policies, including those that influence food markets, are not supporting healthy diets at the most basic level i.e. production.

**Figure 4.1: Changes in relative abundance of crops (1960–2009 in terms of calories)**



**Figure 4.2: The mismatch between what food is produced globally, and what is required for healthy and balanced diets**



Source: Redrawn from data in KB KC et al. (2018)<sup>158</sup>

#### 4.1.2 Not enough nutrient-rich foods are available worldwide

Existing policies and financial incentives in agriculture and food are not supporting the production of enough of the foods needed for healthy diets globally (see figure 4.2). Using this as evidence, many refer to 'broken food systems'.<sup>159,160</sup> However, food systems are in fact currently delivering what they were designed to deliver: plentiful food (calories) in the form of mainly staple grains, which are produced and sold at prices affordable to most (albeit not all) consumers, and underpinned by global markets. One of the results, indeed the goals, of traditional food policies has been to lower the price of staple foods (primarily cereal grains) and much of the policy environment, from agricultural R&D, to agricultural support to trade policies has been designed to facilitate this rather than to deliver more diversity of nutrient-rich safe foods through sustainable, resilient food systems (see Box 4.2).

Support for this approach was based on recognition of the imperative to eradicate famines of the past and to feed increasing numbers of city-based consumers who did not grow their own food. The period since the 1950s has been defined by these policy goals, resulting in a set of remarkable trends:

1. historically high global output of food (mainly cereals), resulting in:
2. a downward trend in the real price of calories in most parts of the world, leading to:
3. many more people meeting minimum energy needs than ever before.

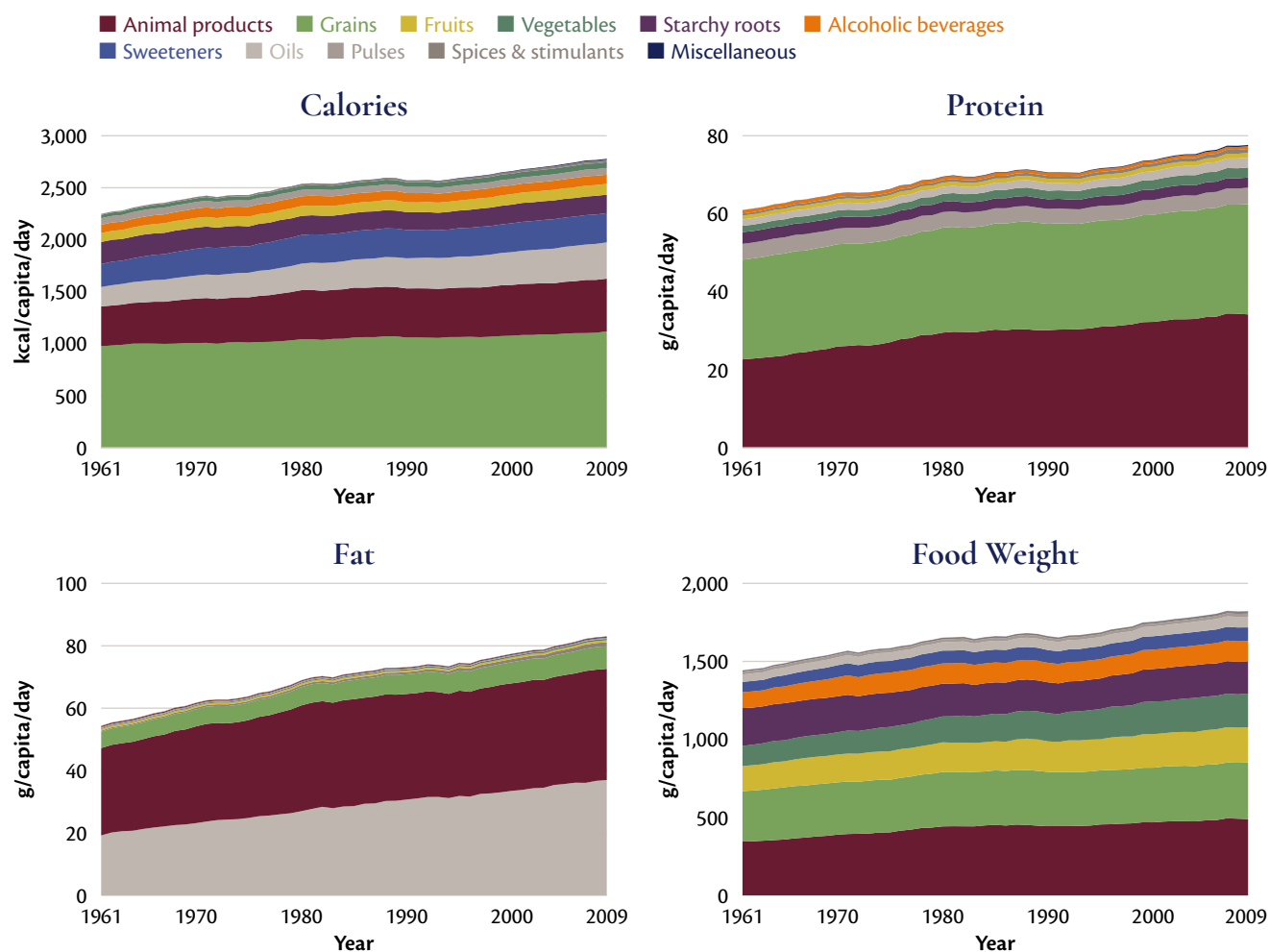
This highly successful outcome has been achieved by productivity gains (triggered in the 1960s through public agricultural research), through land expansion, and by government price supports of various kinds.<sup>161</sup>

This success does not, of course, mean that all people have benefitted, since in 2019 there were still around 690 million individuals classified as chronically undernourished. In early 2020, there were 44 countries, of which 32 were in Africa, deemed to be "in need of external assistance for food" – that is, requiring loans, financial aid, or in-kind food assistance. Such contexts are particularly fragile in the face of climate or other hazards such as pest outbreaks, droughts, or pandemics. By necessity, these countries are especially reliant on external assistance.<sup>50</sup> In wealthy and poor countries alike, income inequality, together with inadequate national programmes to support minimally adequate diets (in nutrient terms) for vulnerable individuals, means that there are too many suffering the consequences of inadequate diets even in the context of plenty.

The world's food supply continues to grow.<sup>152</sup> On average, most countries' food supply has increased over the past 50 years in terms of energy, protein, fat, and food weight. Oils as a food group had the most substantial increase (see Figure 4.3).<sup>55</sup>

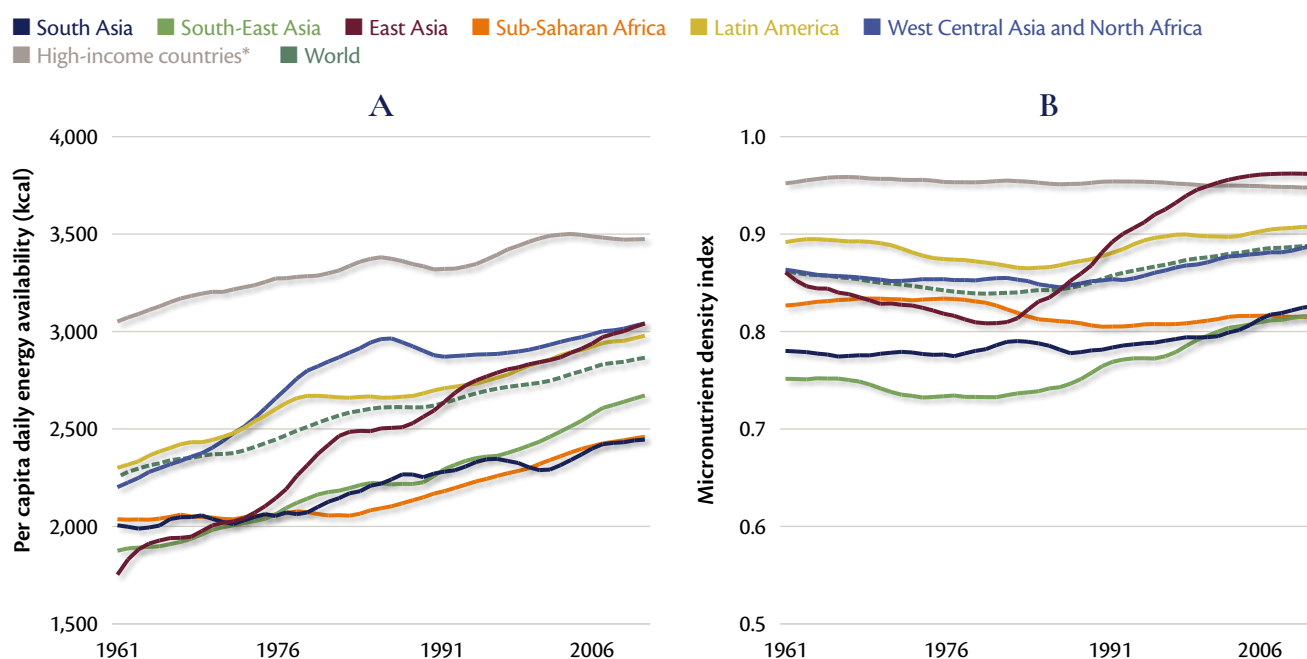
However, the *composition* of countries' food availability (defined as the number and relative abundances of crops and animal products that contribute to energy, protein, fat and food weight) have converged, with variation between food supplies in different countries decreasing on average by 69%. This is because throughout the world, food systems are focused on a diminishing number of crops.<sup>152</sup> Global dependence on a relatively small set of crops equates to a large dependence

**Figure 4.3: Global food supply quantity in energy, fat, protein and food weight by food group**



Source: Khoury et al. (2014)<sup>152</sup>

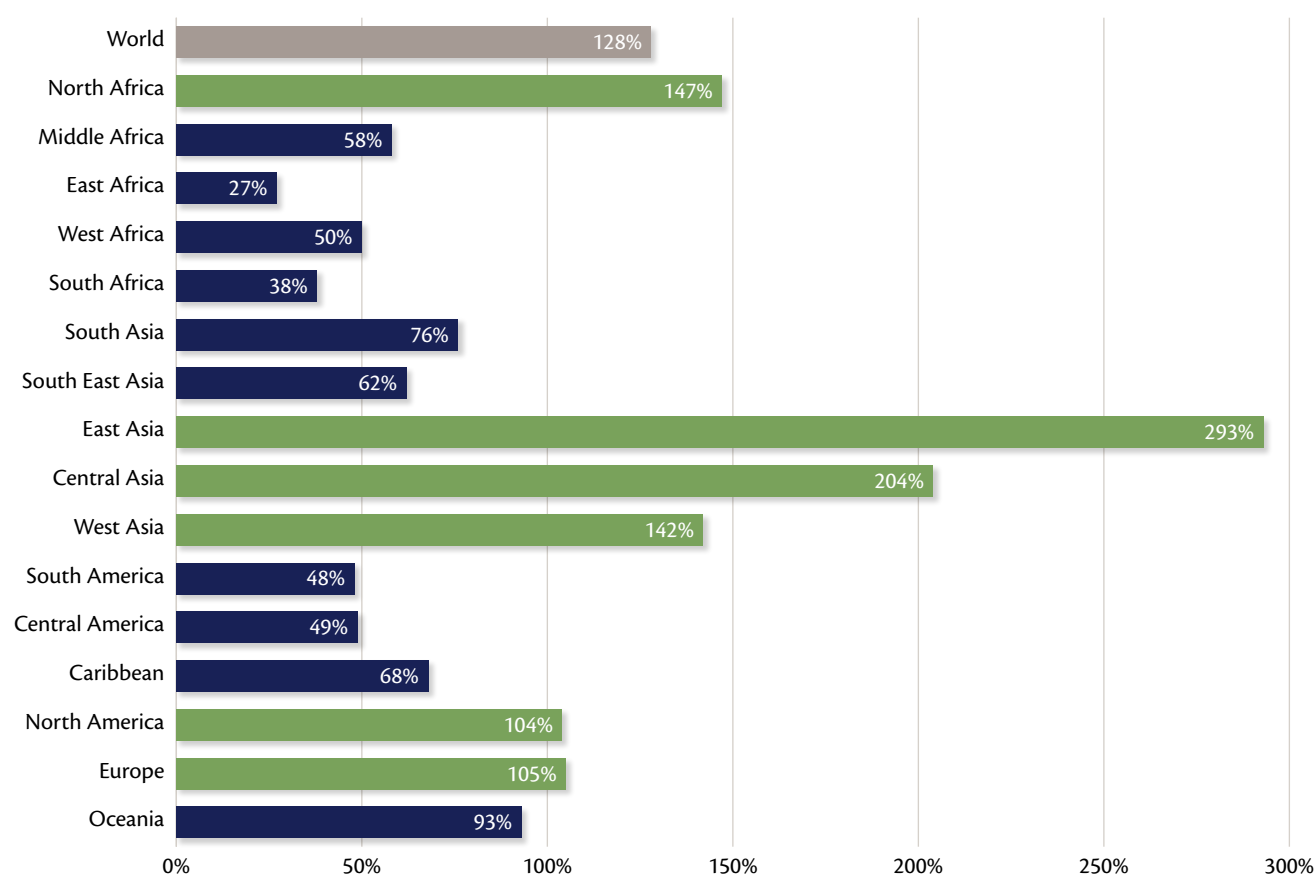
**Figure 4.4: Trends in per capita energy availability (kcal) and micronutrient density index for different regions of the world**



\*Australia, Canada, New Zealand, United States, and Western Europe. Source: Beal et al. (2017)<sup>162</sup>



**Figure 4.5: Vegetable supply by major region in 2013**



Note: vegetable supply per capita, per day; 2013 expressed as a percentage of a 300g recommendation. Intake per capita is expected to be lower than supply.

Source: FAO and GAIN (2020).<sup>163</sup> Original data source: FAOSTAT

on monocropping systems. As discussed in Chapter 3, such farming systems are associated with substantial externalised costs on the environment. And while steps are being made toward sustainable intensification (see Section 4.4), the overall sustainability of single crop monocultures remains limited.

Intensive production systems are by design highly productive per unit area, increasing the affordability of these foods worldwide, despite their impacts on the environment. The ensuing plentiful supply of macronutrients, at relatively low cost, has led to a growing number of countries experiencing an overall excess of calories consumed (see Chapter 2).<sup>148,162</sup>

Policymakers today are at the end of a decades-long era of agricultural development, and agricultural markets which have been incentivised to drive up the yields of a relatively small number of calorie-rich crops. However, the growing evidence for ill-health of populations worldwide, underpinned by poor access to high-quality, nutrient-rich diets, suggests that policymakers must now pay special attention to the supply of nutrients beyond calories. This need is exemplified in Figure 4.4, which summarises regional trends in national food supplies from 1961 to 2011. Across the world, energy availability per person has increased rapidly (see Figure 4.4A) but the levels of micronutrients in food (estimated by the micronutrient density index in Figure 4.4B) have remained much more static over the decades. For sub-Saharan Africa, these have actually declined since 1961.

East Asian countries are the outliers, showing a sharp increase in nutrient-rich food content as well as energy supply per capita. However, LMICs are a considerable distance from such gains. Figure 4.5 shows the supply of vegetables per capita as a percentage of a 300g recommendation. Only six of 16 regions supply vegetables above this level. In particular, sub-Saharan Africa, South-East Asia and Latin America and the Caribbean do not have sufficient vegetable supplies to meet a 300g recommended intake. A fundamental change will be needed so that the imbalance between what is actually produced and what is needed for healthy and sustainable nutrition can be rectified. The subsequent sections in this chapter focus on how this can be done.

## 4.2 Looking ahead: a transformed food system

Before the question of how food production and food systems can be transformed, the question of what is meant by 'transformed food systems' needs to be considered. While the answer to that important question will vary by region, culture, and ideology, it is important for stakeholders in every country to discuss alternative visions of a future in which food systems are sustainably supporting healthy diets. While the details will vary, essential elements will be largely common (see Box 4.3).

### Box 4.3: Core elements of transformed food systems

The goal of transformed food systems is for everyone to be able to access healthy, balanced, and sustainable diets. Meeting this means:

- **High-quality diets are affordable for everyone.** As described in Chapter 6, across the world, sustainable, healthy diets could be less costly than today's diets for some, although substantial effort is likely to be needed to ensure they are affordable to many of the poor. Price distortions towards calorically rich commodities need to be abolished and the cultivation of more nutrient-rich crops must be promoted. More diverse production patterns will lead to more diverse and healthy consumption patterns.
- **All foods are produced in ways that are sustainable in terms of planetary boundaries.** In terms of the total impact of global agriculture, it is consistent with meeting Paris climate goals, leaving space for nature, farming in a way that has low impact on land, fresh water, air, or biodiversity.
- **Shifts in dietary patterns are achieved.** The goal would not be for a single universal diet, but rather a marked shift towards a range of enhanced, culturally relevant choices that favour nutrient-rich foods produced sustainably.

The **benefits of long-term food system transformation** will include:

- **Fewer diet-related diseases.** This means significantly less healthcare expenditure, less preventable premature mortality, fewer days of productive work lost to sickness, and greater productivity at work.
- **Less hunger.** This means significantly fewer people living on the margins, from hand-to-mouth, posing a moral and resource challenge to policymakers the world over.
- **Fewer climate-induced shocks to the food system.** This means significantly less humanitarian aid, and fewer disruptions to food supply chains.
- **Better nutrition and health across the world.** This means significantly more human capital, learning, educational attainment, and social well-being.
- **Better equity in incomes, dietary access, and nutrition,** supporting significantly more wealth creation and healthier societies.
- **Better husbandry of the world's productive resources.** This means a reduction in degradation, pollution, and the depletion of natural resources, with improved ecosystem services leading to benefits to food production (recovered biodiversity, pollinator resurgence, etc.)
- **More employment across the food system,** from farming through to marketing, processing, and retail.
- **More positive contributions of the food system to addressing the climate crisis** (carbon sequestration, tree planting, etc.)

A pre-requisite for universal access to healthy diets is that there be sufficient amounts of nutrient-rich foods for everyone. At the outset, policymakers need to be clear what these terms mean in their own contexts. Supplying the right amount may help promote healthy eating and greater sustainability (see Box 4.3). Meeting demand might lead to people eating unhealthily if societies have a preference for eating energy-rich foods. Supplying an excess may lead to resilience in the face of interruptions but otherwise lead to wasted food, with its high environmental costs.

How much food is needed to fulfil the nutritional needs of people, while protecting the planet? At the moment, the world does not grow sufficient food for diets containing sufficient nutrient-rich foods (see Figure 4.2), but demand will further increase as the world's population increases, and economic growth raises disposable incomes, allowing people to access better diets. As the world's population approaches a possible 9.5 billion by mid-century, there will be a need for both more food – to feed more mouths – and for *different* foods to support healthier diets.

## 4.3 Principles for actions to transform the food system

Actions to transform food systems will need to be tailored to the context of a particular place, culture, climate, or society. However, a number of guiding principles can be discerned that are broadly applicable across contexts. These include focusing on what is grown, how it is grown and by whom, rather than just considering its yield. Another principle is the recognition that agriculture is part of broader food systems, with agricultural production not being the end itself. These principles will guide fundamental shifts in policy goals and approaches.

### 4.3.1 Policy needs to rebalance *what is produced* to ensure sufficiency of nutrient-rich foods

Ensuring healthy diets for all will require a change in policy priorities, in which the focus shifts from quantity to quality. The quantity of foods produced will continue to be very important, not least in view of the increasing global population, but also to address current high levels of hunger and undernutrition in parts of sub-Saharan Africa and South Asia. But in the future, any food supply agenda must be coupled with an equivalent food *quality* agenda so that the world has more food than at present *and* more nutrient-rich foods produced in sustainable ways. Of course, what is produced is not only determined by supply-side influences such as agroecology, prices, and local policies. It is also determined by what commercial enterprises wish to use in developing and selling food products, and what consumers expressly want to purchase. These are dealt with in later chapters of this report. From a supply perspective, ensuring greater availability of nutrient-rich foods will require:

1. Responding to rising future demand for nutrient-rich foods of many kinds,

2. A gradual decline in per capita consumption of cereals, but ensuring adequate calorie consumption by the 690 million or so individuals who today remain chronically undernourished, and
3. Ensuring that food systems can deliver necessary foods on a continuing basis.

Providing sufficient but not excess food for all to lead a healthy life, and to do this sustainably, explicitly requires agriculture to produce many different crops and livestock, in different ways. This will require innovations in many areas.<sup>164</sup>

In terms of rebalancing production, the world's food systems need to produce a great deal more of the kinds of foods that all people should eat to become and remain healthy and well-nourished. National food-based dietary guidelines and WHO recommendations promote greater consumption of fruits, vegetables, pulses, and nuts. Hence:

## “ Systematic public policy targeting the constraints to producing and consuming fruits, vegetables, pulses, and nuts will be needed. ”

Mason-D'Croz et al. (2019)<sup>165</sup>

Similarly, there is a serious disconnect between recommended fish intake and projected outputs globally from both wild catch and aquaculture by 2030,<sup>166</sup> while for dairy there would also be a gap between what people should be able to eat and what is available for them to eat.<sup>167</sup> In other words, few if any countries in the world produce or import the range of foods that would be required if all their citizens were to eat healthy diets.

This is, therefore, a fundamental challenge that needs to be faced by policymakers and the food industry. In short, it implies the need for a substantial systemic change to support a markedly different and healthier profile of consumer demand in the next decade and beyond.

However, there are two important qualifications that need to be made.<sup>168</sup> First, on trade. Few if any countries will ever be able to ensure domestic production of all the foods needed to support healthy diets, so the distribution of food is as important as its production, and the ability for people to work their land. The ultimate goal is to ensure that everyone can eat a range of nutrient-rich products to complement (be eaten with) an appropriate range of staple foods (cereal grains or tubers).

Despite constraints imposed on food trade by national policy responses to global emergencies, such as the global food price spikes of 2007/8, 2010/11, and the 2020 pandemic, the importance of supporting a flow of foods across borders is key to allowing for optimal use of land and other factor

## “ Per capita consumption of fruits and vegetables in developing countries is expected to surpass that of developed countries by 2050 ”

Fan (2018)<sup>169</sup>

inputs; that is, using the natural comparative advantage of growing the crops and livestock best suited to the locality. Resilience in food systems is not synonymous with a country being self-sufficient.

Secondly, the rebalancing of production necessary to support healthier diets is *not* to suggest that staple foods will cease to be important in the future. While more nutrient-dense foods need to be available, there will still be a continuing need to ensure an adequate supply of staple foods in the decades ahead. Past gains in productivity cannot be allowed to degrade in the future, but much more effort is needed to increase the productivity of nutrient-dense food like pulses, vegetables, and fruit.

### 4.3.2 Refocus on who produces: enhancing the role of smallholder farms

Much has been made in the past about the need for farm consolidation to optimise economies of scale in production.<sup>170</sup> That recommendation was typically based on profitability parameters, and an awareness of the large risks borne by smallholder producers in most semi-arid environments of sub-Saharan Africa and South Asia. It was also based on the understanding that throughout history, while agriculture has been a critically important engine of macroeconomic growth, the number of people mainly engaged in agriculture (for most of their income) declines as economies become larger and the contribution of the sector to GDP becomes much smaller relative to industry, services, tourism and more.<sup>171</sup>

Recent assessments suggest that smallholder farmers will have an important role to play in the future as:

1. specialised producers of nutrient-rich foods, particularly through horticulture (for which huge scale-economies matter relatively less),
2. employers, particularly of youth in sub-Saharan Africa, where rural areas will still be home to a majority of people into the second half of this century,
3. a source of own-grown diet quality (as measured by diversity) (see Box 4.4).<sup>172</sup>

Therefore, it will be important for governments and their development partners to find ways to support and enhance smallholder production and diets in ways that promote health as well as contributing more to emissions reduction, optimising natural resources use, and even carbon sequestration through enhanced agroforestry practices.



#### Box 4.4: Farm production diversity and dietary diversity among smallholders

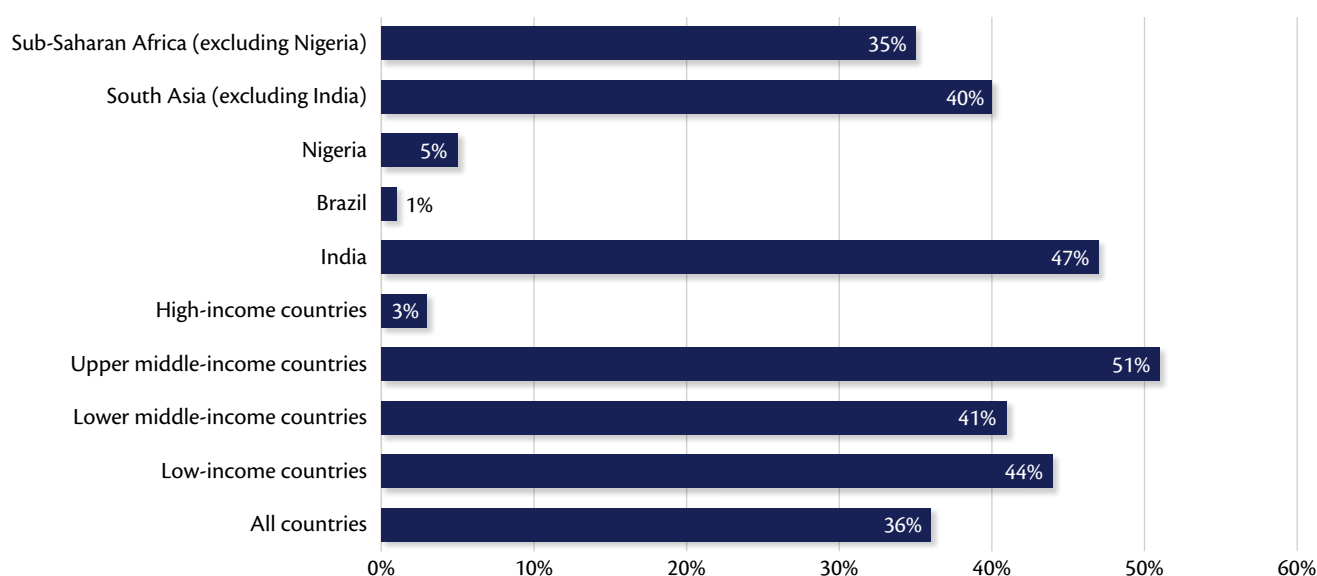
As many people suffering from nutritional deficiencies are smallholder farmers, diversifying production on these farms is often considered a good strategy to improve diets and nutrition. But is this really the case? Recent studies with data from many LMICs suggest that farm production diversity is positively associated with dietary diversity in some situations, but not in others.<sup>173–177</sup> A meta-analysis<sup>178</sup> showed that on average, farms would have to produce 16 additional crop or livestock species to increase dietary diversity by one single food group. Hence, there is little evidence that increasing farm production diversity is an effective strategy to improve smallholder diets in most or all situations.

Increasing farm production diversity may sometimes even have negative nutrition effects – for example when production diversity is already high. Producing too many species on a very small farm can lead to income losses through

forgone gains from specialisation. Smaller farms focused on the consumption of own production often produce more than 10 different species on their plots.<sup>173</sup> Pushing these farms towards even higher diversity may perpetuate subsistence and reduce market and development opportunities. Improving market access and market functioning are generally more promising development strategies.<sup>179,180</sup> Even subsistence-oriented households typically obtain a larger share of their dietary diversity from the market than from their own farm.<sup>181–183</sup>

Of course, affordable access to diverse foods from the market requires that farmers produce these foods. But diversity at the food systems level does not mean that every farmer has to be extremely diverse. If efficient local, regional and global markets for a wide range of nutrient-rich foods exist, food systems will become more diverse without every farmer having to maximise diversity.

Figure 4.6: Smallholder share in value of primary food production



Source: IFPRI (2020)<sup>172</sup>

In 2016 there were 570 million smallholders globally.<sup>184</sup> Recent data from FAO showed that smallholder activities in agriculture still contribute an important share of food production in South Asia and sub-Saharan Africa, particularly in countries such as China (roughly 80%) and India (over 45%), and low-income countries as a whole (over 40%) (see Figure 4.6). This means that policymakers in LMICs need to reconnect with the contributions of smallholder farmers. Initiatives aimed at shifting relative product prices, supporting technological innovations, investing in market infrastructure to reduce transactions costs, facilitating access to information and credit, and promoting access to new seed systems must all take the needs and constraints of smallholders into account.

#### 4.3.3 Refocus on how things are grown: the sustainable intensification of agriculture

As highlighted in Chapter 3, the agricultural intensification seen in previous decades has created significant negative environmental impacts. Given the environmental costs, and pending environmental breakdown, it is crucial that any further productivity growth (increases in outputs per unit area) occurs without the environmental harm that has been typical to date. This is the notion of 'sustainable intensification' (SI). Conceptually, SI broadly overlaps with the notion of 'climate-smart agriculture'. This encompasses agricultural practices that avoid driving climate change and build resilience to future climate impacts (e.g. building soil carbon stocks to mitigate climate change and build fertility).

The intensification of agriculture can come about through many routes, not simply through the intensification of capital-rich technologies and inputs. Examples include new inputs of knowledge, innovations in labour, enhancing natural processes to deliver yield improvements (agroecological intensification), evidence-based integrated pest management systems, and others.<sup>185</sup>

The sustainable intensification of agriculture must be a priority policy objective.<sup>185</sup> It should be aimed at maintaining and enhancing yields while reducing environmental impacts, and it involves three closely interconnected stages:<sup>186</sup>

1. Efficiency improvements mean that inefficiencies in the use of scarce resources are reduced. This is particularly true for land, water, agrochemicals, and other external inputs. The right amount of nutrients should be applied at the right time, in the right place. (see Section 4.3.4).
2. Substitution means that existing ways of production and handling can (and often should) be replaced by new practices and technologies which foster sustainability whilst maintaining or improving yields. For example, replacing synthetic pesticides through host-plant resistance and using the ecology of pests' natural enemies.
3. System redesign involves systemic change in farming (and food systems) to deliver sustainable, healthy diets. For example, adoption of circular agriculture, or agroecology, agrobiodiversity, or diversified farming systems.

#### 4.3.3.1 SI step 1: Improving efficiency

Productivity growth in agriculture through technologies such as improved seeds, water control and inorganic fertilisers has effectively supported the reduction of extreme poverty (see

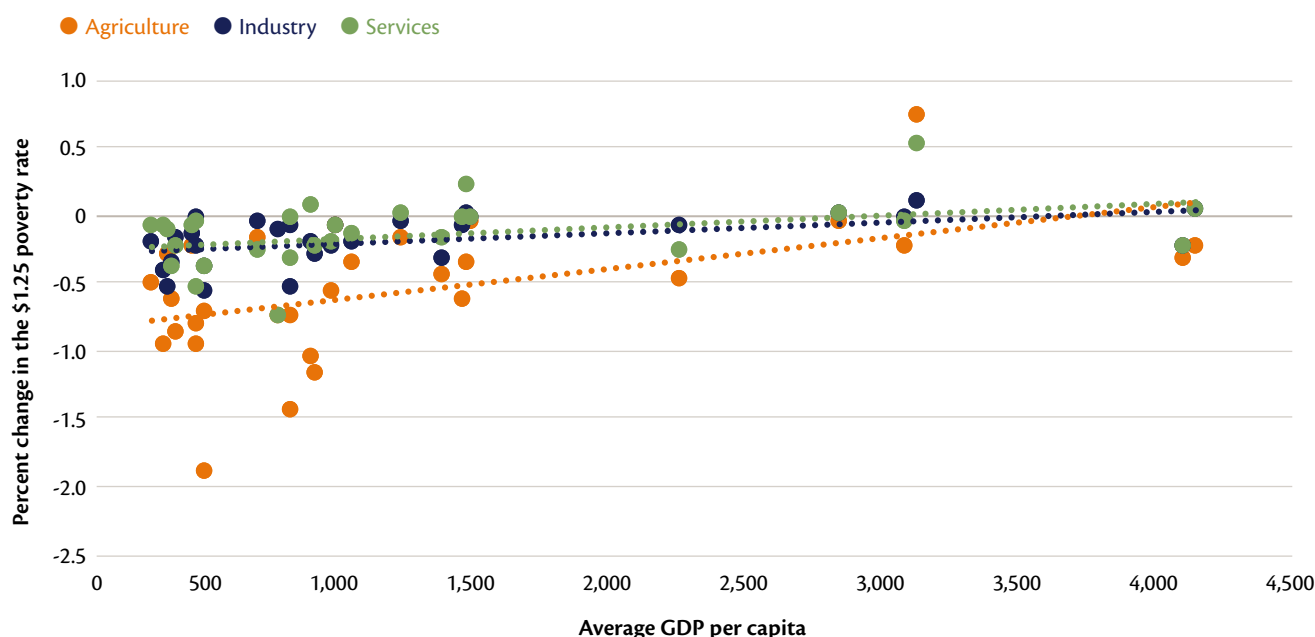
Figure 4.7).<sup>55</sup> New agricultural technologies will continue to be important for food security, poverty reduction and efficiency gains in the use of scarce natural resources. But new directions in the types of technologies will be required.

Many agricultural systems are inherently inefficient, allowing the degradation of natural capital and high leakage of nutrients and pollutants into the air and water courses due to input misuse. Matching inputs to land productivity (or taking marginal land into other uses) is one way of improving overall efficiency. This is the realm of 'precision agriculture'. By avoiding excess inputs where they are not needed and removing marginal land from production, environmental impacts are reduced, and the land allowed to 'do more with less'.

In addition to digital technologies associated with precision agriculture, new breeding and gene-editing technologies offer considerable potential to increase crop yields and climate resilience while reducing the use of chemical inputs (see Box 4.5). However, efficiency gains do not always require more capital inputs. They can also come through intensification of knowledge in terms of improved agronomy and capacity building.

Importantly, large-scale operations may not necessarily be better in the pursuit of efficiency gains. Recent evidence highlighted by the World Bank and others suggests that despite many decades of discussion about the need for sub-Saharan Africa to consolidate farms to achieve scale efficiencies, "there is no economically optimal agrarian structure".<sup>188</sup> While farming operations of many sizes can face disadvantages according to their country's level of economic development and market circumstances, technology innovations and efficiency gains from optimising input use can enhance productivity even for smallholders.

**Figure 4.7: An increase in agricultural productivity has nearly twice the impact on reducing extreme poverty as a comparable productivity increase in industry or services**



Source: Ivanic and Martin (2018)<sup>187</sup>

It is therefore critical to recognise that greater efficiency can be achieved in both small- and large-scale enterprises. This is important, for example, in small-scale livestock operations in sub-Saharan Africa, where livestock often plays an important role in supporting rural livelihoods. Large and small ruminants, camelids and poultry are kept not simply to produce meat, milk, or eggs. They are also used for transport, traction (ploughing), capital accumulation (savings), assets to support resilience via sales during times of economic stress, fertilisers (via manure and urine), fibre and leather for clothing and equipment, and cultural rituals.<sup>189,190</sup>

Continued deforestation and inefficiencies in large-scale commercial production in higher- and middle-income countries must be urgently tackled to reduce significant negative natural resource and climate impacts. At the same time, greater investments are needed in resource-poor environments to support efficiency gains in livestock husbandry via enhanced animal health, fodder and feed quality, and integration of crop and animal production systems. In other words, efficiency gains are both feasible and essential among smallholder livestock producers to ensure continued livelihoods, access to animal-sourced foods where needed in the diet, and reduced climate emissions and natural resource degradation.

#### 4.3.3.2 SI step 2: Substitution

The second step in sustainable intensification goes beyond doing more with less, and involves substituting less environmentally harmful practices for more environmentally beneficial practices. There are many examples of such substitutions in the literature.<sup>186</sup> They include substituting organic fertiliser for inorganic fertiliser (which improves soil carbon, structure and water retention); managing beneficial pest-control insects in order to avoid pesticide usage; using direct drilling rather than tillage; and enhancing yield and resilience through more diversity in production, including more complex crop rotations.

#### 4.3.3.3 SI step 3: Redesigning the production system

While *efficiency* gains and *substitution* are typically additive and create marginal changes within current production systems, a realignment of food systems towards sustainable, healthy diets would entail the most transformative changes across systems.

Redesign means transforming systems to produce valuable outputs whilst minimising the environmental impacts. It harnesses basic agroecological processes including predation, parasitism, pollination services, natural pest or weed suppression, herbivory, and nitrogen fixation to enhance the delivery of beneficial services for the production of crops and livestock. Examples include developing diverse, integrated, and circular farming systems, incorporating livestock and arable systems with agroforestry to complement nutrient flows, and enhancing soils and productivity.

However, redesign is not just an agricultural challenge; it is also a social challenge. There are important feedback loops across the food system, meaning that what is grown is not only determined by supply-side policies and producer prices, but also by expressed demand from the consumer side as well as

commercial retail and product development strategies. Thus, redesign entails actions across the food system that build capacity to adapt and innovate, as well as the use of social and political capital to create large-scale change to improve outcomes for biodiversity, water quantity and quality, air quality, pest management, and soil health. As part of the redesign process, enhancing the nutritional quality of human diets is key: more diversified, mixed farming systems will deliver greater availability of diverse and nutrient-rich foods.

A redesign of production systems will be needed to sustainably support improved diets, especially in view of the rapid pace of changes being experienced around the world – whether ecological, economic, social, or political. For example, as the climate changes and the world faces new pandemic threats, the challenge of new pests, pathogens, and weeds has been amplified. New pests and diseases can emerge quickly in a range of different ways, as the rapid spread of the coronavirus pandemic has shown. Food systems are already subject to the development of resistance to pesticides, pest outbreaks due to pesticide overuse and the ecological disruption of natural enemies of pests, and an increased geographical range of pests and diseases (e.g. through trade or through accidental transport by travellers). Equally, as the climate changes, so will patterns of weather, including its extremes. Redesign is therefore an important route to building farming systems which are inherently more resilient to the shocks and uncertainties ahead.

Policymakers and development partners in all countries, but particularly in low-income food-deficit countries, must pay careful attention to investments which can protect the steps taken during the transition. Actions must be carefully calibrated and sequenced in ways that do no harm to the livelihoods, incomes and diets of the poor, and investments in preparedness are essential to mitigate negative impacts of multiple kinds of shocks on progress already made.<sup>66</sup> There are important lessons to be learned from the years of structural adjustment policies when global financial institutions required significant policy shifts over short periods of time, which often led to unintended negative consequences, including rising income inequality over the medium term.<sup>199</sup>

#### 4.3.4 Refocus food policy agendas from a focus on agricultural output to food systems

The principles above – focusing on what is grown, who grows it and how it is grown – necessarily are concerned with agriculture. However, agriculture is simply the initial production step in food systems. Eventually, it is important to look at the entirety of food systems, which from many perspectives are also highly inefficient.

As discussed throughout this report, conventional agricultural production systems need to be updated to enable them to support sustainable, healthy diets. Sustainable intensification of production will be vitally important, but continuing to grow what is currently grown will not be sufficient. A sole focus on ‘increasing productivity’ to underpin cheaper and more available food through conventional agricultural systems can paradoxically reduce the efficiency of a food system because it incentivises



## Box 4.5 New technologies to support sustainable food production

**Agricultural inputs and practices** including improved seeds, fertilisers, irrigation, crop protection, and mechanisation have led to unprecedented productivity growth and contributed enormously to hunger reduction and food security.<sup>155</sup> However, the yield increases associated with the Green Revolution and related technological developments were typically associated with the intensive use of chemical fertilisers and pesticides, and focused on a few major grain crops – namely wheat, rice, and maize. Novel agricultural technologies must be used to ensure that agricultural productivity growth becomes more compatible with both environmental and nutrition goals, including advanced water management (hydroponics), gene-editing, and micro-applications of tailored fertilisers based on known soil and plant needs (rather than generic field-wide dressings). Depending on local conditions these may include technologies and evidence-based practices, such as integrated pest management, agroforestry, agroecology, and conservation agriculture.

**New digital technologies in agriculture** are driven by the relatively lower cost of collecting data on soil conditions, crop growth, pest infestation, weather and animal health through sensors, drones, and satellites.<sup>191</sup> Coupled with precision farming, they could help to produce more food on less land, with fewer inputs, and a smaller environmental footprint. Complex digital technologies are not yet widely used, as they are typically tied to costly machinery and equipment and require digital literacy and training. Further R&D will be needed to make digital technologies useful and affordable for smallholder farmers in LMICs.<sup>192</sup>

**New breeding technologies** include genetically modified organisms (GMOs) and gene-edited crops or livestock breeds. While public debate often focuses on possible environmental and health risks, many years of research show that new breeding technologies are no more risky than conventional breeding.<sup>193,194</sup> GMOs and gene editing can also contribute to sustainable agricultural development more broadly. They can help to increase yields, while reducing many of the shortcomings of Green Revolution technologies. For instance, increased nutrient use efficiency in crop plants and inbuilt resistance to pests and diseases could help to produce high yields with low amounts of chemical fertilisers and pesticides. Crops can also be

made more resilient to drought, heat, floods, and other climate shocks.<sup>195,196</sup> So far only a few GMO traits have been commercialised, mostly by multinational companies in soybean, maize, and cotton. Many more crop-trait combinations have not yet been released, largely due to the limited public acceptance of GMOs and high regulatory costs.<sup>195</sup>

**Gene editing** allows targeted genetic changes in crops or animals without having to introduce foreign genes. It could help to overcome many of the public acceptance and regulatory issues that GMOs have faced in the past.<sup>197</sup> Cheap and relatively easy to do, it can be applied to a wide variety of crops. Gene editing has been used already to develop various desirable traits in vegetables, fruits, pulses, roots and tubers, and major cereal crops.

**Technological innovations for sustainable fruit and vegetable production are needed** because of high pest and disease pressures in intensive horticultural systems, which may worsen with global environmental change. Fruits and vegetables are often sprayed with significant amounts of chemical pesticides. For more sustainable production, resistant varieties, improved agronomy, and possibly also production in indoor vertical farming units will be required.

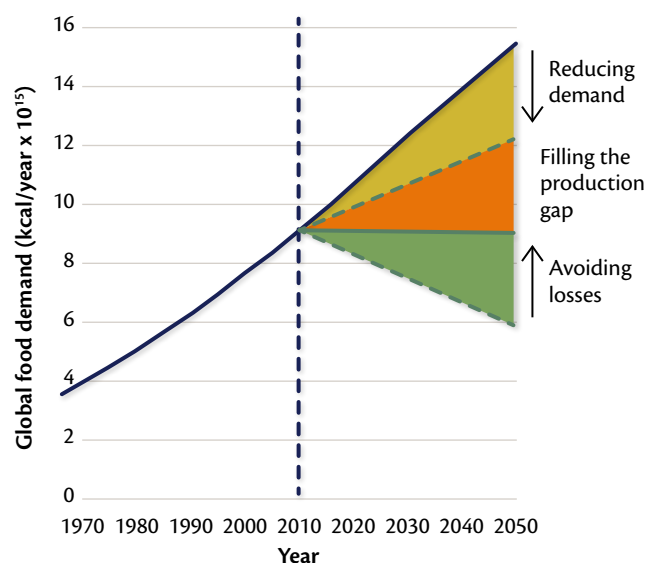
Fully harnessing the potential of new agricultural technologies for sustainable development requires favourable innovation systems and policies, with well-defined R&D objectives (focused less on staple commodities and more on food system support that generates nutrient-rich foods), public-private sector partnerships in agriculture research as well as in promoting adoption of new technologies, and competitive markets in which inputs, information and markets are accessible to all, including smallholder farmers in resource-constrained settings.<sup>95</sup> Favourable innovation systems also require better science communication to address public concerns and prejudices against new farming technologies.<sup>164</sup> New technologies will be crucial in making farming more productive, environmentally sound and nutrition-focused. But they should not be seen as a substitute for other changes also required to make food systems more sustainable, such as reducing post-harvest losses and waste, as well as dietary shifts.<sup>198</sup>

a focus on growing more of a few crops, externalising costs onto the environment to increase yields, reducing the price of calories and increasing their availability, undermining nutritional outcomes, and making wasting calories economically rational.<sup>148</sup>

Instead, we need to refocus on the efficiency of food systems. A productive food system is one that feeds people while minimising traditional inputs (such as land, labour, and capital). It also minimises the inputs from natural capital (e.g. those arising

from the externalisation of costs onto the environment through degraded soil, run-off and so on), and it minimises the costs levied onto society from the poor health resulting from people eating food that does not provide dietary health. Anything that improves the outputs (people fed) whilst reducing the inputs (including environmental impacts and the social costs of poor diets) improves food system efficiency. An efficient food system needs to optimise good nutritional outcomes and yields of nutrient-rich foods, whilst minimising inputs that include natural

**Figure 4.8: Possible actions to meet future food demand**



Source: Keating et al. (2014)<sup>200</sup>

resources (and the social costs of poor diets). In other words, an efficient food system maximises the number of people nourished healthily and sustainably per unit of input. Focusing on maximising productivity alone is counter-productive when food system efficiency is required to ensure sustainability.

Rather than assuming productive agriculture creates an efficient food system, specifically identifying food system efficiency captures many of the elements discussed above – what is grown and how – but also widens the frame of reference to how the products of agriculture turn into food, how it is sold, prepared and consumed. It creates explicit acknowledgement that achieving the goal of providing every person with the diets they need will require integrated actions across food systems, at national and international policy levels, as well as among business entities.

In particular, there is a need to:

1. produce more of a much wider range of products to enhance nutrition;
2. protect food and nutrient losses as they travel through the food system to the plate and beyond, and
3. incentivise changes in people's demand for food so that it better matches what people need to eat for a healthy life and what can be sustainably produced (see Figure 4.8) – rather than producing too little or too much, contributing to waste.<sup>200</sup>

Intervening on the 'demand side' rather than the traditional focus on the 'supply side' inevitably means policymakers will have to make a range of unfamiliar trade-offs.<sup>127</sup> They will need to consider not just how to influence shifts in consumer demand (across categories of foods – see Chapter 7), but also actions that are closely linked to supply-side drivers, including:

1. Avoiding the further expansion of agriculture, particularly into carbon- and biodiversity-rich biomes, as this adds to climate change and undermines the resilience and productivity of agriculture across the planet;

2. Avoiding the loss of agricultural land, through unsustainable land management;
3. Reducing the use of foodstuffs, e.g. cereal grains, as biofuels, and instead using non-land-intensive sources of renewable energy;
4. Avoiding a large increase in cereals used for livestock feed (already in 2016, roughly 36% of cereals produced globally was fed to animals).<sup>201</sup> In the future, there will be a need to both moderate demand, and increase use of alternative protein sources, such as meat-substitutes, algae, insect meal, legume crop by-products, etc.;
5. Drastically improving livestock management efficiency, thereby improving input-to-output ratios;<sup>202,203</sup>
6. Supporting increased production of fruits, vegetables, and pulses through a range of incentives such as developing sustainable cold chains and processing, changing subsidies, and developing more market incentives (including through education and other mechanisms such as public procurement);
7. Recognising that an abundance of calories, produced unsustainably, and sold cheaply, creates an ever-growing environmental and social burden that is literally unsustainable.

The refocus on food systems rather than agriculture is a widening of the framing beyond the traditional view of agricultural economic growth. There is, however, much that can be done with a range of policies which can stimulate demand for healthier diets, and associated new jobs in delivering them (see Box 4.6). The next section focuses on three key policy shifts.



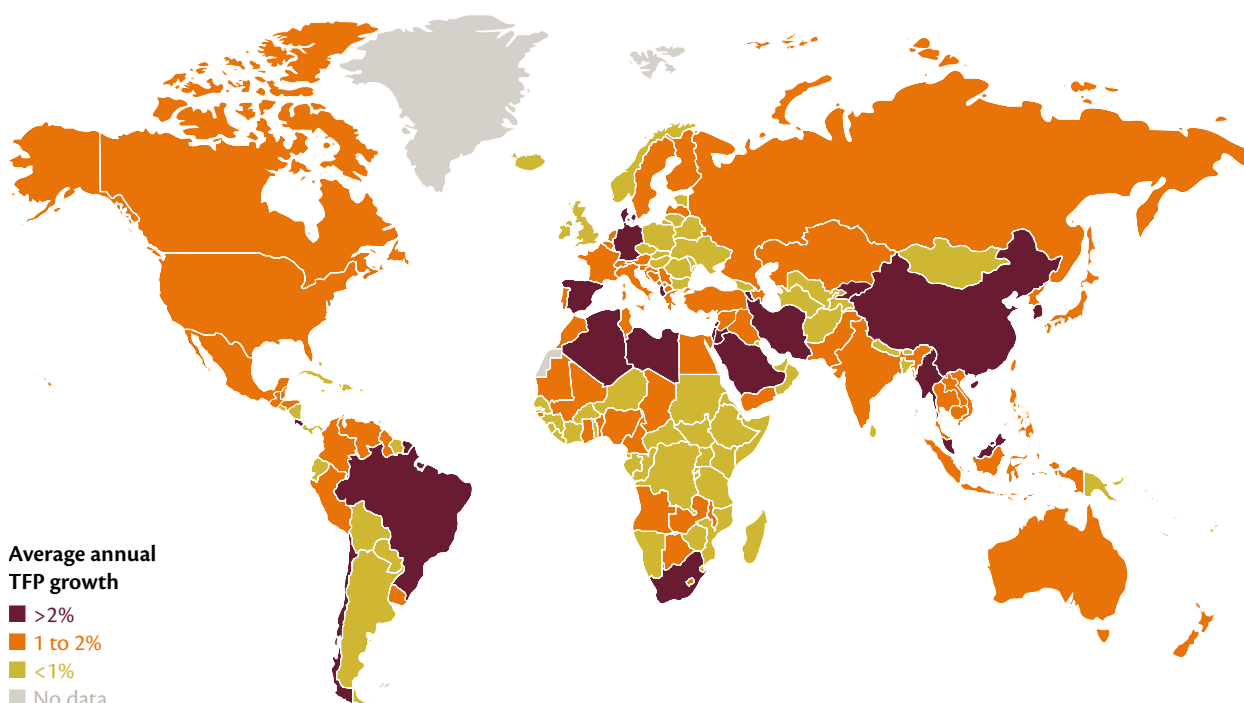
## Box 4.6: How feasible is it to invest beyond farm and trade policies to achieve healthy diets?

In the past, agricultural growth has been strongly associated with significant reductions in rural poverty and undernutrition.<sup>171,204</sup> It was estimated that in 2011, “two-thirds of the 740 million people living in extreme poverty (less than US\$1.90 a day purchasing power parity) were agricultural workers and their dependents”.<sup>19</sup> In the coming decade, policymakers will have to focus even more on rural non-farm employment by investing in technological innovation, infrastructure, education, and credit access, none of which is new, but essential nonetheless. It is estimated that around 730

million new jobs must be created in sub-Saharan Africa by 2050 to keep up with demand linked to rapid population growth.<sup>20</sup>

This is possible for LMICs where “investments to increase agricultural productivity can offset the adverse impacts of climate change and help reduce the share of people at risk of hunger in 2030”.<sup>165</sup> But agricultural productivity growth has been low over many decades in the parts of the world which have the greatest challenges in raising the efficiency of food system functions (see Figure 4.9).

**Figure 4.9: Gains in agricultural total factor productivity varied greatly across countries from 1971 to 2015**



Note: TFP= total factor productivity. Source: World Bank (2019)<sup>188</sup>, original data Source: USDA-ERS (2018)<sup>205</sup>

To turn things around, a possible strategy would be to:

1. Significantly increase funding for public agricultural research and development (R&D), for both essential staples and for a greater diversity of nutrient-rich foods, but also for research that goes beyond commodity traits to include policy and programming impacts on food system functioning, cost-effectiveness analyses, enhanced climate-smart and resilient systems, and approaches to scaling up best practices where win-win opportunities have been empirically documented as success stories;
2. In partnership with commercial interests, facilitate larger investment in public goods that reduce inputs, and the costs of food transportation and marketing;
3. Expand energy and water access, and productivity-enhancing technologies, ensuring their use is to reflect environmental externalities;
4. Facilitate income growth that supports demand-creation via enhanced rural employment within and beyond agriculture (linked to higher value food commodity supply chains), labour productivity gains, and efficient social protection programmes;



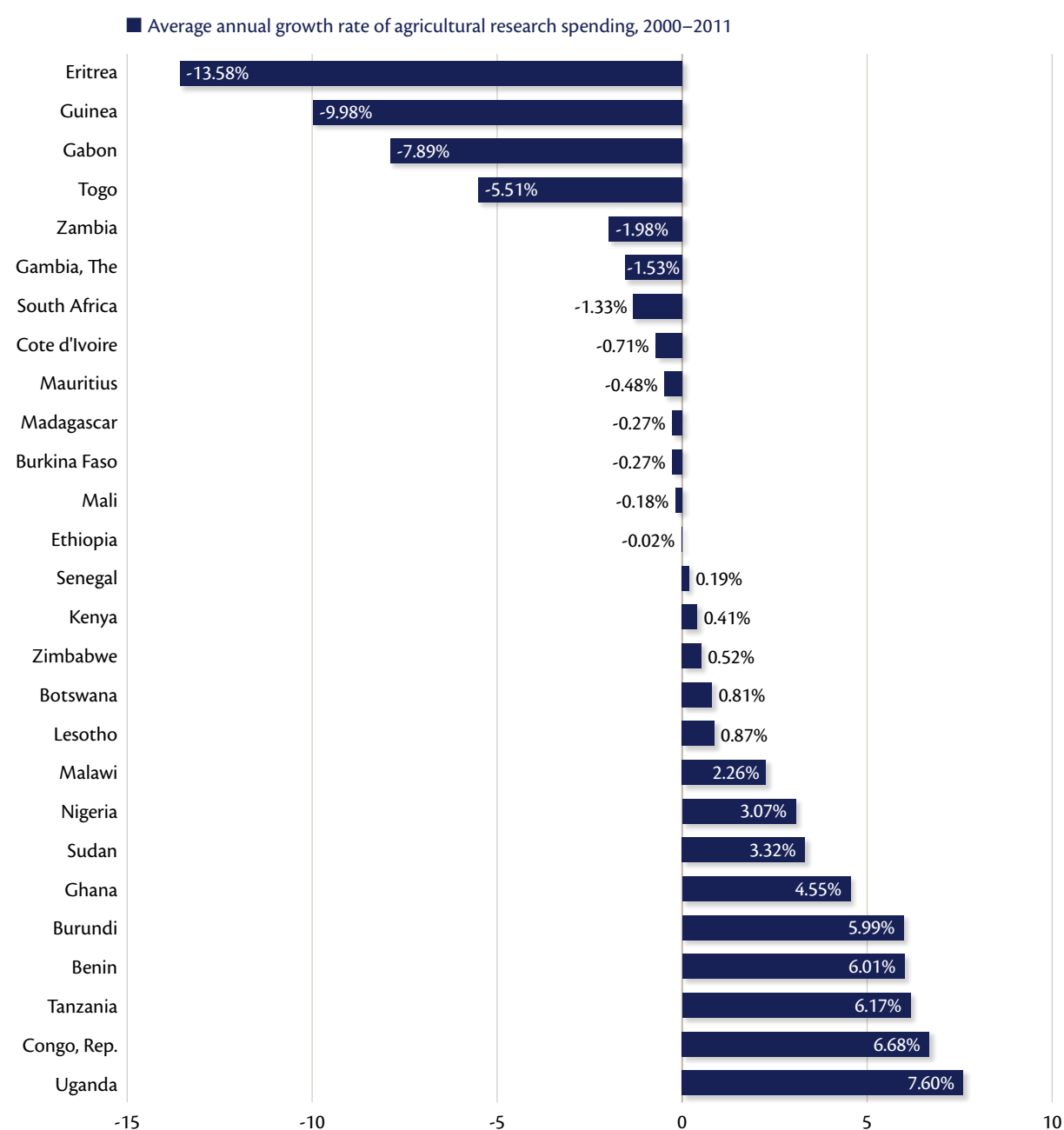
## Box 4.6 continued

5. Promote wide use of promising technologies, including smartphones for information push, digital platforms for accessing new markets, 3D printing, agricultural drones, 'intelligent' materials, vertical agriculture, grey water recycling and more.<sup>164</sup>

This strategy represents an important challenge for parts of sub-Saharan Africa which have struggled to fund public

agricultural investments (see Figure 4.10).<sup>188</sup> But it also presents an opportunity for rapid change, using government investments and a major refocusing of support from development agency partners. Enhancing incomes derived from gains in agriculture and downstream across the food system represents massive potential for pro-poor poverty reduction, particularly in Africa and South Asia in the next two decades.

**Figure 4.10: Half the countries in Africa have zero or negative growth in spending on agriculture R&D, 2000–11**



Source: Goyal and Nash (2017)<sup>206</sup> based on IFPRI Agricultural Science and Technology Indicators data

## 4.4 Three key policy shifts are needed

A food system transition requires many sorts of policy interventions. There is no silver bullet.<sup>207,208</sup> For example, the IPCC's Special Report on Food, Land and Climate, lists 24 policy areas (Table 5.6, p509) from both the demand and supply side that will help shift the system towards increasing sustainability.

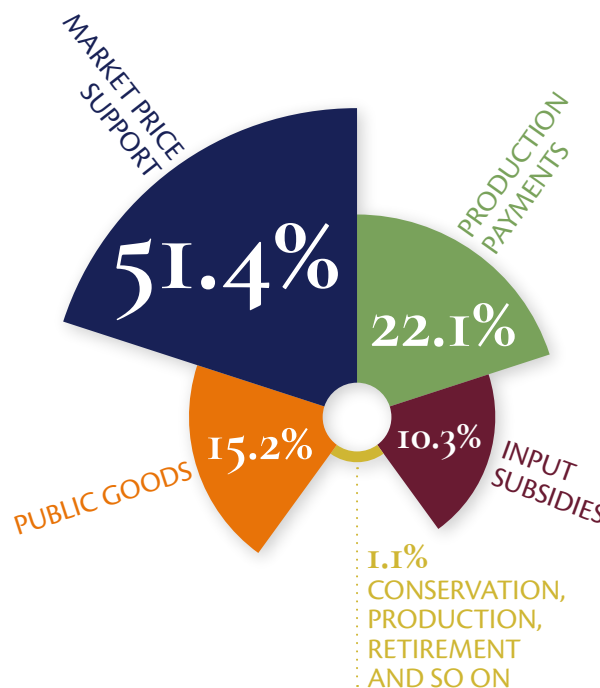
This chapter focuses on the supply or availability of food. Three important routes for decision makers to enable change are: using public support to agriculture and food (subsidies) in new ways; refocusing agricultural research and development funding; and refocusing the incentives applied to food production towards systems that deliver better outcomes for people and the planet. Each of these is discussed in detail below.

### 4.4.1 Rebalance supply-side subsidies to better support nutrient-rich foods as well as grains

The first area for a policy re-focus is public support for commodity production. Currently, more than US\$620 billion is spent globally each year on agricultural subsidies (commodity support, services, etc.).<sup>157</sup> These subsidies include investment in public goods (such as research and advisory services, transport infrastructure, and food safety regulations), as well as subsidies to agricultural producers. Figure 4.11 provides a breakdown of where public agricultural subsidies were targeted across 51 countries in 2015–17, while Box 4.7 offers a World Bank classification of subsidies.

In the past decade, OECD governments were on average allocating roughly 26% of their subsidy support to cereal grains, and 14% to fruits and vegetables. Interestingly, the share of sectoral support to fruits and vegetables was much higher in non-OECD countries at 37%, although the other 63% of subsidy support went to cereals, livestock, oilseeds, sugar, production of fibre (wool) and more.<sup>210</sup> Also, in some countries, such as Egypt, there have been large and often untargeted food subsidies.<sup>211</sup>

**Figure 4.11: Annual average forms of public agricultural support in 51 countries, 2015–17 (%)**



Source: World Bank (2018)<sup>209</sup>

There have been substantial increases in producer subsidies in recent years (see Figure 4.12). According to the World Bank, these subsidies increased from US\$255 billion in 2000–02 to US\$484 billion in 2015–17 in 10 non-OECD (a mix of developing and emerging) economies, largely driven by a 16-fold increase in producer support in China.<sup>209</sup> The remaining nine non-OECD countries included in the analysis also increased their support, from US\$11 billion to US\$24 billion. Unfortunately, producer subsidies often worsen rather than improve GHG emissions, and lead to overuse of fertilisers, and water pollution. In addition, subsidies are often captured by wealthier farmers, as for example in Pakistan and India.<sup>153</sup>

### Box 4.7: Forms of agricultural production subsidies

According to the World Bank,<sup>209</sup> subsidies for agricultural producers fall into three broad categories:

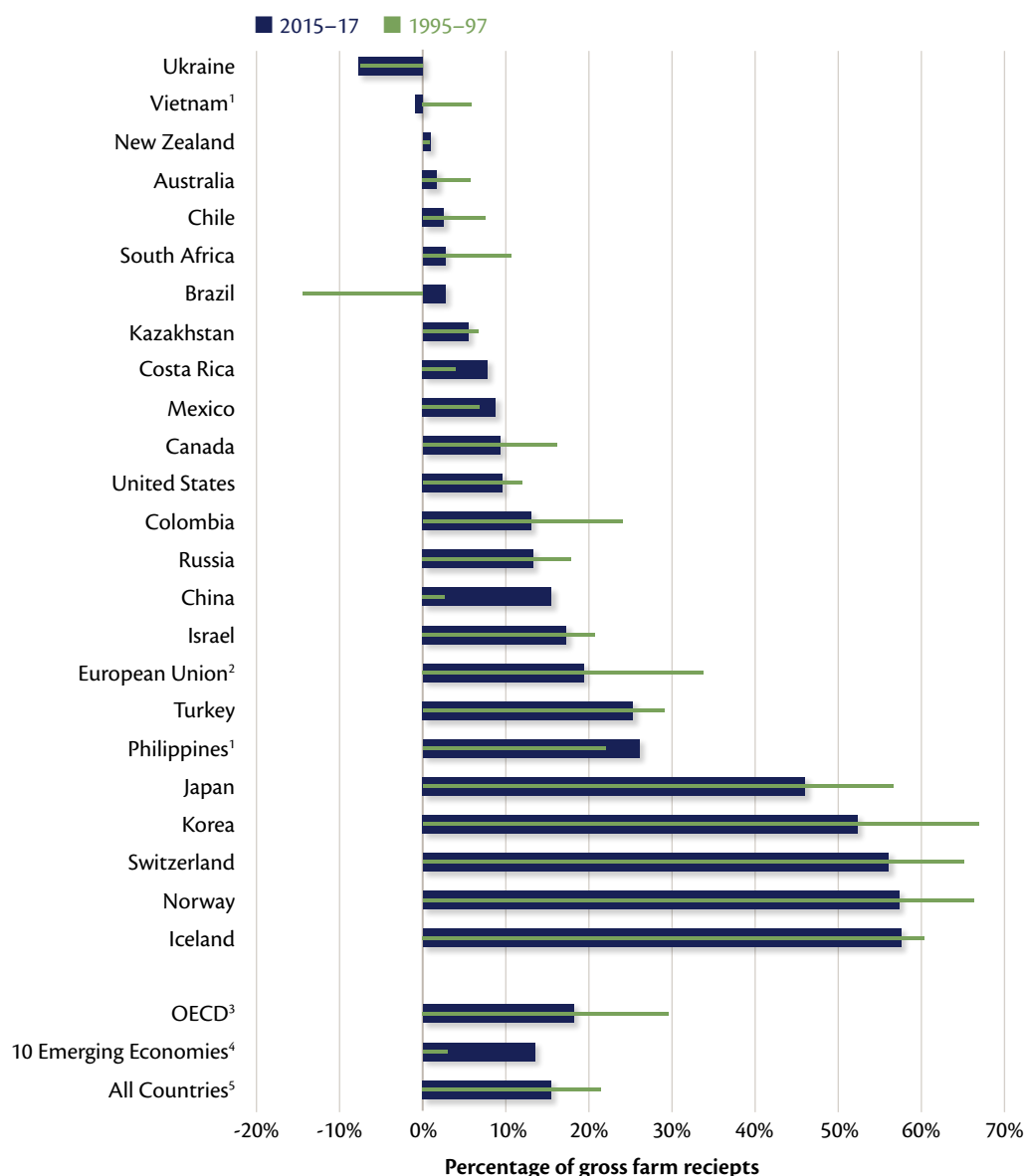
#### 1. Price supports to keep domestic prices for specific outputs higher than equivalent world market prices.

These supports are given directly through public spending for the public procurement of farm outputs, or indirectly through import restrictions and other market barriers that help push producer prices higher. In the case of market barriers, no public expenditures are involved.

**2. Transfers to producers linked to the type of inputs used or agricultural outputs produced.** These subsidies include lowered interest rates on agricultural credit or lowered prices of specific inputs (either variable or fixed capital) such as fertilisers, pesticides, seeds, water, and electricity. Producers can also receive direct payments tied to the production of specific outputs.

**3. Payments to farmers not tied to the outputs produced or inputs used.** This is often referred to as 'decoupled' payments.

**Figure 4.12: Producer support estimate by country: 1995–97 and 2015–17 (percentage of gross farm receipts)**



Notes: Countries are ranked according to the 2015–17 levels.

1. For the Philippines and Viet Nam, 1995–97 is replaced by 2000–02.

2. EU15 for 1995–97 and EU28 for 2015–17.

3. The OECD total does not include the non-OECD EU Member States. The Czech Republic, Estonia, Hungary, Poland, the Slovak Republic and Slovenia are included in the OECD total for both periods and in the EU for 2015–17. Latvia is included in the OECD and in the EU only for 2015–17.

4. The 10 Emerging Economies are Brazil, China, Colombia, Costa Rica, Kazakhstan, the Philippines, Russian Federation, South Africa, Ukraine and Viet Nam. The Philippines and Viet Nam are included only for 2015–17. Indonesia is not included in this report.

5. The All countries total includes all OECD countries, non-OECD EU Member States, and the 10 Emerging Economies.

Source: OECD (2018)<sup>212</sup>

“There is substantial potential to redirect farm support toward climate change mitigation. Redirect funding to focus on mitigation, including measures that increase efficiency in the use of natural resources”

Searchinger et al. (2020) World Bank.<sup>214</sup>

The various forms of subsidy mentioned keep staple grain supplies and relative prices out of balance with the food patterns needed to support sustainable, healthy diets. Also, while some subsidies are aimed at farm-based actions that support ecological requirements (such as land set-aside, longer fallow, tree-planting), practically none are aimed at supporting healthy diets. For example, 25% of the European Union’s €60 billion annual agricultural subsidies are

dedicated to promoting public goods (primarily in terms of multi-use landscapes), but there are none which focus on how health or nutrition outcomes can be improved.<sup>213</sup>

This situation suggests that the realignment of subsidies presents a major opportunity for policymakers. Even a relatively modest repurposing of subsidies (say, 25%) towards promoting the production of nutrient-rich perishable foods and the reduction of food loss and nutrient waste would amount to US\$150 billion in capital to support the generating of more nutrient-rich foods. New scenario modelling commissioned by this project has demonstrated striking benefits which could result from realigning subsidies – in terms of GDP, health, and environmental impacts – although this work has also highlighted trade-offs that would need to be managed (see Box 4.8). It was recently argued by the World Bank that “because of the importance of this redirection of support for whether countries achieve climate goals, and because of the need for international cooperation to push needed innovations, global action is required”.<sup>214</sup>



## Box 4.8: Scenarios for rebalancing subsidies: preliminary insights from modelling scenarios

An analysis commissioned for this report modelled a range of scenarios pertinent to the goal of repurposing domestic agriculture sector production subsidies (US\$211 billion in 2011) towards supporting more sustainable, healthy diets.<sup>210</sup> The scenarios include:

1. removal of all agriculture sector subsidies by 2030,
2. 50% redirection of those subsidies (at current levels) towards fruits and vegetables, and
3. 100% redirection of subsidies to fruits and vegetables.

Outcomes of interest were economic impacts, human health, and environmental impacts.

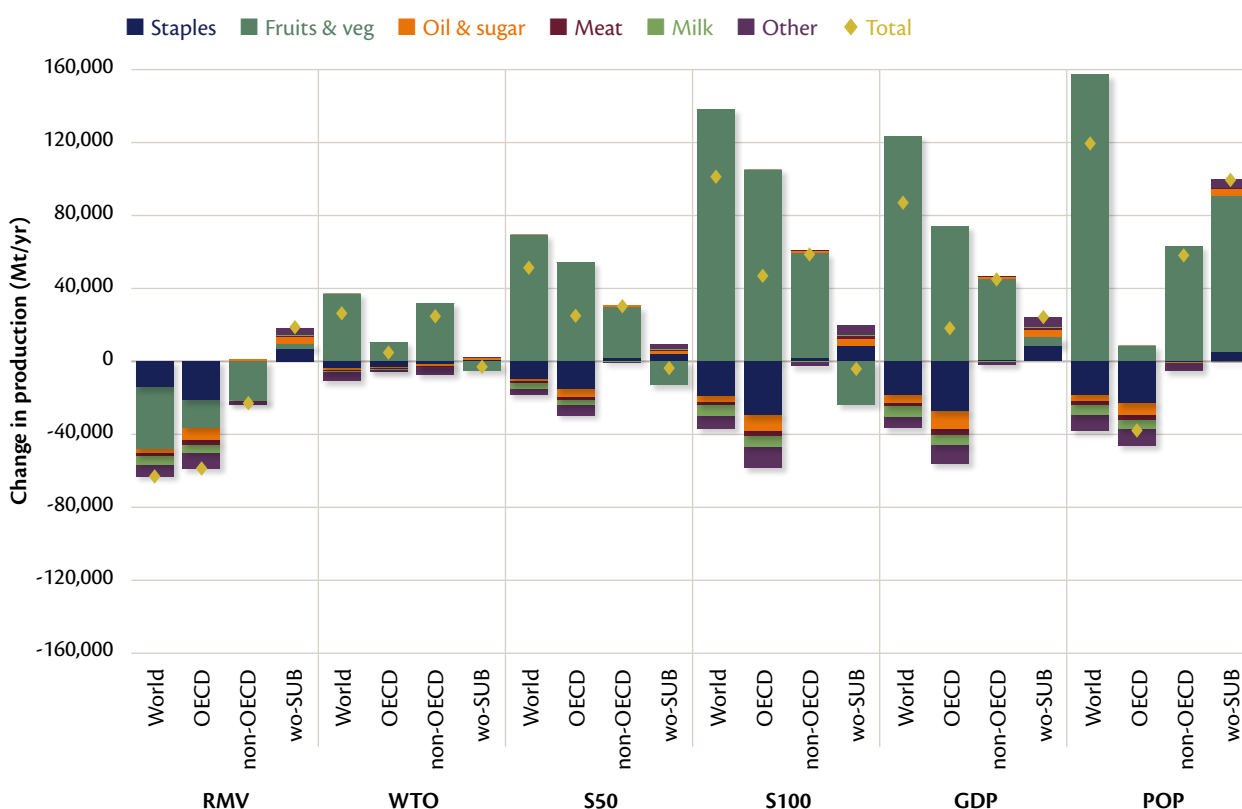
**Implications for food production patterns:** A 100% removal of subsidies led to lowered global output. The fall was particularly large for highly subsidised commodities in OECD countries, such as grains and oilseeds, but also for fruits and vegetables in OECD and non-OECD countries alike (see Figure 4.13). Parts of the world with no subsidies to remove increased domestic production to compensate, but their output could not make up for overall losses, resulting in a net decline in supply. This suggests that subsidies continue to play an important role in stimulating food production.

**Macroeconomic impacts:** Complete removal of agricultural subsidies increased economic output, measured as change

in gross domestic product (GDP), by US\$1.5 trillion, which suggests that not all subsidy investments have high economic returns. A 50% reallocation of subsidies towards fruits and vegetables would have a positive global GDP return of US\$3.3 billion, but a 100% redirection to fruits and vegetables would result in a global net loss of US\$8.7 billion, in large part because the other profitable commodities would lose out. This underscores that careful analysis is needed to determine net outcomes when considering how subsidies are allocated.

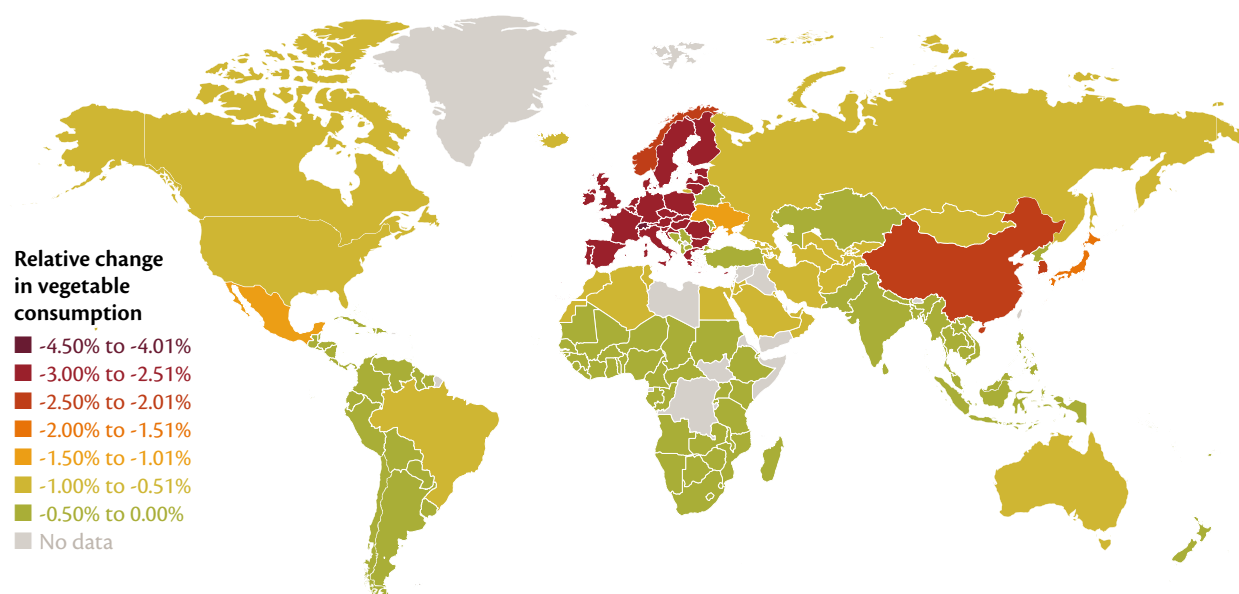


Figure 4.13: Changes in production across regions and agricultural reform scenarios



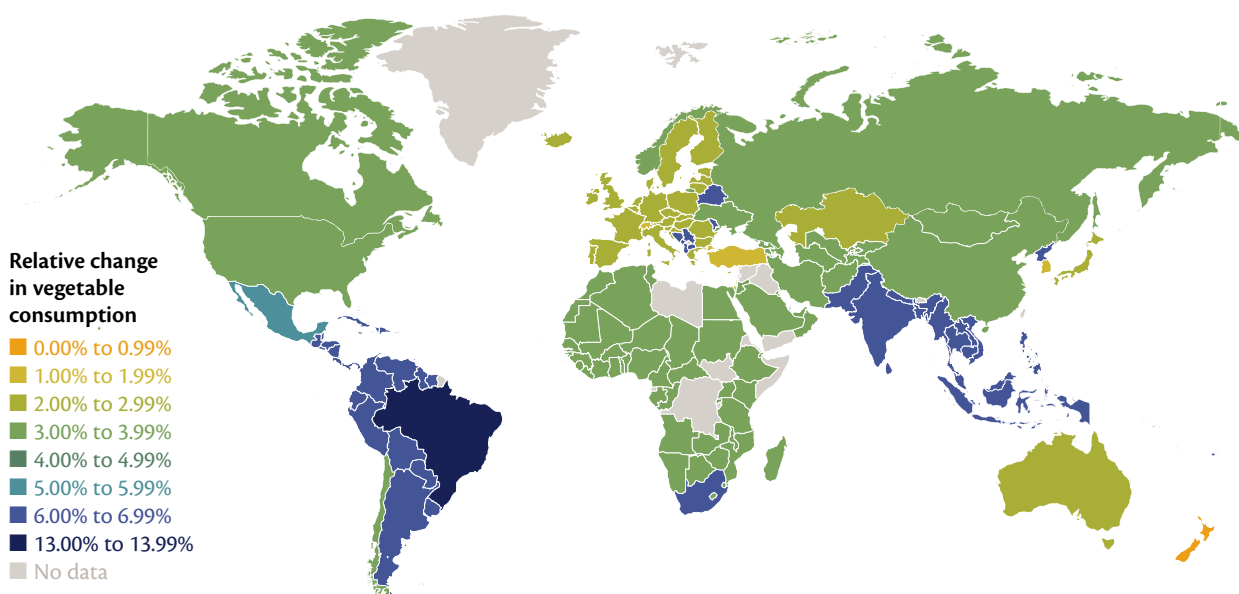
Source: Freund and Springmann (2020)<sup>210</sup>

Figure 4.14: Consumption of vegetables after 100% removal of subsidies



Source: Freund and Springmann (2020)<sup>210</sup>

Figure 4.15: Increase in vegetable consumption in production subsidised at rate relative to population



Source: Freund and Springmann (2020)<sup>210</sup>

**Food consumption patterns:** Because of the net production loss associated with 100% subsidy removal, intake of all nutrient-rich foods would also fall in that scenario, with predictable health outcomes. Figure 4.14 shows the relative decline in vegetable consumption linked to 100% removal, the greatest impacts being seen in Europe and China, but felt

across the world. By contrast, a 50% or 100% reallocation of subsidies to nutrient-rich foods would see their consumption rise, highest in OECD and middle-income non-OECD countries, and much less in low-income nations which do not currently subsidise domestic production. Figure 4.15 shows that if nations were subsidising vegetable production

## Box 4.8 continued

at rates relative to the size of their population (the POP scenario), then low- and middle-income countries would see their intake of vegetables rise.

**Human health:** Removal of all agricultural subsidies was associated in the models with an increase of 140,000 diet-related deaths, representing an increase in mortality of 0.3% on average. Most of this was due to reduced supply and intake of vegetables and fruits, nuts and seeds and pulses. Thus, simply taking away subsidies on the grounds of economic gain would not help from a nutrition or health perspective. But repurposing half or all subsidies led to almost 600,000 fewer diet-related deaths per year. Premature mortality was reduced by up to 2.1% in the OECD, 1.6% in non-OECD countries with subsidies, and by 0.2% in countries without subsidies.

**Environmental impacts:** The picture here is mixed depending on whether GHG emissions, or demand on freshwater, nitrogen and phosphorous are considered. (see Figure 4.16). Removing all subsidies is associated in the models with moderate falls in GHGs and in some environmental resource demand (particularly with reduced need for nitrogen and phosphorous fertilizers) in OECD and non-OECD countries (of 1.5-2.0% and 0.1-0.8%, respectively), but with increases in regions without agricultural current subsidies (of 0.4-0.6%). Repurposing subsidies leads to similar reductions in GHG emissions when 50% or 100% is allocated to nutrition-sensitive crops. But repurposing of subsidies leads to much higher water use, mainly in non-OECD and non-subsidy countries, as well as in higher demand for other environmental resources.

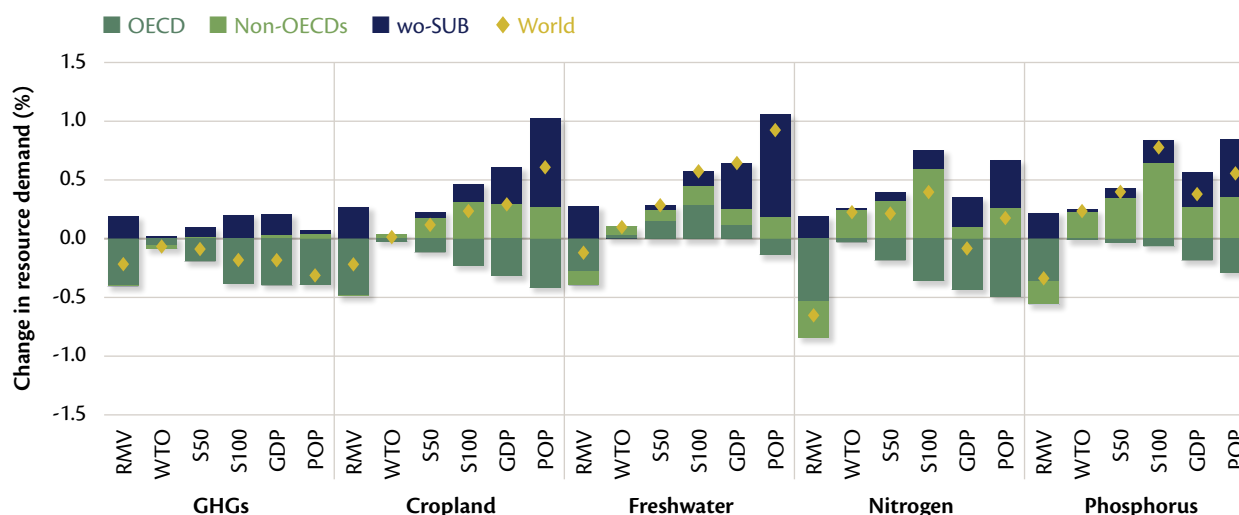
More refined modelling of regional and global trade dynamics and efficiency gains (in the use of environmental

resources and GHG emission reductions) holds considerable potential to shed light on the positives and negatives associated with sets of policy choices both locally and globally. Importantly, this modelling highlights the importance of considering a) net effects across nations, food commodities, and various outcomes, but also b) how domestic food policy changes may have unintended effects globally or for other countries.

### Scenarios considered:

- 1. Removal of subsidy payments (RMV):** All subsidy payments are removed
- 2. Repurpose subsidy payments (\$25...\$100):** Different shares of the overall subsidy budget are redirected to low-emitting and nutrition-sensitive food commodities (vegetables, fruits, pulses, and nuts) in a budget neutral manner.
- 3. Repurpose subsidy payments according to WTO provisions (WTO):** Subsidies are repurposed towards nutrition-sensitive and low-emitting food commodities up to the limit allowed by the WTO's de-minimis provisions.
- 4. Repurpose subsidy payments and redirect them globally (GDP, POP):** Scenarios 2-3 assume constant overall subsidy budgets in countries that have a subsidy scheme. However, not all countries use subsidies. Scenario 4 models a more equal distribution of subsidies globally. To do this, subsidy budgets were maintained at 2011 levels, but allocated across all countries according to either their GDP or population share to support domestic production of nutrition-sensitive and low-emitting foods.

Figure 4.16: Change in resource demand in response to scenarios



Source: Freund and Springmann (2020)<sup>210</sup>



## “ The world probably devotes only around 1.4–1.7% of agricultural GDP to agricultural R&D ”

Searchinger et al. (2018)<sup>19</sup>

In summary, to ensure a much greater sustainable supply of nutrient-rich foods, national and global subsidy flows need to be rebalanced in the following ways:

- Broaden the policy priorities and investments from the current primary focus on staple grains, livestock, and cash crop commodities (such as cotton and sugar);
- Focus on a greater diversity of nutrient-rich foods, which will be in much higher demand in coming decades;
- Focus on sustainable production, notably through efficiency gains across all forms and scales of production, reduced exploitation of natural resources (land and water in particular), reduced food loss in and around the farm, and lowered greenhouse gas emissions.

### 4.4.2 Rebalance agricultural research and development to deliver better outcomes (R&D)

Beyond supply-side subsidies, the second area for a policy refocus is agricultural research and development. Agricultural R&D (public and private) has a key role to play in developing innovations although currently that potential is not being fully exploited. In LMICs, as the World Bank has pointed out, Africa's R&D systems are “underinvested, highly fragmented, and subject to volatile funding from governments and especially donors.”<sup>215</sup> But the situation in higher-income settings is also less than optimal. Research from the World Bank shows that in OECD countries, as well as in several big agricultural producing middle-income countries (such as China, Brazil, and the Russian Federation), only 6% of public sector support to the agricultural sector is dedicated to research, including education and technical assistance.<sup>214</sup> While it may not be possible to increase funding for research, particularly in resource-constrained countries, there is considerable scope to increase both the quantity (funding levels) and quality (focus relative to need) of food-related research.

For example, as mentioned above, most public sector agriculture research investments today focus primarily on improving productivity in a small handful of staple crops. A narrow focus by donor agencies and national agriculture sectors on productivity improvement fails to tackle wider strategic issues of what should be grown, by whom and in what ways. Furthermore, it tends to lead to relatively incremental changes (gains in agricultural efficiency) rather than fundamental transformation.<sup>216</sup> More focus is needed in agricultural research (including reprioritisation of donor funding for relevant R&D) to deliver healthy diets grown sustainably. This will be particularly important in terms of

support for domestic R&D in LMICs. For such countries, the imbalance of public agriculture research between cereals on the one hand, and fruits and vegetables on the other, is particularly stark, whereas it is less so in high-income settings.<sup>217</sup>

Staple grains have been, are, and will be key elements of people's diets around the world, and will remain important for global food security. Research on staples remains important, particularly through the lens of increasing the sustainability of their production and yield stability in the face of climate change. But all donor agencies and national research programmes relating to food systems must pursue a shift from focusing on staple commodities toward food system-wide challenges.

Three areas where agricultural R&D could be refocused are discussed below: sustainability; increasing diversity and production of nutrition-providing foods; and ensuring the gap between innovation and uptake at scale is bridged.

#### 4.4.2.1 R&D to drive food system sustainability.

To fully deliver on sustainable intensification (Section 4.3) requires going beyond the incremental gains arising from efficiency improvements (doing ‘more with less’). Substitution of one practice with one that is less damaging can be insufficient to transform the farming system to work with nature, instead of against it.<sup>186</sup> This is because reducing the rate at which intensive agriculture may harm the environment, through increasing efficiency, does not solve the problem.

Sustainable productivity gains imply that more output is produced with a lower use of agrochemicals and scarce natural resources. This needs to be reflected in the types of technologies fostered. Natural resource management (NRM) – including longer crop rotations, conservation agriculture, agroforestry systems, integrated pest management, agroecological intensification, and other agronomic innovations – need to play an important role.<sup>218</sup>

A key research need is for greater focus on diverse farming systems, rather than individual crops: circular agriculture to prevent waste and nutrient leakage, agroecological systems, complex rotations, mixed farming and so on. Compared to ‘conventional’ agriculture, the amount of money invested in other farming systems is very small, and often focused on a small number of approaches (e.g. organic).<sup>219</sup> Too little money has been invested in finding ways to maximise the outputs in diversified, small-scale, and agroecological systems which can produce a wider range of nutrient-rich foods in a more sustainable way (including supporting livelihoods) than broad-scale agricultural monocropping.

From a broader sustainability perspective, a greater focus is required on landscape-level outcomes for the delivery of ecosystem services (clean air, water, biodiversity, fuel, fibre and food; as well as preservation of culturally important landscapes and their heterogeneity).<sup>220,221</sup> Current applications of research funding will not deliver the knowledge and products required to support sustainable, healthy diets in coming years. The funding has to be better aligned with these new planet-wide goals.

### Box 4.9: Seed systems research: a target for reform in Africa

While R&D by commercial seed companies has expanded in many parts of Eastern and Southern Africa and in Nigeria, the focus is quite narrowly on hybrid maize. This needs to change significantly if non-staple food production and marketing is to accelerate. There is a good case for many African countries to update outdated seed safety laws to encourage investment in areas beyond staples.

Seed regulators have a key role to play. Effective institutional management of the quality of seeds, young fish stock and breeding livestock is a crucial component of high-performance agricultural systems that generate high-quality food products. KEPHIS in Kenya is a good example of a strong regulatory body supporting quality in the seed system. Many others would benefit from being substantially strengthened.

supply and profitability of the production of these foods, while also raising labour demand.

Research that boosts the micronutrient content of staple grains, beans or tubers (biofortification) can also be a cost-effective strategy for helping deliver nutrients to nutritionally vulnerable individuals.<sup>222,223</sup> Once developed and if widely disseminated, some biofortified crops can be multiplied by rural households without additional costs. Hence, biofortification can be a viable medium-term strategy to complement dietary diversification programmes and other types of micronutrient interventions.<sup>224</sup> However, this represents a substitution step rather than a redesign.

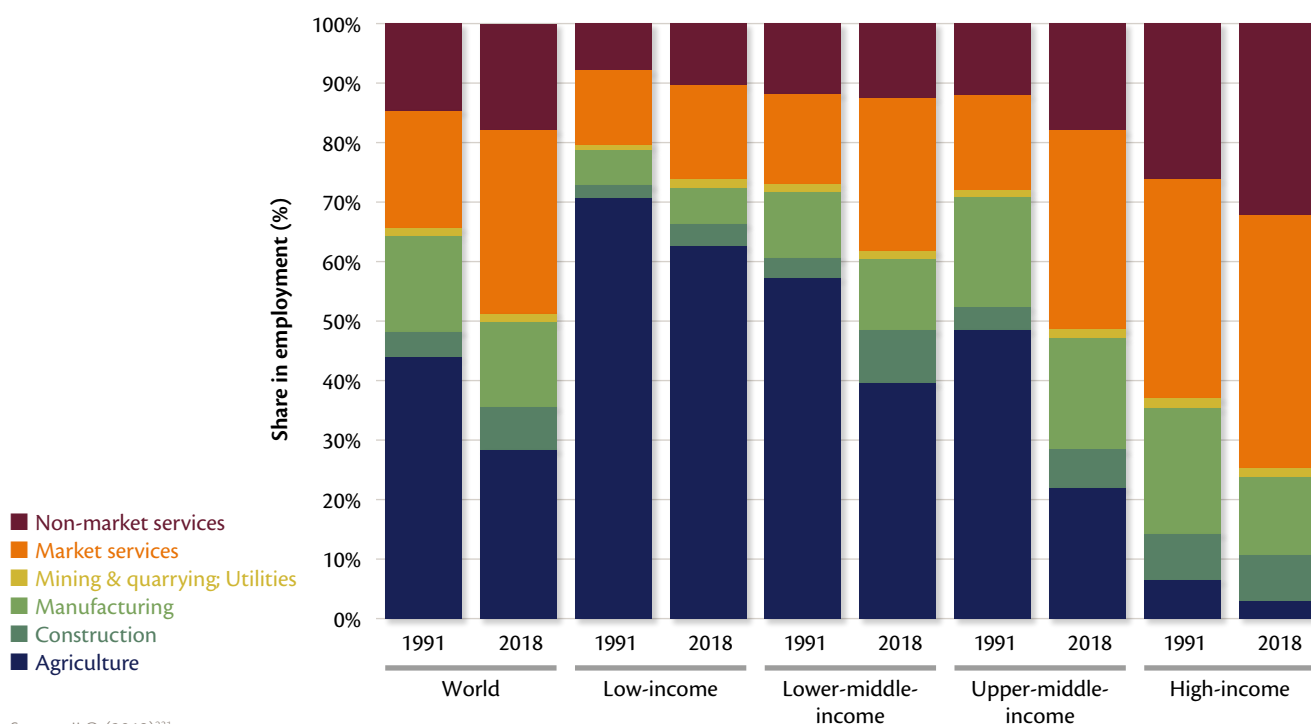
Investing more into research for, and production of, a wide range of micronutrient-rich foods (e.g. fruits, vegetables, pulses, fish etc.) will help to incentivise production of relevant crops and appropriate animal-sourced foods, and also help to increase their affordability. It may also have implications for seed regulatory agencies that have tended to focus on cereals (see Box 4.9). It may also involve confronting important constituencies, such as traditional grain marketing boards and associations, which have in the past ensured that most public investment was channelled towards cereals. Indeed, powerful actors across the food system often pull in different directions, motivated by factors unrelated to health or food system sustainability. These power relations between different actors in the food system matter hugely, and negotiated policy solutions will need to identify and harness common benefits and common ground.

<sup>viii</sup> Traditional cultivars that have largely been ignored by science due to having relatively low potential for yield growth under conventional production technologies and under previous market conditions.

### 4.4.2.2 Promoting the production of micronutrient-rich foods

Any move towards a healthy diet for all requires significantly more policy attention and investment in the supply of a diversity of safe foods that provide important quantities of vitamins and minerals. This requires support for enhancing outputs of nutrient-dense fruits, vegetables, nuts, seeds and pulses, including orphan crops<sup>viii</sup>, knowledge and extension, market investments (to reduce food loss), and education. These can all combine to increase the

Figure 4.17: Employment by sector (1991 and 2018)



Source: ILO (2019)<sup>231</sup>

### Box 4.10: Ethiopia: a particular success story

Government support for agriculture in Ethiopia illustrates the benefits that can flow from well-judged policies. A concerted policy of agriculture-led growth has been highly successful in raising not just yields but also the number of jobs in agriculture and its output (in terms of agricultural GDP per worker).<sup>188</sup>

**Table 4.1: Impacts of agricultural and economic growth in Ethiopia**

Indicator	2001	2015
Cereal yield (tons/hectare)	1.12	2.56
Agricultural GDP/worker (2010 US\$)	\$333	\$538
Agricultural employment (million)	22.6	32.3
Poverty rate (share of population earning <\$1.90/day)	61.2% (1999)	27.3%

Source: Fuglie et al. (2019)<sup>188</sup>

One example of promoting research diversification is the Rice Tariffication Bill adopted by the Philippines in 2019. This replaced long-standing quantity-based import quotas for rice, with flexibility for any importer to secure rice if they meet minimum quality standards.<sup>225</sup> Some of the government revenue from this scheme is intended to support cropping diversification among locally affected rice farmers, contributing to more diverse food systems and diets.

#### 4.4.2.3 Bridging gaps between technology innovation and farmer adoption

Simple-to-use technologies that increase farmers' yields and profits are often adopted rapidly. More complex approaches that may have longer-term benefits but do not necessarily increase farm profits immediately are often adopted much less rapidly without specific extension and training efforts.<sup>226</sup>

Examples are natural resource management practices (including approaches such as conservation agriculture) tailored to location, which can improve the nutrient content of crops, but not necessarily raise crop or livestock yields in the short term, leading to low rates of uptake. Recent studies have shown that well-designed extension approaches that combine agricultural training with nutrition and health training, and market linkage support, can significantly increase the adoption of complex technologies by smallholder farmers.<sup>227–229</sup> More enhanced approaches to farm extension are needed, both face-to-face and using digital or cellular platforms. Other approaches include using wider ecosystem service provision to create a market that pays farmers to take up beneficial approaches: for example, hydro-companies paying farmers for better soil management to prevent sediment off-flow that can silt-up power stations.<sup>230</sup>

#### 4.4.3 Rebalancing the incentives supporting food production

The third area where policymakers can create a new focus that will aid the transition beyond R&D and subsidies, is to develop value-added production systems for high quality foods to realise

considerable employment opportunities, as well as a cascade of other benefits. Rebalancing in this case means increasing the focus of food production towards generating universal access to sustainable, healthy diets as the top priority, rather than just on traditional goals of producing ever-higher volumes of cheap food, or earning foreign exchange from commodity exports.

Across the world, but especially in high-income countries, the food system is the largest employment sector – as there are many employment possibilities in production, processing, manufacturing and retailing of foods, as well as services, including hospitality (see Figure 4.17).<sup>232</sup> The challenge for high-income economies is to align these high-employment value chains to deliver more nutrient-rich food products, produced through sustainable farming methods. In lower-income countries, the development of food and agricultural systems has the potential to contribute very substantially to employment opportunities, and the economic prosperity of individuals and countries – far beyond the dual objectives of ensuring healthy and sustainable diets.

For example, in West Africa, the food system accounts for 66% of total employment (82 million jobs as of 2017). Roughly 78% (64 million jobs) are in agriculture itself, 15% (12 million) in food marketing and 5% (four million) in food processing.<sup>233</sup> This constitutes an important opportunity for countries in Africa with rapidly growing populations. Estimates from the International Labour Organisation project that there will be 283 million young people aged 15–24 years in sub-Saharan Africa by 2030, an increase of approximately 100 million from 2015.<sup>234</sup> The overall working age population (15–64 years old) in Africa is expected to increase by 805 million between 2020 and 2050, representing 76% of the expected global increase.<sup>235</sup>

The potential benefits are massive. By 2100, it is estimated that sub-Saharan Africa and Asia will be home to roughly nine billion people (of the world's then total of 11 billion).<sup>237</sup> The World Bank has argued that Africa earns roughly 25% of its annual economic growth from agriculture but “if matched with more



## “ Since almost all new jobs in Africa today are in agriculture and microenterprises, improving the business environment in these sectors is a high priority. ”

World Economic Forum (2017)<sup>236</sup>

electricity and irrigation, smart business and trade policies and a dynamic private agribusiness sector that works side by side with government to link farmers with consumers in an increasingly urbanised Africa, [...] agriculture and agribusiness together could command a US\$ 1 trillion presence in Africa's regional economy by 2030<sup>215</sup> (up from US\$313 billion in 2010).

The benefits to employment incomes of successful agricultural policies will also cause a cascade of wider benefits (see an example in Box 4.10). Higher GDP growth will open a range of opportunities in diverse areas of public spending including healthcare, education, and infrastructure development. The result would be to fuel virtuous cycles of growth and development. There are benefits to incomes and livelihoods through engagement in agriculture and food systems more generally.<sup>238</sup> Moreover, there is strong evidence that the income effects of appropriate investments in agricultural growth in the decades ahead will continue to be “an important driver of poverty reduction in South Asia and especially in sub-Saharan Africa”<sup>238</sup> (see Box 4.10).

Whilst to date, there are examples (as in Box 4.10) of successfully promoting poverty reduction through improved productivity, the need is increasingly to target the productivity growth of a range of nutrient-rich foods, produced sustainably. To secure the greatest growth in incomes and salaried employment across food systems, policymakers will need to take a broad view of where to act. It will be important to look for new opportunities right across food systems, including those which help incentivise demand growth for nutrient-rich foods rather than calorie-dense, ultra-processed foods. Tomorrow's workforce also needs to be prepared so that it is well-placed to capitalise on new and emerging opportunities, not just in agriculture, but also in the various links along value chains all the way to retail and food services. Today, many food producers, particularly in LMICs, are also food insecure, burdened by high levels of malnutrition, and at high risk of climate-related shocks. This underlines the importance during a transition to protect and enhance the ability of these smallholders to contribute effectively to food system change. It requires an extension of appropriately designed and appropriately funded, effective social protection interventions (including the persistence and strengthening of those only brought in as a response to the coronavirus pandemic).<sup>239</sup>

The same is true at the level of small- and medium-sized enterprises (SMEs) working in the food system, which have been severely affected during the coronavirus pandemic.<sup>240</sup> All have a part to play, from the smallest producers to larger-scale operations which may generate high-value commodities and support for export earnings. In the latter case, for example, it will be

particularly important to facilitate access to productive credit and direct investment, and enhance market access (see Chapter 5).

For public and private sectors to work together to optimise employment opportunities across a food system which is transitioning will require specific employment policies. These will need to target potential constraints through the development of many kinds of skills, knowledge, and finance, particularly among youth and women. Most countries lack an integrated strategy which supports job opportunities and income growth across food systems, which means that they are less able to support SMEs and larger public-funded institutions with appropriate fiscal policies, entrepreneurship services, training and nurturing health and safety regulation.

Improving working conditions across food system employers, matters in the context of widespread child labour, gender and age inequalities, poor enforcement of labour laws and a lack of support for workers' organisations.<sup>20</sup> In other words, addressing both the quantity and quality of jobs in the food systems will deliver valuable gains for governments and private industry, contributing hugely to economic growth, including a reduction in poverty and income inequality, with significant spill-overs for the rest of the economy and society.

In sum, food systems must be transitioned in ways so that what is grown, and how it is grown, are focused on supporting sustainable, healthy diets while enhancing the productivity and economic efficiency of all food system operations. Also, the redesign needs to be driven by realignment of subsidy supports for agriculture, and R&D investments refocused on food system challenge. These need to include how to overcome constraints to the provisioning of markets year-round with a diversity of safe nutrient-rich foods, and modernisation of value chains in ways that better link demand to supply via innovations of all kinds.



### Box 4.11: Pathways to multiple ‘wins’: Great Green Wall for the Sahara and Sahel<sup>241</sup>

This visionary project of the African Union is a continental-wide initiative to halt desertification and land degradation in a belt of land averaging 15km in width, stretching from Senegal in the West right across to Eritrea, Ethiopia and Djibouti in the East (see Figure 4.18).

It is a US\$1.1 billion program funded in part by the World Bank and the Global Environment Facility, involving numerous African countries and a host of international partners including the FAO, the UN, and the European Union. Once complete, the Great Green Wall will be the largest living structure on the planet, three times the size of the Great Barrier Reef. To do this, improved water management is needed through water harvesting, micro-irrigation and the reduction of runoff.<sup>242</sup>

The project aims to halt further desertification, and secure food reserves – thereby addressing food insecurity. In 2017 in the Horn of Africa alone, 20 million people were declared on the verge of starvation following severe drought and food

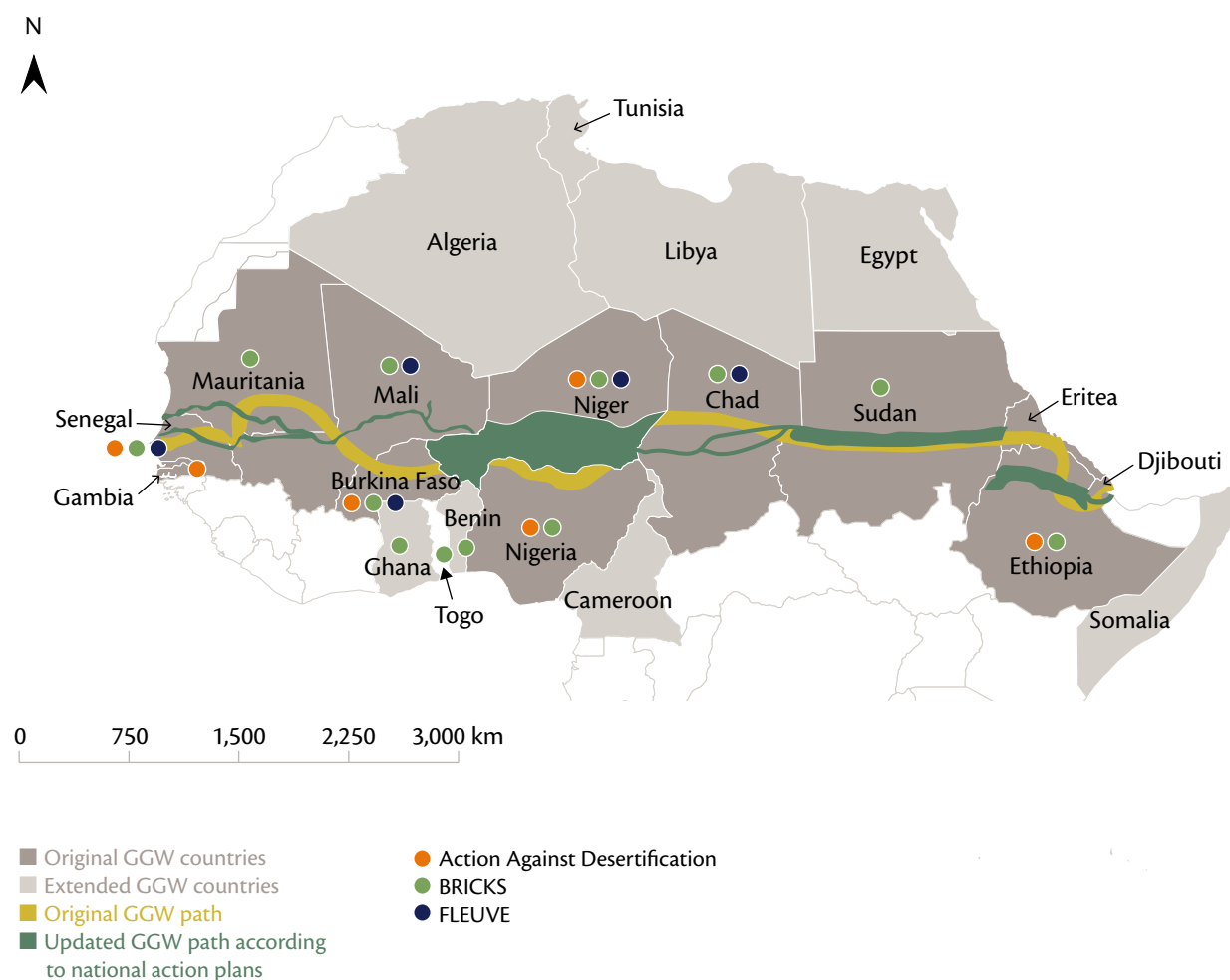
crisis. However, its benefits go much further. It aims to improve the health and livelihoods of those communities in its vicinity, create employment, and work against the threats of conflict and outmigration. It has been seen as a ‘game changer’ for the region.<sup>243</sup> Overall, it contributes to an estimated 15 of the 17 Sustainable Development Goals.

Already approximately 15% completed, its results to date include:

- Nigeria: five million hectares of degraded land restored;
- Niger: five million hectares of degraded land restored, yielding an extra 500,000 tonnes of grain a year – enough for 2.5 million people;
- Ethiopia: 15 million hectares of degraded land restored.

Looking to 2030, the Wall aims to restore 100 million hectares of degraded land, and sequester 250 million tonnes of carbon. Importantly, it will also create 10 million much needed jobs in rural areas – the Sahel’s population of 100 million is projected to rise to 340 million by 2050.

**Figure 4.18: The path of the Great Green Wall, including extensions**



Source: Goffner (2019)<sup>243</sup>







# 5 Making sustainable, healthy diets accessible to all:

markets, trade and protecting the foods already produced

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# Key messages

Year-round access to sustainable, healthy diets means all consumers being able to obtain the nutrient-rich foods needed to maintain an active healthy life. Since most citizens around the world do not produce what they eat, policy instruments relating to markets and cross-border food trade, as well as reduction of food loss and waste, are of growing importance for governments seeking to support healthy diets. Specific actions include:

- 1. Using trade policy levers more effectively to achieve the goal of sustainable, healthy diets.** While not usually designed to achieve health, nutrition, or environmental goals, trade mechanisms present a substantial opportunity. Many instruments relating to trade can help shift the menu of foods available domestically as well as their relative prices, including formal trade agreements, appropriate tariffs, and food safety regulations.
- 2. Resisting the imposition of export restrictions at times of sharp**

**food price spikes. Governments should instead be lowering tariffs and Value Added Tax (VAT) to encourage trade flows.**

Protectionist trade policies are increasingly acknowledged to have serious consequences for food and nutrition security. Food trade helps manage price volatility and risks stemming from financial crises, pandemics or shocks associated with climate change. The export of nutrient-rich foods is not necessarily undesirable and should be considered in the overall context of the nutrient value and affordability of foods available to domestic consumers via own production and imports.

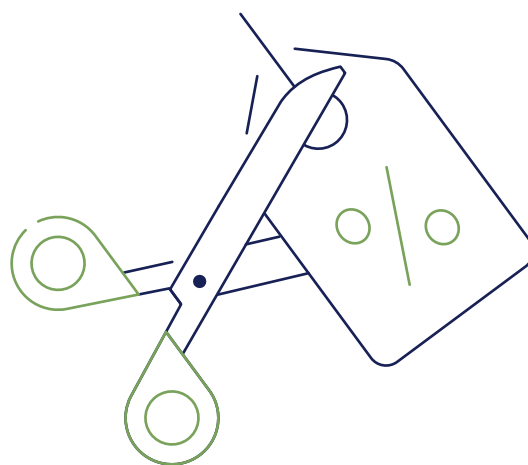
- 3. Supporting investments in the infrastructure needed to optimise food value chains.** Strategies will be needed to 'feed the cities', especially where urban populations continue to grow relative to rural settings. Substantial investments in infrastructure will be important to move food (particularly perishable

nutrient-rich foods) from rural to urban markets.

- 4. Generating employment across the food system beyond agriculture.** Adding value to food through processing, packaging, and handling is a major potential source of job creation in rural economies in LMICs, and Africa in particular. It is also crucial for developing manufacturing sectors, as well as helping to make nutrient-rich foods available at locations more distant from their place of production.
- 5. Significantly reducing loss and waste to preserve nutrients in the value chain.** Nutrients need to be retained in the food system for consumers to benefit. There is a wealth of potential innovations to be drawn upon by actors throughout the food chain. But the choice of where to act needs to take careful account of where in the food chain most losses of nutrients occur.



The foods needed for sustainable, healthy diets must be **accessible** to all people



The new African Continental Free Trade Area (AfCFTA) aims to remove tariffs from **90%** of goods



**It is not enough for the world to produce the foods needed for sustainable, healthy diets. Those foods must be accessible to all people, which means bridging the distance between producers and consumers through markets and trade. A range of actions are also needed to protect nutrients as they move across the food system, including measures to significantly cut food loss and waste. Investment in the value chain beyond production will create multiple additional benefits, including the creation of high-quality jobs, business opportunities to add value to food products, and growth in the technology sector through promoting technological innovation. Reducing food loss and waste will also help environmental sustainability in the food system by limiting the need to ‘grow food twice’.**



## 5.1 The importance of markets and trade for sustainable, healthy diets

Since most people around the world do not produce the food they eat, local and global trade will remain important for moving food from where it is produced to where it can be consumed. Moving food across borders enables hundreds of millions of people to eat foods not grown in their own countries or regions.<sup>244</sup> For example, in Kenya and Zimbabwe, maize is an important source of calories. While attempts are being made to enhance domestic productivity in maize, both countries depend on imports for roughly 27% of their domestic maize needs. This is feasible when regional and global supply is high and prices are relatively low, but becomes a challenge when supply dwindles and prices rise sharply.<sup>245</sup> A more extreme example is Singapore, which was listed as the world's most food secure country in 2018 despite importing over 90% of its food that year.<sup>246</sup>

International trade in food is also essential to support access to food-based nutrients not available within a particular country.<sup>247</sup> It follows therefore that policy instruments relating to markets and cross-border food trade must be critically important for governments that seek to enhance diets for all individuals.<sup>247</sup> This includes active negotiation of trade agreements, use of appropriate tariffs, ensuring adherence to food safety regulations, and maintaining commitments made to unrestricted flows of commodities during times of crisis.

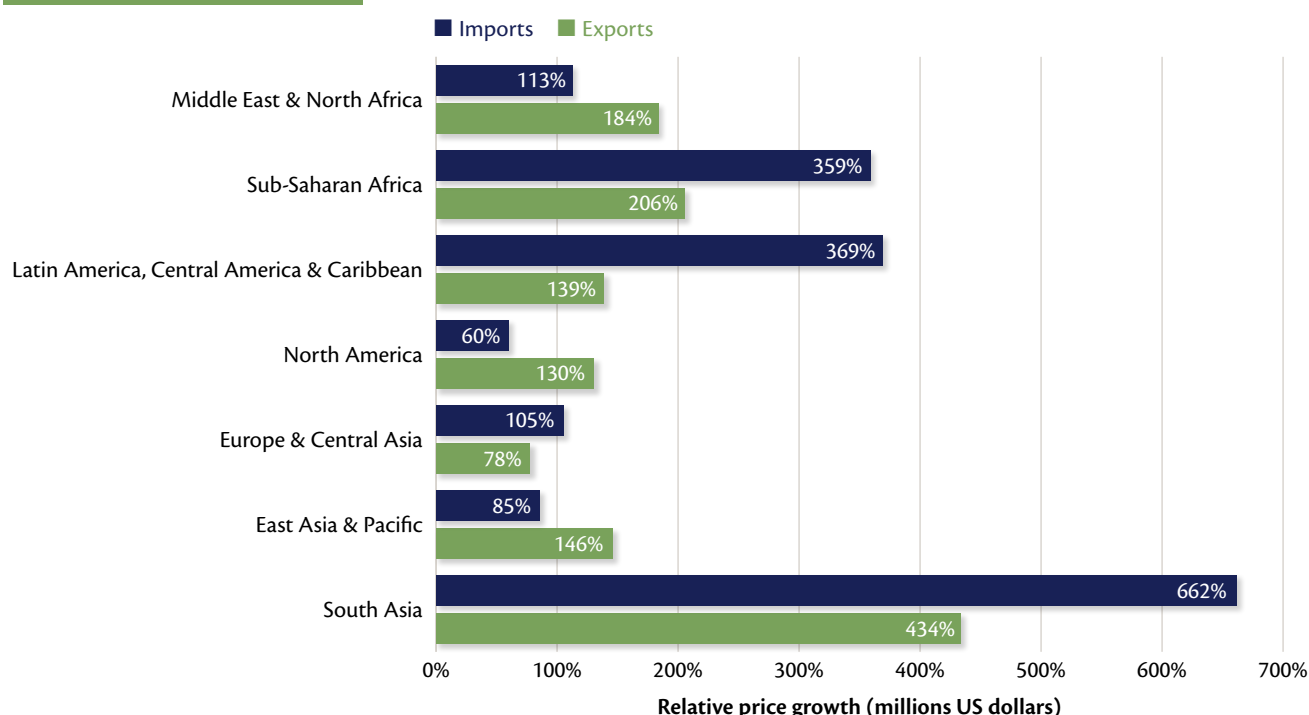
However, professionals and analysts concentrating on trade mechanisms often overlook the role of trade in influencing dietary patterns. Improving diets through trade policy is not straightforward given the highly political nature of trade agendas and their underlying economic objectives.<sup>248–250</sup> Not all trade has wholly positive benefits, as outlined in the Global Panel's policy brief on rethinking trade policies to support healthier diets.<sup>247</sup> While the movement of food across borders influences the range of foods which are available in a given country, sometimes it does so at the expense of local producers and traditional food systems.<sup>251,252</sup> Also, when imports such as sugar-sweetened beverages (SSBs) and highly processed foods become relatively less costly than local nutrient-rich foods, increases in consumption of the former can adversely affect human health and, in time, add to the burden on healthcare systems<sup>253–255</sup> (see Chapter 2).

**“ Trade policy instruments should be part of any government's toolkit for improving diet quality for their populations. Given the scale and devastating impact of malnutrition, it is imperative that no policy tool to address sub-optimal diets is overlooked. ”**

Reddy (2020).<sup>247</sup>



**Figure 5.1: Relative growth in food import and export values at base period prices between 1993 and 2016**



Note: Includes all food, except fish. Source: Global Panel (2020).<sup>247</sup> Original data source: FAOSTAT

## 5.2 Facilitators of food markets and trade

### 5.2.1 Global trends in food trade – past, present, and future

During the past 50 years or so, trade in food has increased eight-fold, while global production has trebled.<sup>247,256</sup> Across the world today, for every 100kg of food produced, 17kg of food is traded internationally, increasing to 50kg and 56kg for nuts and oils respectively.<sup>72</sup> Figure 5.1 shows the relative growth in food import and export values between 1993 and 2016. Growth in exports was greatest in regions with the highest levels of undernutrition: South Asia, sub-Saharan Africa, and Latin America, Central America, and the Caribbean.

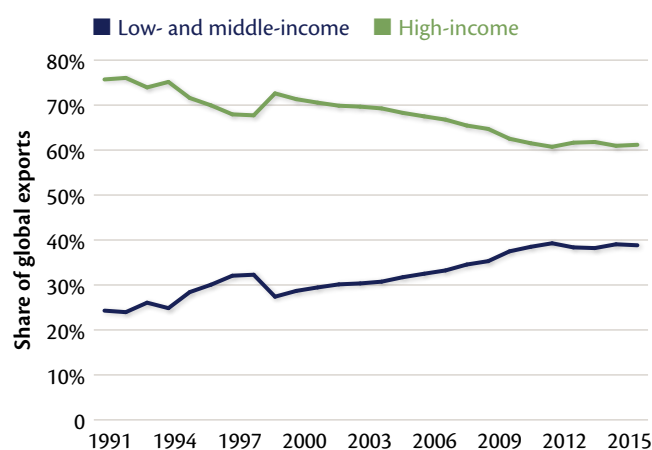
Notwithstanding a slow-down in trade liberalisation over the past few years, food-related tariffs have fallen globally, and many countries have reduced trade-distorting producer support. LMICs in particular have benefited, as their importance as both suppliers and markets for agricultural products has grown (see Figure 5.2). For example, the new African Continental Free Trade Area (AfCFTA), which covers 54 of the 55 African Union nations, is expected to boost intra-African trade by 52% by 2022<sup>257</sup> as members remove tariffs from 90% of goods, allowing free access to commodities, goods, and services across the continent.

The pace of agricultural policy reform has slowed in most OECD countries, in part as a result of the food price crises of 2007/08 and 2011/12, which led to a *de facto* reversal of prior commitments towards multilateral agreements supporting open food trade and price liberalisation. For example, according to the

OECD's Agricultural Policy Monitoring and Evaluation report of 2019: "Little progress has been seen this decade in reforming agricultural support policies. Many agricultural policies continue to distort farm production and trade decisions and do not effectively target stated government objectives."<sup>259</sup>

More recently, the challenges posed by the coronavirus pandemic have raised further questions about reliance on international markets, both for food imports and for agricultural exports. International demand for specialist foods (e.g. shrimp, lobster) fell abruptly as restaurants closed in one country after another, and logistical problems with labour-mobility hampered harvesting, processing and transportation.<sup>260</sup> Hoarding behaviour,

**Figure 5.2: Share of global exports from agriculture**



Source: OECD (2019)<sup>258</sup>

along with trade restrictions imposed by some governments, led to concerns about food supplies despite high global food stocks.<sup>261</sup> For example, in response to the pandemic, Honduras introduced export restrictions on red beans in early 2020;<sup>262,263</sup> Algeria imposed a ban on exports of flour, milk intended for children, some fresh fruits and vegetables, vegetable oil and tomato paste;<sup>264</sup> and Egypt imposed a ban on all pulses.<sup>265</sup> These trade-restricting policy reactions risked heightening fears about the accessibility of food on global markets, as in the 2007/2008 food price crisis. Low-income families around the world, and low-income food deficit countries, rely on the continued flow of goods and services. Closing these off translates into accentuated hardships, particularly in many LMICs.

Looking beyond the pandemic and the likely economic impacts that will follow, international trade in food is set to grow in importance in the decades ahead. This is due to a combination of population growth, rising incomes, climate change, and growing environmental degradation affecting food systems.<sup>266</sup> In particular, substantial population increases are projected to occur at lower latitudes (see Chapter 3), just as some food production will tend to shift to higher latitudes, driven by changing climatic and weather patterns.<sup>76</sup>

Trade will represent an important mechanism to address this growing mismatch, and nutrient-rich perishable foods will need to move around the world in all seasons. Seasonal and inter-annual variability in local food supplies, along with rising incomes, already lead to a growing demand for foods that often have to be sourced from outside a country's borders. Trade, therefore, plays a key role in determining the quantity of foods available, their relative prices, and thus the quality of diets that rely on market purchases. Yet, because of the highly political nature of trade agendas, and their underlying economic objectives, most policymakers have tended to ignore the potential role of trade mechanisms in relation to improving diets and nutrition.<sup>247</sup>

That said, in a positive development, the Deputy Director General of the World Trade Organization (WTO) recently called for a major updating of the WTO Rulebook for Agriculture to finally secure a more effective multilateral food trading system that supports “ways of reducing waste, improving productivity, and limiting negative impacts on the environment.”<sup>267</sup> Much more empirical evidence is needed to better understand the trade-offs in terms of economic and environmental impacts of global trade versus reliance on local domestic production, but recognition by the world's leading trade body of its *potential* role in supporting agriculture and environmental agendas is encouraging.

### 5.2.2 Developing domestic and regional markets

Within LMICs there continues to be an important focus on developing domestic markets and trade with close neighbours. Both are helped by traditional investment in rural road infrastructure. Studies in Nepal, for example, have shown a close link between child growth and proximity to road infrastructure, particularly where the latter provides access not just to food

markets but also to farm inputs, health services and nutrition information.<sup>268</sup> But trade also requires investments to expand access to electricity, to develop agricultural input markets, and reduce border transaction costs.

A recent study of the potential impacts of agricultural growth on 14 African countries found that increased investment in the farming sector generated substantial benefits: it led to higher overall employment (in countries such as Ethiopia, Tanzania, Kenya, Nigeria and Egypt) and reduced gender disparities in labour participation. In eight of the countries considered, female employment increased more than male employment largely because of women's traditionally significant role in food system activities.<sup>269</sup> Many employment benefits from agriculture are also boosted via investment in infrastructure. And increasing investments in food markets and trade networks not only provide new employment opportunities and income streams, but can also play an important role in enhancing the efficiency of transactions, thereby reducing costs.

Regional trade agreements (e.g. the new AfCFTA, MERCOSUR, and the new Comprehensive and Progressive Agreement for Trans-Pacific Partnership (TPP-11)) are also increasingly important for the food security of participating countries (see Box 5.1). There is much to be gained from supporting the implementation of national government commitments to regional strategies, such as Africa's Malabo Declaration on Accelerated Agricultural Growth. This was signed in 2014 and seeks to double agricultural productivity and triple intra-African trade in agricultural commodities and services by 2025 through harnessing “market and trade opportunities, locally, regionally and internationally.”<sup>270</sup> Development partners concerned with promoting agriculture and increased participation of small and medium-sized enterprises (SMEs) in food production, trade, retail and services, need to support such national commitments

#### Box 5.1: Food trade and protectionism

According to the OECD, protectionist trade policies have serious negative consequences for food and nutrition security. Certain policies can impair sector growth and export competitiveness by increasing the cost of agricultural inputs and constraining participation in global markets. They can cause “a negative impact on the food security of poor households by increasing prices for staple foods.”<sup>258</sup> Additionally, they limit the availability of different types of foods and reduce the number of days per year that products might otherwise be available.<sup>271</sup> Every effort must therefore be taken to protect and nurture supply chains, and to keep borders open to ensure continued supplies of products and agricultural inputs. This is particularly important at times of stress in food systems, such as during the coronavirus pandemic. There is potential for stronger agreements on maintaining the flow of food, and this should be urgently pursued in the context of World Trade Organization (WTO) negotiations.



and the actions that flow from them. To date, this agenda has not featured prominently on most donor priorities.

Overall, food markets have been evolving to respond better to shifting demand for higher quality and diversity in products, but much more needs to be done. In this context, a number of challenges have been identified by African countries as constraining the further development of their markets. These include:

1. **Degraded and congested wholesale markets**, affecting transaction efficiency in small cities and rural towns close to farms (lessons from China's connectivity strategies of the 1990s are relevant here);
2. **Poor road and other infrastructure quality**, which limits the effective marketing of food, raising costs, losses, and hence consumer prices;
3. **Corruption** in the governance of roads and the movement of supplies, and associated transaction costs;
4. **High cost of fuel and uneven access to it**, which affects the efficiency of supply chains. This requires investment in fuel delivery infrastructure, as well as policies to manage supply and price uncertainty;

5. **Lack of knowledge and training of traders and hauliers**, which leads to accident-related food losses, food contamination, and lack of quality control and protection; and

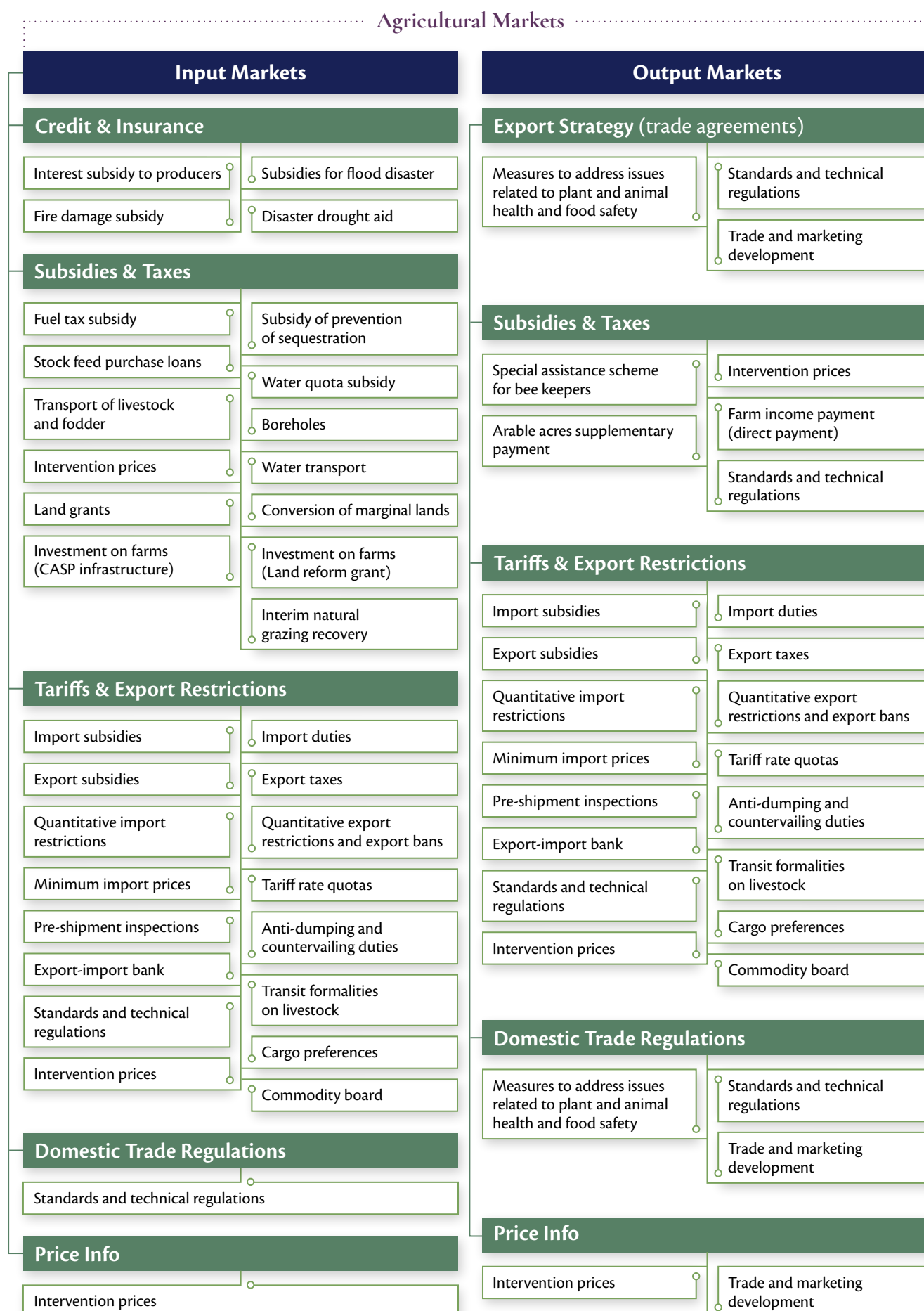
6. **Constraints on access to vehicles, equipment and machinery**; most lorries and cooling equipment in Africa are imported.<sup>272</sup>

Many rural areas remain under-served in terms of flows of information, financing, and products.

There is considerable scope to learn from, and replicate, examples of effective public sector engagement with private actors in domestic markets. In Uganda, for example, the government has capitalised on under-used warehousing left over from the parastatal era, and has made storage facilities available to the Uganda Grain Traders Ltd – a company formed by 16 national grain trading companies – to coordinate processing, warehousing, and quality control for products destined for export markets.<sup>215</sup> Similarly, there are examples of public-private partnerships creating viable cold chains. These have been used to overcome high start-up costs and are aiming to optimise the shelf-life of perishable fruits and vegetables. Two examples are Kenya's fresh fruit and vegetable terminal, and Ghana's cold storage facilities at the main port, each financed partly by government, but privately managed.<sup>215</sup>



**Figure 5.3: Policies that can influence agricultural markets**



Source: Balino (2019)<sup>273</sup>

## 5.3 Leveraging markets and trade for improving food access

Trade mechanisms are not traditionally designed to achieve nutrition, health, or environmental goals. While this has been a missed opportunity in the past, it presents multiple opportunities for the future. In particular, there are a wide range of trade policy tools available to LMICs to leverage nutrition gains through enhancing markets (see Figure 5.3). These can support greater productivity in agriculture, profitable activities by SMEs across the entire food system, and access by all people to the range of foods needed to support healthy diets.<sup>247,273</sup>

The portfolio of potential policy instruments includes tariffs and non-tariff trade policies on food and other agricultural commodities, producer subsidies (lowering input costs or supporting product prices), support for food processors, and policies that involve income support to custodians of the rural environment (direct payments not linked to production).

No single approach fits every national circumstance in all developmental contexts. However, it has been shown that in most countries, economic growth has involved leveraging agriculture to generate not just outputs but also to raise demand for non-agricultural services and products, and hence employment growth outside of agriculture.<sup>161,171</sup> The most successful examples of agricultural support for employment, government revenue growth and income distributions have occurred where food policies were defined and implemented while taking close account of how food system interventions fitted into the broader economic and social policy environment.<sup>274</sup> This requires selecting policy levers that specifically address market failures which disadvantage the agricultural sector relative to the rest of the economy. Also, appropriate actions in the middle ground of food sector operations can also be important in enabling the sector to align producer interests more closely with demand.

Looking ahead, market efficiencies will need to be framed both by the production of staple grains and by adding value across a wider range of nutrient-rich foods. Staple foods will continue to be important in tackling hunger, but nutrient-rich foods will be crucial in the broader aim of ensuring access to sustainable, healthy diets for everyone. Given the wide range of possible policy options in this area, the following sections highlight some examples which will help drive the food system transition set out in Chapter 1.

### 5.3.1 Long-distance and local supply chains must align as part of sustainable food systems

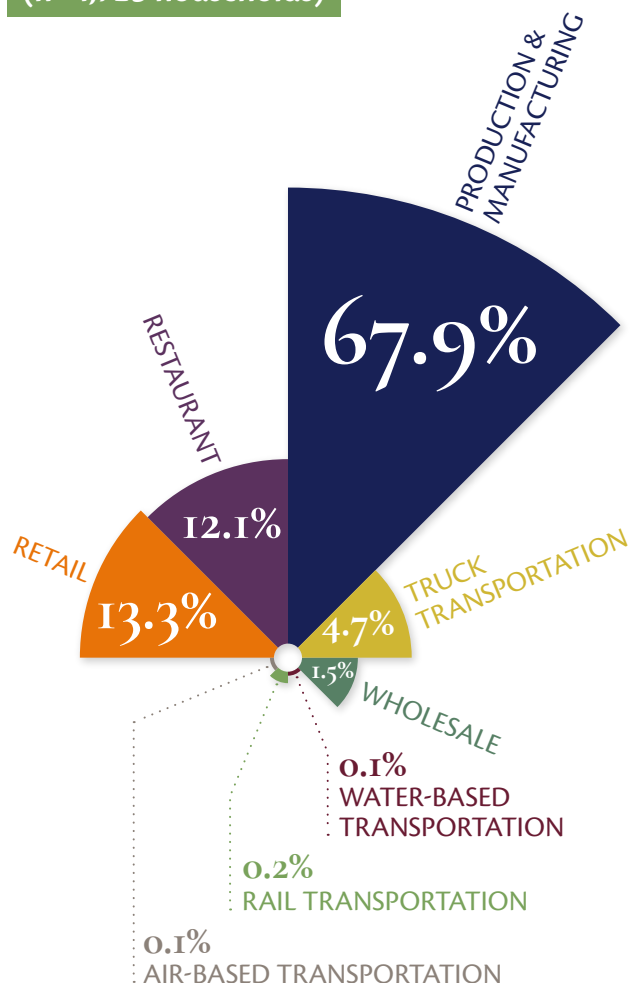
A concern for some people is the long-distance transport of food, which is often assumed to be associated with large carbon emissions. Especially in high-income countries, this view often leads to a preference for 'locally' or 'regionally' produced food, as this is believed to be more climate-friendly.<sup>275</sup> However, a study of GHG emissions associated with food system activities in the US showed that transportation accounts for just 5%, compared with

68% for producing and processing foods, and 25% for marketing and retail (see Figure 5.4).<sup>276</sup> More work along those lines is needed, especially in LMICs.

More generally, the FAO has found that when comparing 'local' and 'non-local' foods in terms of GHG emissions, the least detrimental effect on the environment depends on many factors: the food product, the type of farm operation, transport, season, and the scale of production.<sup>277</sup> Thus, in some cases, it is possible that the adoption of comparatively low-emission technologies in primary production phases could compensate for emissions from 'long-distance' value chains.

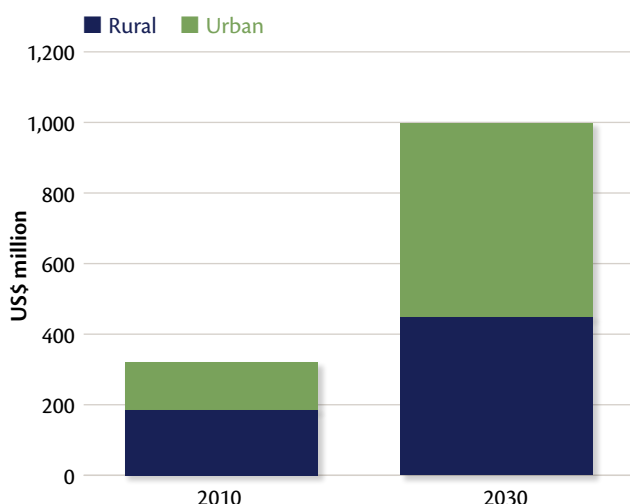
Such studies underline the need for policymakers to base decisions on robust evidence and to take a nuanced look across the entire food chain. This conclusion is supported by research concerning food production in Kenya.<sup>278</sup> When supplying cabbages to local supermarkets, it was found that farmers used roughly double the amount of chemical inputs per unit of output that would otherwise be used when producing cabbage for their own consumption. If supplying formal retail outlets with

**Figure 5.4: Average weekly household greenhouse gas emissions per Standard Adult Equivalent by supply chain stage (n=4,723 households)**



Source: Boehm et al. (2019)<sup>276</sup>

**Figure 5.5: Projected value of food markets in sub-Saharan Africa**



Source: World Bank (2013)<sup>215</sup>

blemish-free standardised products necessitates more chemical fertilisers/herbicides/pesticides and fossil energy per unit of output, the local GHG emissions could potentially be higher overall than those associated with other more efficient value chains that might operate over longer distances.

### 5.3.2 Support urban-rural value chains

All governments will need effective strategies to ‘feed the cities’. It has been estimated that by 2018, 55% of the world’s population lived in urban environments,<sup>279</sup> yet in 2016 urban residents already consumed roughly 70% of the entire world’s food supply. This was because they have higher incomes relative to rural households, and tend to consume higher amounts of food per capita.<sup>280</sup> Roughly 50% of urban dwellers in low- and middle-income countries live in towns of less than half a million inhabitants. These concentrations of people serve as nodes in extensive networks which link rural markets to urban retail, as well as urban inputs (seed, credit, etc.) to rural producers.<sup>281</sup> Figure 5.5, for example, shows how the value of food markets in rural and urban contexts could grow in sub-Saharan Africa between 2010 and 2030. While Africa’s population will remain relatively more rural than any other continent well into the 21st century, the growth of urban areas will be particularly large. In many other parts of the world, populations will have



already become predominantly urban. This carries important implications for strategies to support adequate food sourcing.

Urban agriculture will have some potential to address local demand, as will novel forms of food production (including hydroponics, lab-grown proteins, insect farms, etc.). But large investments in infrastructure will be needed to move food from rural settings to urban dwellers. According to the FAO: “Agriculture and family farming in particular, must be more firmly linked to the broader rural and urban economy. This can be done by developing agro-industries and setting up infrastructure to connect rural areas, small cities and towns.”<sup>55</sup>

At the same time, the producer-to-retail chain is largely conditioned by the nature of products moving through it.<sup>282</sup> For example, some foods may be highly perishable, while others can be stored over long periods. They may be seasonal or available year-round, concentrated geographically or widely available, or produced by many smallholders or a few large suppliers. In general, the more perishable the product, the more geographically concentrated are its suppliers, and those suppliers tend to be more narrowly concentrated in terms of the size of production units. There is also a greater likelihood that the product is procured directly by wholesalers or even retailers through vertical supply chains. The more a commodity is produced by many small producers, the more likely it is to be procured via traditional wholesale markets.

Control of vertical supply chains is typically associated with perishable nutrient-rich and higher-value foods, and these products are often associated with opportunities for applying new technologies and best practice innovations aimed at reducing food losses, protecting nutrients, and reducing emissions. Governments, especially those in LMICs, have an important role to play in determining geographically targeted investment strategies to support SME growth across the food sector in ways that promote sustainable food production and marketing across rural and urban networks, and secure consumer access.

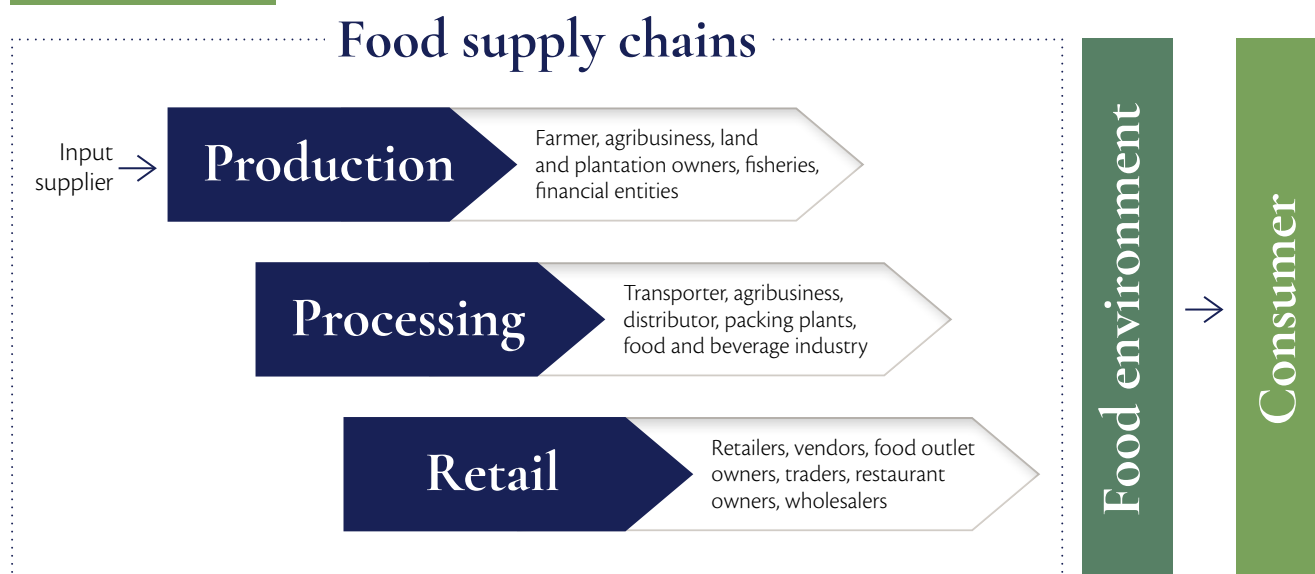
### 5.3.3 Build and strengthen small- and medium-sized enterprise (SME) partnerships for enhanced diets

Most stakeholders working across the food system are private businesses, often referred to collectively as ‘the food industry’<sup>ix</sup> While governments play an important role in investing in agriculture R&D and infrastructure as well as regulating and monitoring food safety standards, food trade and more, it is food industry entities that generally produce, transport, process and sell food products.<sup>283</sup> The many commercial actors working along the food supply chain therefore have very considerable potential to play a leading role in supporting public goals related to sustainable, healthy diets.

<sup>ix</sup> Food industry enterprises encompass companies involved in agri-business, food and beverage manufacturers, food retailers (including supermarkets), food service providers, and industry trade associations. Food wholesalers, food distributors (including importers and exporters), and the advertising and marketing industry, are also influential private sector players in the food system.



**Figure 5.6: Activities pursued by small- and medium-enterprises at different parts of the food chain**



Source: Demmler et al. (2020)<sup>286</sup>

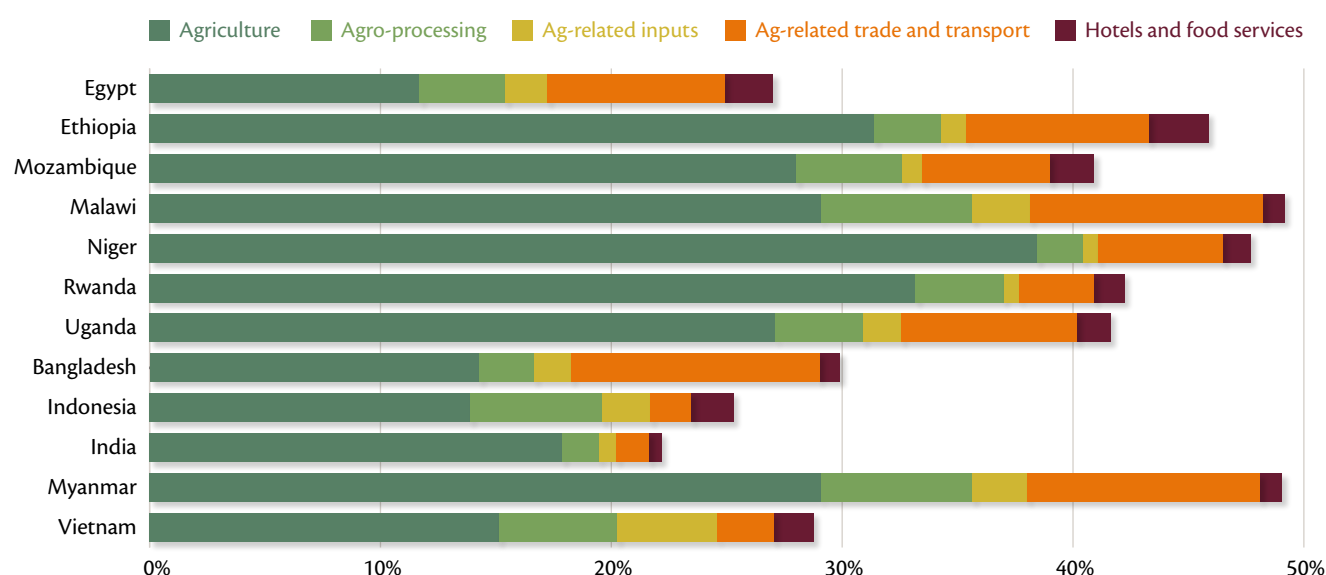
For example, it has been estimated that over 60% of all food consumed in sub-Saharan Africa is supplied via mainly domestic SMEs involved in the food sector.<sup>272</sup> SMEs are not well-defined, but they are generally classified as independent business or commercial entities having fewer than 250 employees, with those at the lower end (micro-enterprises) employing fewer than 10 people.<sup>284,285</sup> The types of activity pursued by SMEs depends on their place in the food chain, be it agribusinesses supporting food production, transport or processing, to retail and food service (see Figure 5.6).

The share of national GDP contributed by actors in the agri-food system is estimated to range from 40-50% in low-income countries across Africa (where SMEs account for up to 90% of all businesses in processing, transportation and trade as well as food services),<sup>287</sup>

to around 30% or less in lower-middle income countries such as Vietnam, Bangladesh and Indonesia (see Figure 5.7).<sup>288</sup>

Governments can play a key role in supporting and nurturing SMEs. In particular, a lack of road infrastructure, cold storage facilities, and electrification can negatively affect the development and quality of food value chains mid-stream (between farm and fork) as well as the efficiency, costs and profitability of smallholder producers and SMEs. By improving access to all forms of infrastructure, as well as enhanced warehousing, water, and financing (particularly credit), even relatively small-scale food sector stakeholders can take on significantly more important roles by connecting producers to markets, markets to processors and retailers, and rural to urban markets.

**Figure 5.7: The share of agrifood value chain segments in GDP in Africa and Asia**



Source: IFPRI (2020).<sup>172</sup> Original data source: Thurlow

### 5.3.4 Develop partnerships with supermarkets

Where conditions are conducive, LMICs are seeing a rapid growth in the number and reach of domestic and regional food retail companies alongside the appearance of global food corporations.<sup>289</sup> The growth of franchised retail food outlets has greatly expanded as part of the ongoing global shift in where people procure most of their food (the 'supermarket revolution').<sup>290</sup> The penetration of supermarkets (which often count as SMEs in LMICs) is accelerating rapidly in both rural and urban settings.<sup>291,292</sup> For example, Africa's largest food retailer (South Africa-based 'Shoprite') today operates more than 2,800 outlets in 15 African countries and aspires to be "Africa's most accessible and affordable food retailer".<sup>293</sup>

Notwithstanding regional variation,<sup>11</sup> the reach of supermarkets continues to expand around the world, bringing profound changes in terms of food prices, processing levels, packaging sizes, and marketing.<sup>294–296</sup> In addition to a higher standard of fresh foods, supermarkets offer a wide variety of processed and highly processed foods and drinks, often in larger packaging sizes and combined with special promotional campaigns.<sup>297</sup> Analysing the effects of supermarkets on diets and nutrition is not straightforward, because of many possible confounding factors which need to be controlled for. But the limited evidence that is now emerging suggests that their effect is mixed.

A study from Guatemala shows that buying food in supermarkets, as opposed to traditional retail outlets, is associated with higher body mass index (BMI) and a higher likelihood of being overweight in adults, after controlling for household income, education, and other confounding factors.<sup>298</sup> Similar results were also obtained in studies of urban spending in Kenya.<sup>299,300</sup> Here, health data collected for the same households and individuals suggest that buying food in supermarkets is also associated with a higher prevalence of nutrition-related NCDs, such as diabetes and metabolic syndrome.<sup>301</sup> Also, supermarket shoppers often consume more highly processed foods, including semi-processed items as well as ultra-processed foods and snacks.<sup>299,300,302,303</sup>

The data from Kenya show different effects in the case of children and adolescents. While supermarket shopping appears to be associated with weight gain in adults, effects of supermarkets on childhood obesity have not been identified. Recent studies with data from Kenya and Zambia suggest that supermarket shopping may contribute to gains in diet diversity and in child height (i.e. reduced stunting).<sup>304, 484</sup> Recent country-wide analysis of aggregated data also supports the idea that the spread of supermarkets in developing countries may help to reduce child stunting in certain situations, and equally, does not reveal significant effects of supermarkets on childhood obesity.<sup>305</sup> Another study with micro-level data from urban Indonesia also failed to establish a significant relationship between supermarket shopping and childhood obesity, although a significant effect of supermarkets on child overweight was found in a subsample of wealthier households.<sup>306</sup>

Overall, these findings imply that the spread of supermarkets may help to reduce the prevalence of child stunting in urban as well as rural areas. In rural areas, part of the effect may also

be attributable to higher incomes for smallholder producers, as recently reported in India where the average effect of supermarket purchasing on farmgate prices was around 20%.<sup>307</sup> This premium is due to fewer intermediaries and reduced transactions costs. But there are dangers in terms of a rapid shift from stunting as the primary nutrition concern, towards obesity and NCDs linked to supermarket retailing of ultra-processed packaged foods.

For lower-income families, food processing, enhanced preservation of perishables and lower prices characteristic of many supermarket foods can support regular consumption of certain nutrient-rich foods that are otherwise less accessible. But more generally, the findings show that the effects of supermarkets on people's diets are complex and context-specific, as supermarkets are rarely the only source of food purchases.

Given the potential for supermarkets to improve people's access to food calories, diversity, safety and quality, they offer the opportunity for partnership with the public sector in pursuing diet-related goals.<sup>304,308,309</sup> Governments in LMICs should engage strategically with supermarkets to explore ways in which public diet-quality agendas can align with the supermarkets' own commercial strategies. Joint target-setting, transparency of data on inputs and impacts, and accountability (for outcomes) would all be essential principles underpinning engagement. Already in Europe, North America, and New Zealand there are examples of community-focused supermarket chains promoting consumption of fresh nutrient-rich foods (e.g. free offerings in the grocery aisle, lower pricing of blemished but sound produce, improved nutrition information, etc.). There have also been positive examples of engagement with commercial retailers as part of community-wide initiatives seeking to tackle child obesity in the USA.<sup>310</sup>

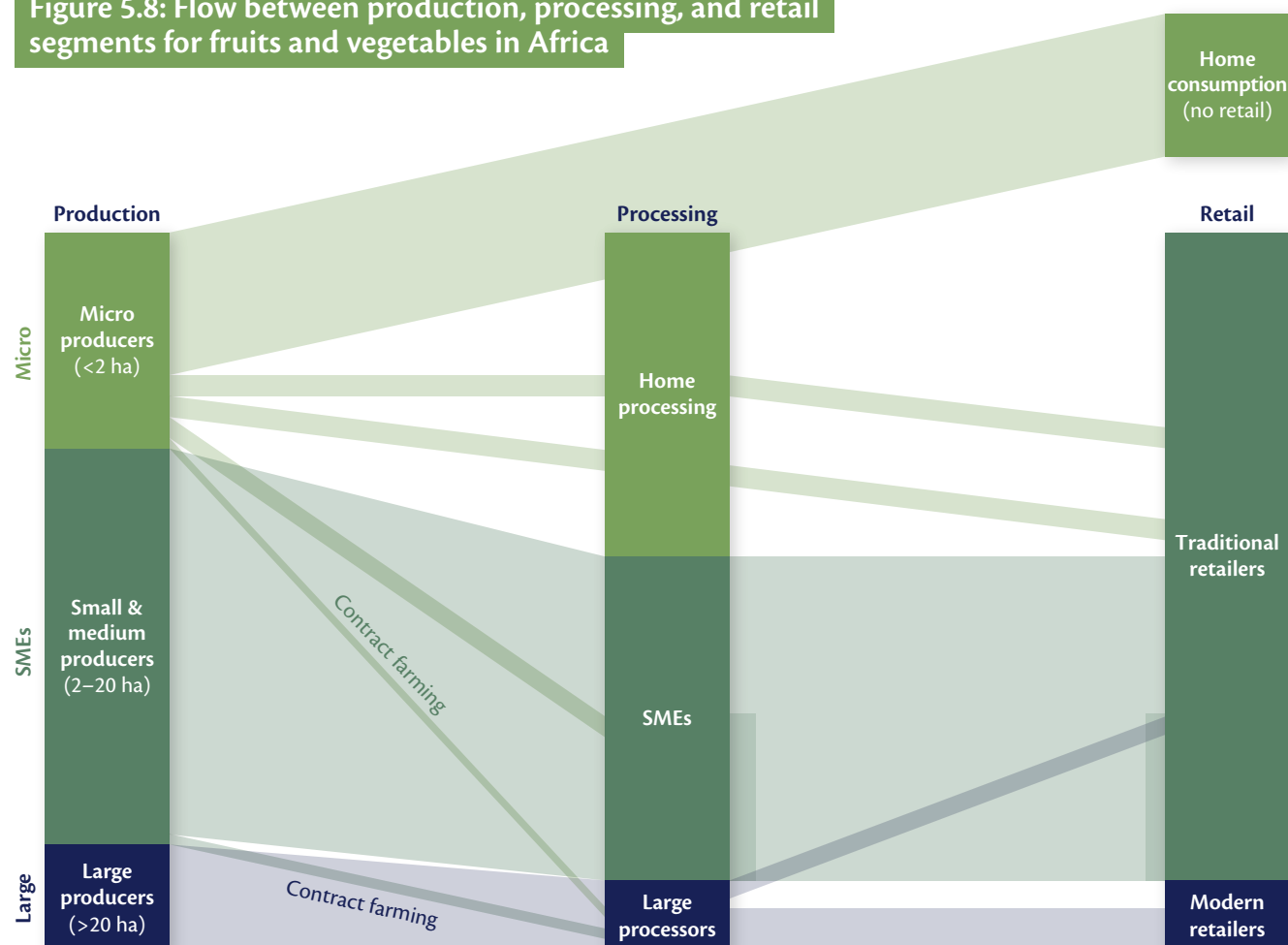
### 5.3.5 Support employment across the entire food system

Chapter 4 highlighted the substantial opportunities in LMICs in terms of job creation in the *food production* sector. However, there is also considerable potential for jobs to be created *throughout* food value chains. According to the World Economic Forum's (WEF) recent assessment of African competitiveness, 'unlocking' Africa's agricultural potential requires efforts that "sustainably transform the sector from low-productivity small farms (producing mainly for household local consumption) into larger farms and more intensive agro-processing activities".<sup>236</sup>

Adding value to food through processing, packaging, and handling can yield multiple benefits. An assessment of the role played in the production, processing and retail segments of the fruits and vegetables value chain by SMEs in Africa found that small entities (working on two to 20 ha) are responsible for the largest share of total output. The same study concluded that SMEs involved in fruit and vegetable processing make up almost half of the activity in that segment, but very little in retail (see Figure 5.8).<sup>286</sup>

It is important to note that returns to labour in agri-food activities post-farmgate are higher in most African countries

**Figure 5.8: Flow between production, processing, and retail segments for fruits and vegetables in Africa**



Source: Demmler (2020)<sup>286</sup>

that returns to labour on the farm, whether its one's own farm or wages for farm labour (see Table 5.1).<sup>286</sup> This suggests that the conventional narrow view that relatively small businesses mainly play a role in food processing or retail should be reconsidered.

SMEs of various kinds are important actors in the production and processing value chain arenas, and require appropriate support (e.g. access to finance, information, and markets) to enhance and expand their activities.

**Table 5.1: Returns to work in different sectors and functions (US\$ per full-time equivalent)**

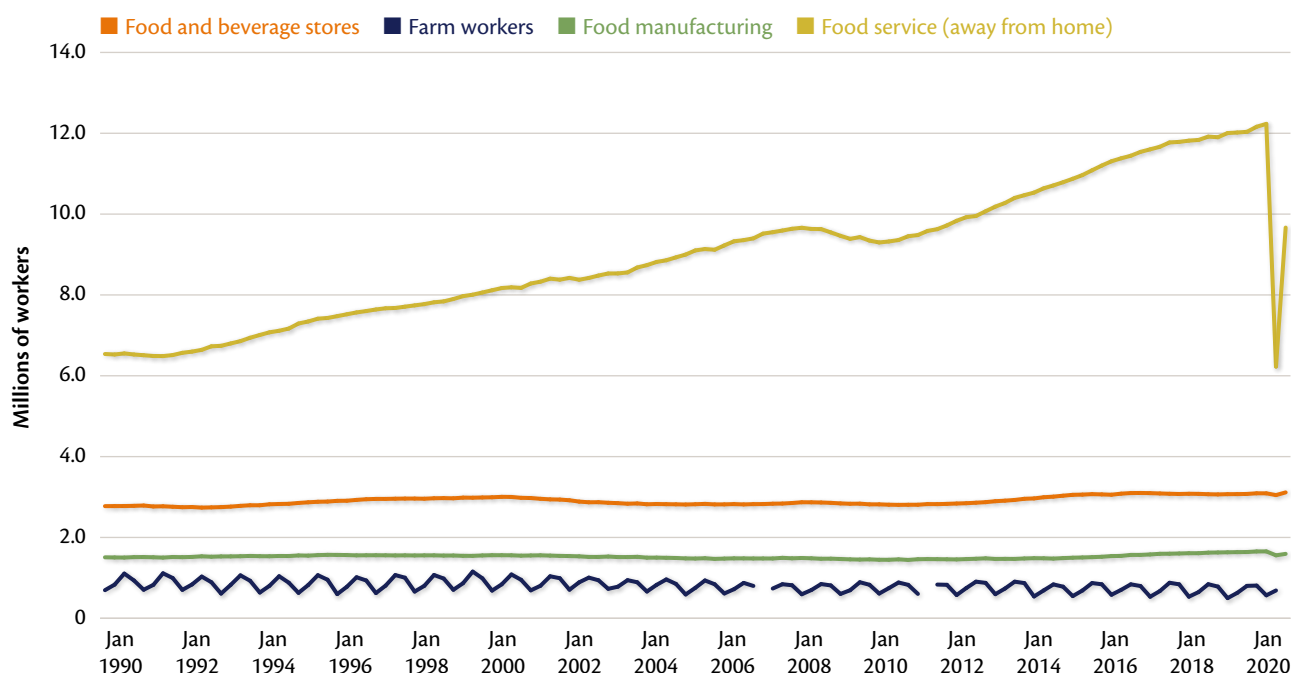
	AFS				Non-AFS	
	Own farm	On-farm wage	Post-farm AFS wage	AFS enterprise	Non-AFS wage	Non-AFS enterprise
Ethiopia	2.47	3.68	2.43	6.04	2.60	3.83
Malawi	1.74	0.20	1.41	2.61	2.48	3.36
Niger	1.28	1.38	1.70	5.51	2.94	3.64
Nigeria	1.24	3.65	2.17	2.83	5.05	3.33
Tanzania	3.11	1.08	1.97	4.47	3.23	4.96
Uganda	1.29	0.91	1.22	11.62	1.99	27.42
All countries	1.68	1.51	2.15	3.98	3.96	3.97
All countries, excluding Nigeria	2.21	1.21	2.14	5.59	2.71	5.19

Note: Incomes are converted to constant US\$ values using the 2011 PPP (Atlas Method). The returns to labour are calculated by dividing the total income generated by all households in each category to the total amount of FTEs worked by everyone in that category in each country during the survey year. The extremely high values for Uganda's enterprise sectors are primarily driven by a few observations in the data. This warrants caution in interpretation of the estimated returns to labour in Uganda's enterprise sectors.

Source: AGRA (2019)<sup>272</sup>



**Figure 5.9: Farm and food system employment in the US, 1990–2020**



Source: Masters (2019)<sup>313</sup> updated August 2020. Note: The dip after Jan 2020 reflects the impact of the COVID-19 pandemic.

The Partnership for Inclusive Agricultural Transformation in Africa (PIATA) is an example of a public-private partner focused on driving investments in economic activity across food value chains. It involves deliberate engagement with businesses to build sustainable systems. Launched in 2017 with 11 priority countries, this multi-donor activity includes support for expanded access to national and regional agricultural markets.<sup>311</sup> The food system as a whole is a major potential source of job creation in sub-Saharan Africa and South Asia, particularly in the region's food processing and value-added domains. Already today, the food sector is the world's largest employer, with more than two billion people working in it.<sup>231</sup> That can grow, especially in parts of the world with a rapidly growing and youthful population seeking employment.

There are also substantial opportunities for job creation associated with making nutrient-rich foods available at locations more distant from their place of production. For example, a survey of 300 traders in Zambia found that informal food markets (typically open air) offer important opportunities for livelihoods and income generation, particularly for women on low incomes, and young people.<sup>312</sup> These markets also continue to play a critical role in linking poorer consumers with markets for fruits, vegetables, dairy and meat products. But their informal nature means that traders face many hurdles. For example, gaining access to capital or credit may be difficult. Traders also suffer high levels of spoilage because of limited access to cold storage facilities and growing competition from sellers of imported packaged foods.

Overcoming such constraints and generating new job opportunities requires what the World Economic Forum has called "an enabling environment for agro-processing".<sup>236</sup> This should include:

1. Improving all forms of infrastructure (transport, water and sanitation, electricity, communications, and irrigation) to support competitive agri-processing firms;
2. Setting appropriate standards and regulations for food quality, safety, and trade to facilitate export competitiveness; and
3. Promoting vertical linkages among enterprises across the food system to reduce risks of mismatched supply and demand, and to promote regular income flows.<sup>236</sup>

Large shifts in jobs downstream from the production domain are typical as part of the economic transition of industrialising countries around the world.<sup>171</sup> In a high-income setting like the United States, employment in farming (production level work) has remained broadly static from 1990 to 2020, as have jobs in food manufacturing; indeed, employment in agriculture in the US rose slightly from around 2.5 million in 2005 to 2.7 million in 2016.<sup>314</sup> But service jobs in the US relating to food (mainly retail, but also delivery) have expanded considerably over those years, pointing to employment in the post-production phases of the food system as the locus of most growth in countries where incomes are high or growing fast (see Figure 5.9).

This suggests potential for increasing food-related employment in the food system beyond the farmgate, from which LMICs could benefit hugely.<sup>289</sup> According to analysis from four lower-income countries in Asia and six African countries, Asia has a larger share of wage earners in the post-farm agri-food system than Africa (12% versus 5%, respectively). Africa, however, has a larger share of self-employed workers in the post-farm food sector (20%) compared with Asia (8%). In both regions, there is scope for growth in off-farm food sector employment and incomes. The trend globally is for faster employment growth in food-related activities off

the farm compared with on-farm. For example, farming in Brazil accounts for around half of employment in the food system, with food services and processing each making up about 25% of food-related jobs.<sup>315</sup> While off-farm work still accounts for only 9% of total food sector employment in Eastern and Southern Africa, the potential for expanding that share is strong.

For food sector job growth to occur, specific policies are needed in LMICs to ensure ‘associated agricultural jobs’<sup>316</sup> – i.e. income-earning activities downstream of production. Evidence also suggests that the promotion of rural development and employment in these countries has focused mostly on farming activity, and the effects on rural incomes “are greater if indirect jobs associated with agricultural activity and post-production processing (e.g. manufacture of food products and beverages) are also included.”<sup>316</sup>

A recent report from the Alliance for a Green Revolution in Africa (AGRA) on the emerging modern revolution in agri-food processing in sub-Saharan Africa highlights the increasing importance of the midstream of the food value chain to rural economies. Traders, truckers and processors constitute about 40% of the total gross value of food value chains across sub-Saharan Africa, generating a share that is as large as production on farms.<sup>272</sup> An estimated 80% of the midstream is comprised of SMEs that have already ‘taken off’. These are generating increasingly large income flows, and a fertile foundation for future investment. In other words, food processing and retail offer important growth potential in rural Africa.

To realise all of this potential, the public sector needs to find ways to stimulate business investments in the ‘middle’ of the food supply chain (after the farm, and up to and including retail) specifically to make the diverse (including fresh) foods needed for healthy diets accessible to all. In Kenya, the coronavirus crisis has led the Kenya Private Sector Alliance (KEPSA) to form a COVID-19 Business Response Committee that brought together business leaders, government decision makers and donor partners to protect jobs while ensuring food access under lockdown.<sup>317</sup> One partnership to emerge involved an online food order and delivery company called Jumia Food. This partnership has focused on increasing digital sales in Kenya, and on training other vendors in the basics of e-commerce, marketing, finance and sales.<sup>318</sup>

Finally, a particular challenge for policymakers is to ensure that the processed products offer value addition for healthy diets rather than moving towards ultra-processing to produce foods

which are high in unhealthy fats, salt or sugar – especially since most of the associated economic activity in processing involves SMEs. One example of success comes from northern Senegal, where *La Laiterie du Berger* worked with pastoralist milk producers to strengthen the milk value chain by improving micronutrient content through commercial vitamin fortification, and enhanced food safety controls.<sup>319</sup>

## 5.4 Promote innovation and employment in cutting food loss and waste

Reducing food loss and waste needs to be a central component of the food system transition. Food that is neither lost nor wasted does not have to be ‘grown twice’<sup>xi</sup>. Nor does its production, storage and marketing consume double the energy consumption and emit emissions twice over. In this sense, loss and waste are not issues relating just to production, but equally to the potential for preserving and distributing nutrients through the food value chain (making more of them accessible to more people), ensuring the environmental sustainability of food systems, and stimulating innovation and job creation.

Estimates of losses and waste in the food system (from production to human consumption) remain contentious, largely because there is a wide variation in results from individual studies and their methodologies. A common estimate is that losses and waste account for about 30% of the food produced globally. However, much lower and higher estimates also exist. A recent reassessment of FAO data reduced their earlier estimate of food losses by a factor of almost two.<sup>320</sup> Other analyses of post-purchase food waste suggested that levels are twice as high as thought previously.<sup>321</sup> While consumer-level food waste is a global problem, it starts to emerge as a serious threat to national food supplies when a food expenditure threshold of US\$6.70/capita per day is crossed. Tackling these particular inefficiencies (loss and waste) would contribute substantially to efficiency gains, amplifying the benefits of yield increases generated by changing agricultural practices while also cutting the volume of food needing to be ‘grown twice’.

The vital importance of reducing loss and waste is clear when considering future projections. One modelling scenario

<sup>xi</sup> The amount lost somewhere in the system, that has to be ‘grown again’ to meet demand.

“Attention is growing to the “importance of post-harvest, processing and marketing activities in job and income creation, their role in feeding non-farmers, in nutrition and health, in the consumption of energy and resources, in loss and waste, in biodiversity and pollution.”

Dury et al., (2019) FAO<sup>20</sup>

## “From an environmental perspective, reducing food losses and waste contributes to reducing carbon, water and land footprints.”

High Level Panel of Experts on Food Security and Nutrition (2020)<sup>325</sup>

estimated that global food loss and waste (by weight) would increase by roughly 37% between 2010 and 2030 (assuming 30% food loss and waste projected forward in terms of population growth, rising incomes and changing urban consumption patterns), from 1.3 billion metric tonnes of food per year in 2010 to 1.8 billion metric tonnes. Those projected levels represent about a quarter of all food production needed in 2030, and a third of total consumption.<sup>322</sup> Even if current loss and waste is ‘only’ around 20% globally (based on recent recalibration of estimates by FAO), the absolute losses would still exceed one billion metric tonnes by 2030. These figures are huge, and represent an additional strain on the world’s environmental system that is arguably both unnecessary and avoidable.<sup>322</sup> The following section discusses the challenges involved, and how they may be met.

### 5.4.1 Loss and waste through the value chain

Nutrients generated in the food system need to remain in the food system for individuals to benefit. It is therefore important that foods, once produced, remain fit for consumption until they reach the person who can eat them. Although the FAO has recently revised downward its widely-cited estimate of one third of all food produced being wasted globally to ‘only’ 20%<sup>323</sup> (14% food losses and 6% food waste<sup>323</sup>), this issue remains a significant feature of current inefficient food systems with important implications for resource use over the long term.

The Intergovernmental Panel on Climate Change (IPCC) report of 2019 on land issues linked to climate change estimated that 8–10% of total anthropogenic GHGs relate to loss and waste across the whole food system.<sup>207</sup> The disappearance of edible food between production and retail, and food discarded by retailers and those who make purchases, adds unnecessary additional pressure on the food system, on the natural resource base and on the climate.<sup>324</sup>

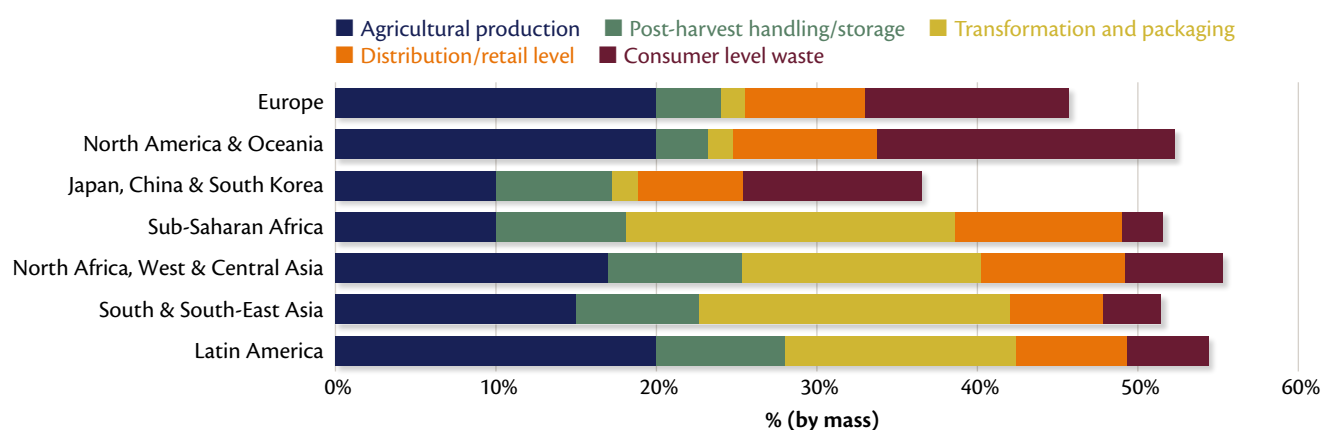
Actions to reduce food loss and waste are needed at different points in the value chain depending on geographic location and commodity. Not all foods are equally perishable, nor are all food categories equally vulnerable to losses in production, processing, and through the value chain. In LMICs, substantial losses of fruits and vegetables occur on-farm, but poor post-harvest handling, transport and storage are also important drivers of the total ‘lost to the consumer’ component. Processing and retail activities contribute even more to these losses.<sup>326</sup>

Many foods packaged and processed in bulk have longer shelf-lives and an ability to withstand challenging environmental conditions, such as high temperatures and humidity, contributing to ease of access. However, perishable nutrient-rich foods are typically at much greater risk due to inadequate protection, particularly in LMIC settings. For example, in 2015 high production-related food losses were associated globally with fruits and vegetables as well as roots and tubers, while





**Figure 5.10: Loss and waste of fruits and vegetables at different points of the food system**



Source: Global Panel Policy Brief no.12 (2018)<sup>326</sup>. Original data source: FAO 2011

cereals (typically processed and stored in bulk) showed relatively low production-related losses.<sup>327</sup> Meat and dairy products also had low production-related losses globally, arguably because these are very high-value commodities which engender greater efficiency and care in processing, packaging, storage and distribution. In contrast, consumer-level waste was highest in 2015 for cereals, but closely followed by fruits and vegetables and fish-related products.

Just as different amounts of food loss and waste occur in different settings, the same is true for specific nutrients. This is an important consideration where a population is already subject to deficiencies in certain nutrients. For example, in low-income countries, calcium and riboflavin leak from the system in almost equal amounts through losses and waste, but for vitamin A, the losses are closer to production practices than to post-consumer waste. In high-income countries, important losses of folate occur mostly in the production/processing domains.

Recent work using global data on 25 nutrients in 225 food categories for over 150 countries details the significant nutrient

losses which can occur (see Table 5.2). As a share of nutrients available for consumption, about 25% of available calories and protein are lost globally, roughly 10-15% of fats, and 18-41% of vitamins and minerals, including 23-33% of vitamin A, folate, calcium, iron and zinc. Reducing food loss and waste therefore has the potential to significantly improve diet quality.

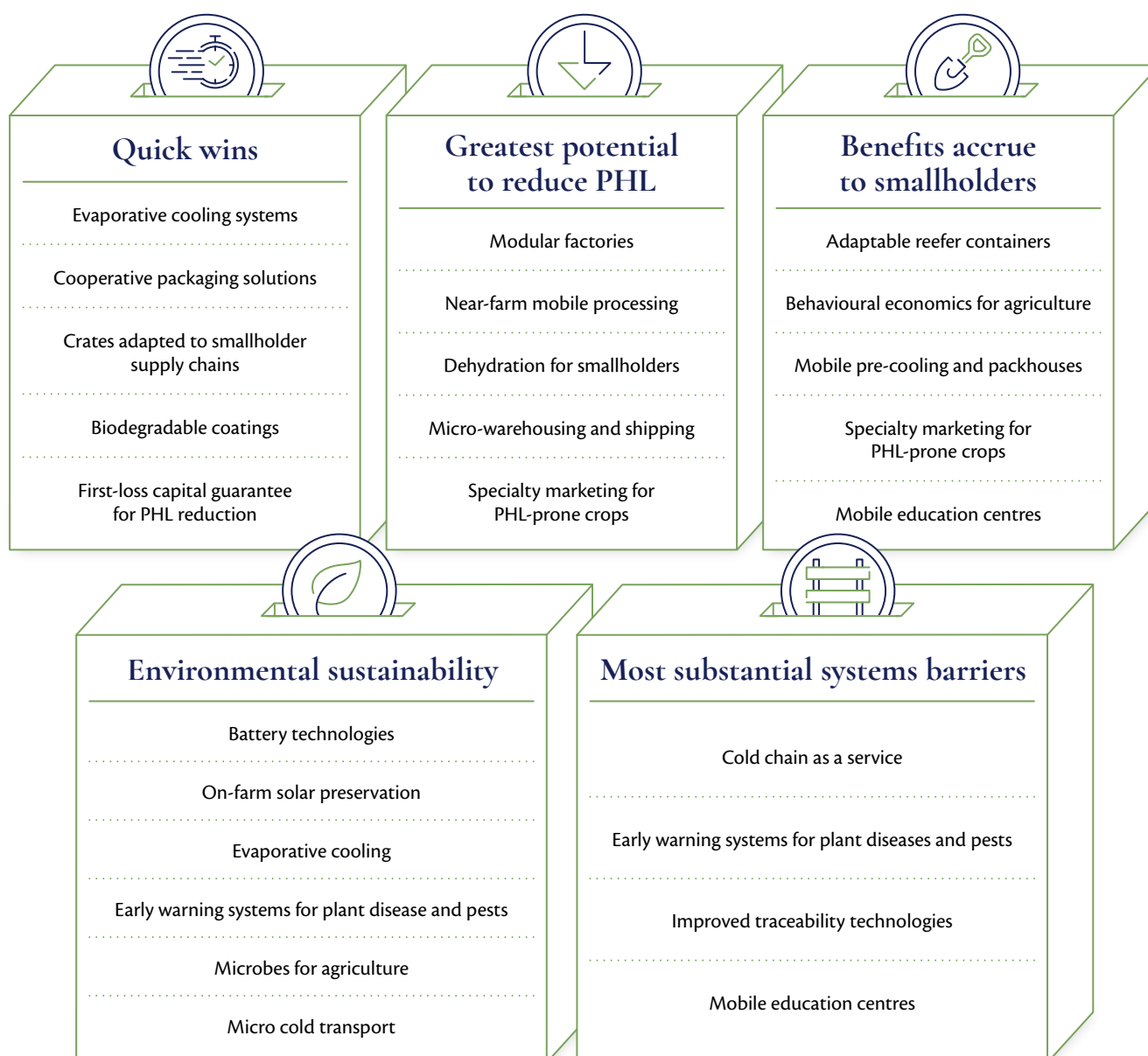
Since different levels of loss and/or waste occur at various points in food value chains, there are many opportunities for the public and private sector to act together to achieve gains. But context matters. Globally, food losses (i.e. before consumption) are significantly greater than waste (i.e. at the point of consumption). For example, in the production of fruits and vegetables, Latin America and North America have the highest food losses relating to harvest, while sub-Saharan Africa has the lowest (see Figure 5.10). By contrast, losses are greatest in the post-harvest links of the value chain in sub-Saharan Africa, and smallest in Europe and North America. Much of the difference relates to storage facilities, transportation efficiencies, and climate.<sup>326</sup> At the consumer level, the highest food waste is found in high-income settings.

**Table 5.2: Nutrients lost through food loss and waste**

Nutrients	% loss				
	Global	High-income country	Upper-middle-income country	Lower-middle-income country	Low-income country
Calories	25	27	28	24	24
Protein	28	30	27	27	26
Carbohydrates	30	39	35	29	27
Fat	12	12	13	12	11
Calcium	23	20	20	26	24
Folate	33	37	32	34	28
Iron	33	38	36	32	30
Vitamin A	24	30	21	26	16
Vitamin B6	18	38	39	15	29
Vitamin C	41	45	44	41	37
Zinc	28	32	29	28	27

Source: Springmann (2018)<sup>322</sup>

**Figure 5.11: Investible innovations for today**



Source: Adapted from Global Knowledge Initiative and Rockefeller Foundation (2017)<sup>329</sup>

Finally, protecting nutrient-rich foods through the value chain can yield benefits other than the preservation of nutrients. The deterioration of perishable crops in warm and humid climates is exacerbated by lack of infrastructure, such as inappropriate storage facilities and poor roads, while the seasonality of some nutrient-rich crops, like mangoes or papaya, can also lead to unsaleable gluts. A recent study in Malawi assessing the presence or absence of key foods in five major markets found that good storage capacity had a positive effect in moderating seasonal price fluctuations in the accessibility of beans and peas, making their year-round sale on market stalls possible.<sup>328</sup> That said, the same study also made it clear that the capacity of markets to ensure that perishable foods are always accessible remains somewhat limited due to a lack of storage infrastructure, weak coordination among producers and buyers, poor hygiene at informal markets (so-called ‘wet markets’), and poor understanding by wholesalers and stallholders of the nutritional value of foods on offer.<sup>328</sup>

#### 5.4.2 Innovations to cut food loss and waste

A renewed and intensive focus is needed on innovative technologies as well as best practices to promote efficiency gains along food chains. A scenario analysis undertaken by the Global Knowledge Initiative and the Rockefeller Foundation to better understand what innovations could reshape food systems over the next 20 years identified a set of 22 innovations (see Figure 5.11).<sup>329</sup> These would help to address post-harvest loss of food, but would also benefit smallholder farmers, improve supply chain efficiencies of perishable foods, and reduce environmental footprints on the farm and in the movement of food.

For example, activities such as dehydration, low-cost solar drying, micro cold transport, biodegradable coatings, and traceability can all be game-changers in enhancing efficiency and sustainability along food supply chains.<sup>330</sup> The study calls for investors, innovators, businesses and policymakers to take on new partnerships to bring these solutions to scale, and for

local governments to facilitate the connectivity along value chains to impact the food system as a whole.

The World Economic Forum has also considered the role of technology innovation in enabling and accelerating improvements in food systems (see Figure 5.12).<sup>331</sup> Enhanced policies, investments in infrastructure, institutional capacity-building, individual behaviour change and improved resource management, and new technologies, can all work at scale to generate employment, new income streams and the kinds of diets needed to meet growing demand. For example, supply chain efficiency, including traceability, could reduce food losses by millions of tonnes each year. Enhanced value chain-based digital communications could lead to improved market



**Figure 5.12: The 'Transformative Twelve' could deliver significant impacts to food systems by 2030**

## Changing the shape of demand



### Alternative proteins

- Reduce GHG emissions by up to 950 megatonnes of CO<sub>2</sub> eq.
- Reduce freshwater withdrawals by up to 400 billion cubic metres
- Liberate up to 400 million hectares of land



### Food sensing technologies for food safety, quality, and traceability

- Reduce food waste by up to 20 million tonnes



### Nutrigenetics for personalised nutrition

- Reduce the number of overweight by up to 55 million

## Promoting value-chain linkages



### Mobile service delivery

- Generate up to \$200 billion of income for farmers
- Reduce GHG emissions by up to 100 megatonnes of CO<sub>2</sub> eq.
- Reduce freshwater withdrawals by up to 100 billion cubic metres



### Big data and advanced analytics for insurance

- Generate up to \$70 billion of income for farmers
- Increase production by up to 150 million tonnes



### IOT for real-time supply chain transparency and traceability

- Reduce food loss by up to 35 million tonnes



### Blockchain-enabled traceability

- Reduce food loss by up to 30 million tonnes



efficiencies, reduced loss and waste, and better linkages between producers and food buyers.<sup>331</sup>

There is considerable scope for different stakeholders to realise opportunities for growth in ways that enhance the food

system overall. This opportunity is further highlighted by the International Food Policy Research Institute (IFPRI), which argues for a strategy to incentivise commercial actions along value chains to retain as many nutrients as possible as food makes its way along those chains.<sup>332</sup>

### Box 5.2: Pathways to multiple wins: reducing food loss and waste

In striving for sustainable, healthy diets for all, some actions that policymakers can take may be especially attractive since they offer pathways to multiple wins. Reducing food loss and waste is one such example, yielding many benefits in areas such as:

- **The environment.** Only having to grow food once means less pressure on land for growing crops and livestock, less demands on soils, and potentially less pollution due to fertiliser runoff and use of pesticides. Less land needed for growing food also means more land is available for carbon sequestration and biodiversity.
- **Resource management.** Having to grow less food means less fresh water is needed for crops and livestock, and there are lower fuel and infrastructure demands for transporting food. Energy demand could also be reduced, although here policymakers need to pay attention to the balance between savings and additional demands – for example for processing.
- **Business efficiency.** Reducing loss and waste as food moves through the food system will act to increase the efficiency of businesses, helping to make them more competitive.
- **Affordability of foods.** Increased business efficiency will act to drive down food prices. For high-nutrient foods, this could help the poorest in particular to access better diets,<sup>326</sup> leading to multiple benefits in terms of health and increased earning potential.
- **Better food security.** For poor smallholder producers, losses mean that less food is available for personal consumption. Women and young children are particularly vulnerable to these impacts of food losses as they are often less able to access appropriate technologies, infrastructure, storage facilities and markets.

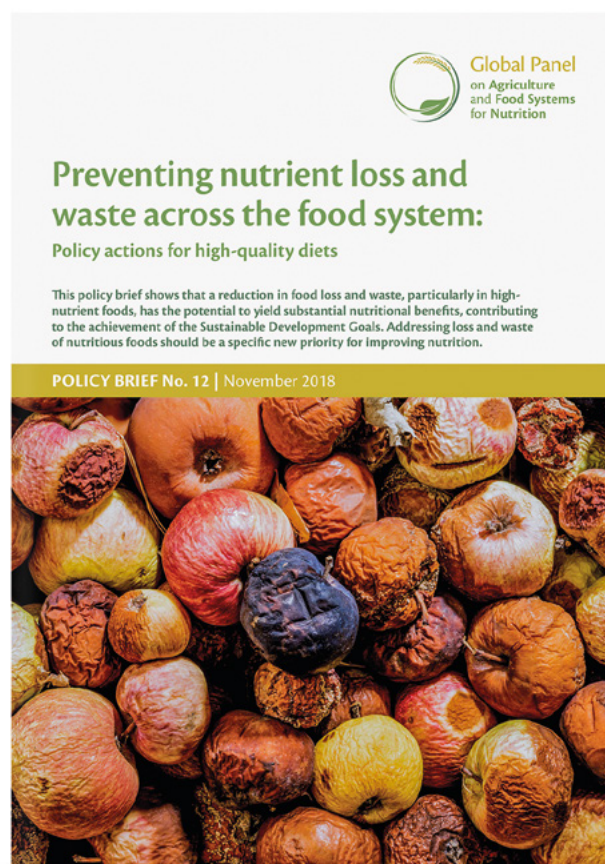
#### Save Food: Global Initiative on Food Loss and Waste

**Reduction.**<sup>333</sup> This major international initiative provides help and support for countries seeking to reduce food loss and

waste. The FAO and Messe Düsseldorf are collaborating with agencies, donors, financial institutions and business partners to provide support and assistance. Tools and methodologies have been developed for quantifying food losses and their causes. Solutions are being piloted in a number of countries, and support is being provided for capacity building, advisory and technical support.

Global Panel policy brief.<sup>326</sup> The Global Panel has separately issued advice and guidance for policymakers on preventing nutrient loss and waste across the food system (see Figure 5.13)

Figure 5.13: Global Panel Food Loss and Waste policy brief









# 6 Making sustainable, healthy diets affordable to all

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## Key messages

- Nutrient-rich products are today more expensive (on average) to produce, and therefore to purchase, compared to other foods such as staples. This is because of high seasonality, geographic constraints to growing conditions, and perishability. Diverse pressures could increase prices further in the future.
- Healthy diets are unaffordable today for most poor people (and for many nutritionally vulnerable people) the world over. A recent assessment of the affordability of a healthy diet showed a healthy diet to be out of reach for at least three billion people. Most of those people are in Asia (1.9 billion) and Africa (965 million). Ensuring that everyone can afford sustainable, healthy diets is therefore a formidable challenge.
- There has been significant progress in recent years in addressing poverty. An additional 900 million people reached the US\$10/day threshold (joining the ranks of the global middle class) between 2007 and 2017. Most projections suggest that poverty and extreme poverty will continue to fall in the coming decade, although the

coronavirus pandemic could reverse the last decade's gains. Indeed, a pessimistic scenario could lead to an increase in the number of people living in poverty of between 420 and 580 million, relative to 2018. That would be a catastrophic shift in the poverty trend.

- Shifting diet patterns so that they become healthy will be a considerable challenge for the poorest countries, and the poor in all countries. But at country level, a shift to significantly improved diets would actually cost less in 86 countries (with a combined population of 4.2 billion), but would cost more (at current prices) in 71 countries (with a combined population of 4.1 billion), most of which are LMICs.

Four classes of action are needed to ensure the affordability of sustainable, healthy diets for all in the future. The scale of the challenge means that interventions in each of the four are essential, and need to work in concert:

### 1. Pro-poor income growth.

This is needed to support greater

purchasing power. However, this must be accompanied by efforts to make healthier diets more desirable (see Chapter 7). As incomes rise, people often shift their food choices to items that are less healthy.

### 2. Consumer-level taxes and subsidies on key food categories.

The aim is to shift relative prices in favour of nutrient-rich foods needed in healthy diets, and away from foods that are less healthy.

### 3. Safety nets designed to support diet-quality goals.

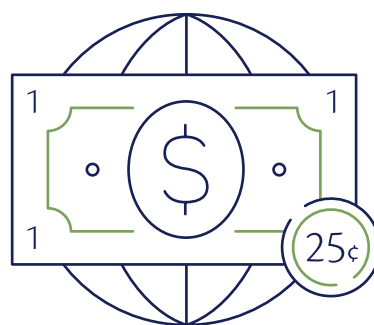
This is essential to protect the most vulnerable from food price volatility during the necessary transition.

### 4. Reduce the cost of nutrient-rich products through technology and innovation.

Examples include investments in agricultural research which could increase the productivity of fruits, vegetables, legume crops and nuts/seeds; precision agriculture; reduced food loss/waste; and improved storage technologies that better protect perishables along the entire value chain.



Healthy diets are unaffordable for an estimated **three billion people** around the world



**90%** of the world's poor that have an income **below US\$1.25/day** live in countries where domestic food prices are closely linked to international prices

**A locally available least-cost healthy diet based on today's prices and patterns of consumption is already unaffordable for an estimated three billion people around the world. Ensuring that everyone can afford sustainable, healthy diets in the decades ahead is therefore a formidable challenge. The scale of the task requires careful analysis of local contextual challenges and opportunities. Policymakers cannot rely on rising incomes alone to 'solve' the affordability problem. Implementation of policies to promote 'pro-poor' growth will be important, but this chapter sets out a broader strategic approach which encompasses further components to be implemented simultaneously. This includes measures on technology and innovation, subsidies, and taxation to reduce the cost of nutrient-rich foods, and on social protection to protect the most vulnerable.**

Food makes up a large share of the budget of the poor and vulnerable in all countries (see Figure 6.1). This is particularly true for poor and vulnerable households in sub-Saharan Africa, South Asia, and Latin America and the Caribbean.<sup>1</sup> The challenge for households on low incomes is that even spending up to 75% of their total income on food may not be enough to secure diets of a sufficiently high quality to avoid ill-health related to various forms of malnutrition. Based on average estimated income levels and food prices in 2017, roughly three billion people across the world were unable to afford a least-cost healthy diet as recommended by the national governments where they live. Most of those people are in Asia (1.9 billion) and Africa (965 million).

However, wealthier countries are not immune to this challenge. The unaffordability of these diets extends to the poorest in wealthier countries too. The primary focus of this chapter is therefore on how policymakers can ensure that healthy and sustainable diets are affordable to everyone.

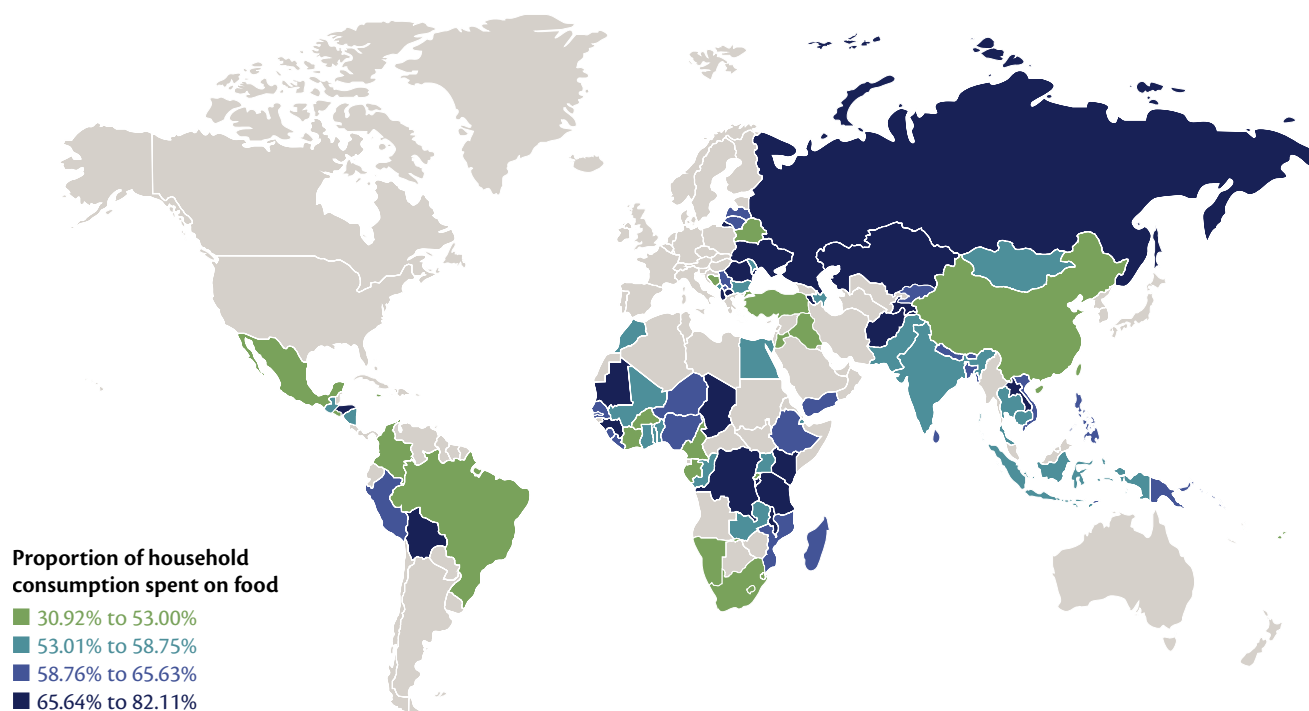
The affordability of sustainable, healthy diets must be addressed from both the supply side and the demand side simultaneously through concerted action in both high- and low-income

countries. Many actions are possible at the national level, but food prices are also affected by global food markets, and hence by high-income countries' domestic policies as well as by bilateral trade agreements. Higher quality sustainable diets accessed by everyone may cost more or less than they do today. This will depend on the evolution of dietary patterns, the extent to which environmental externalities are factored into prices, how income growth translates into demand in coming years, and the size of the gap needing to be bridged between insufficient food intake today (among undernourished populations) and improvements needed tomorrow. It will be critical for policymakers not only to encourage and facilitate enhanced production and marketing of nutrient-rich foods, but also to support purchasing power through higher incomes via pro-poor job growth and social protection.

This chapter sets out a range of policy actions which together have the potential to address the challenge surrounding the unaffordability of sustainable, healthy diets. These are essential actions to be pursued in an integrated and coherent way, especially in LMICs. Importantly, it is not axiomatic that higher purchasing power leads to improved dietary choices in the absence of improved knowledge (these issues are discussed in the Chapter 7). However, progress in increasing purchasing power is fundamental to the goal of making sustainable, healthy diets affordable to all.



**Figure 6.1: Proportion of household consumption spent on food and beverages (among households consuming less than \$2.97 per person per day)**



Source: Food Systems Dashboard,<sup>322</sup> based on World Bank Purchasing Power Parity cut-off of \$2.97.<sup>323</sup> Original data source: World Bank, Global Consumption Database.

## 6.1 Progress in addressing poverty and income inequality: a mixed picture

Until the COVID-19 crisis pushed the global economy into a deep economic recession<sup>336</sup> associated with significant job losses, poverty had been declining for decades. In 2007, only a quarter of the world's population lived on more than US\$10 per day (i.e. they were not classified as 'poor'). This rose to more than one third a decade later, which meant that 900 million more people reached the US\$10/day threshold in just 10 years, thereby joining the ranks of the global middle class.<sup>337</sup> That said, there is today a strong rationale for updating national poverty lines globally, and related estimates of purchasing power parity. This could better incorporate the reality that if three billion people cannot afford healthy diets as recommended by their own governments, the latest estimate of 734 million people living below the international poverty line (<US\$1.90 per day) in 2015 is at the very least misleading.<sup>338</sup> To ensure that people can afford sustainable, healthy diets in future, pro-poor policies and income transfers to support enhanced consumption (as recommended in this report) must be framed by a different threshold of poverty; one in which being poor actually means not being able to afford a healthy diet regardless of place and time.

Regardless of the poverty definition or methodology used, most projections suggest that both poverty and extreme poverty will continue to fall in the next 20 years, although the 2020 slowdown of the global economy linked to the

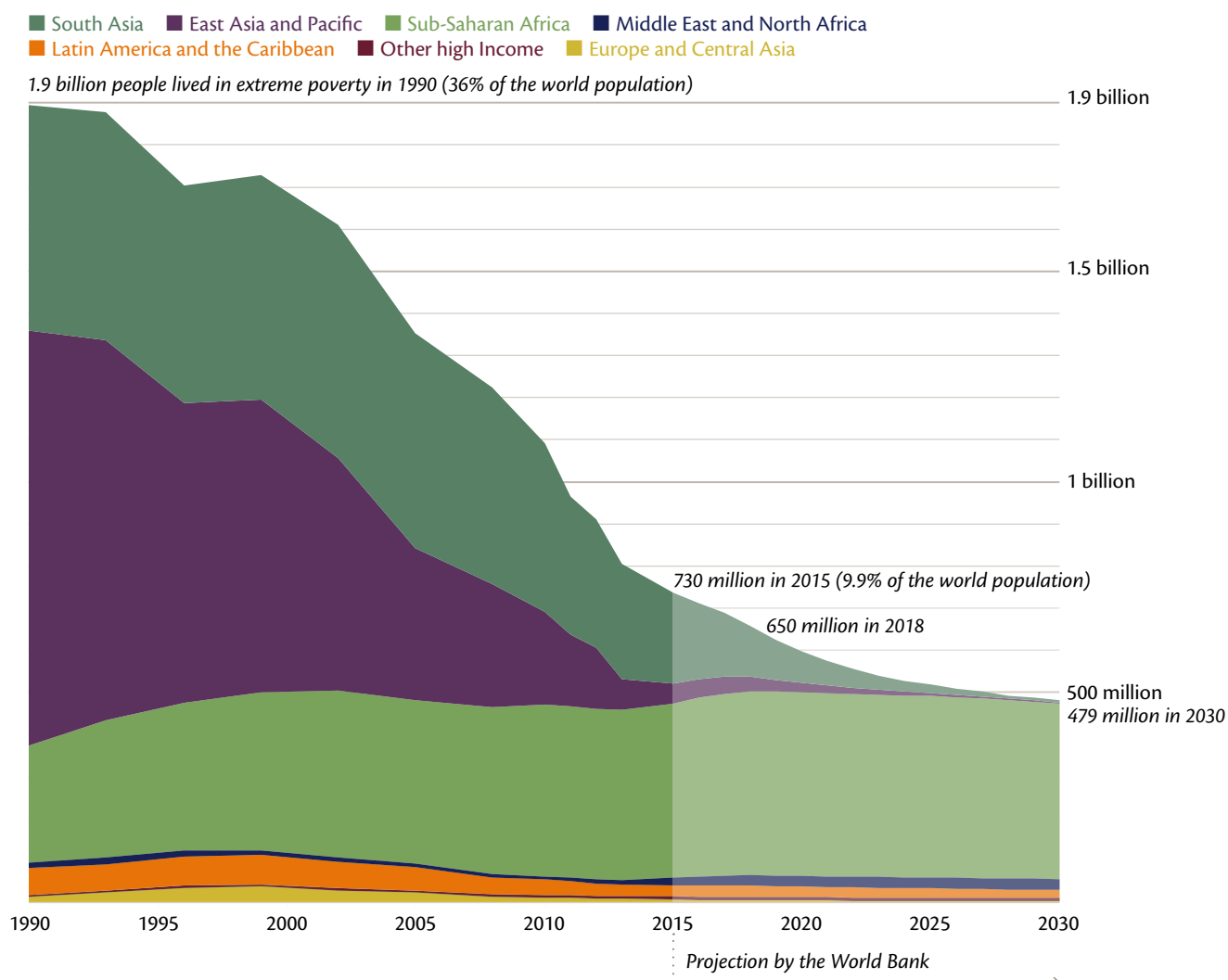
pandemic will dampen the pace of progress.<sup>337</sup> One estimate suggests that the pandemic could reverse the last decade's gains, posing a genuine challenge to the poverty reduction targets set for 2030 by the Sustainable Development Goals.<sup>339</sup> Indeed, the most pessimistic scenario in that study (a 20% contraction in income or consumption) could lead to an increase in the number of people living in poverty of between 420 and 580 million, relative to 2018. That would be a catastrophic shift which would likely increase income inequalities, particularly in LMICs where poverty remains endemic and gains have been most recent. This prospect has led to calls for massive resource support for countries whose economies and household livelihoods are most vulnerable to income losses resulting from the crisis. One estimate suggests that the African continent will require a US\$100 billion financial stimulus package from high-income countries.<sup>340</sup>

It is certainly possible that this most recent global economic crisis will increase income inequalities between nations. Even before the pandemic, it was thought that there could still be around 500 million people living in extreme poverty (on less than US\$1.90/day) by 2030, mostly in sub-Saharan Africa<sup>341</sup> (see Figure 6.2). Income inequality also persists within countries and the people on lowest incomes (less than US\$1.90/day) are not just found in low-income countries. Today, there are more poor people living in middle-income countries such as Nigeria and Indonesia than in the world's lowest-income countries, such as Haiti, Madagascar, or Liberia. This means that governments in middle-income (and even high-income) settings also need to pay particularly close attention to supporting their own low-income families to access sustainable, healthy diets.



**Figure 6.2: The number of people in extreme poverty – including projections to 2030  
(produced before the COVID-19 pandemic)**

Extreme poverty is defined by the 'international poverty line' as living on less than \$1.90/day. This is measured by adjusting for price changes over time and for price differences between countries (PPP adjustment). From 2015 to 2030 the World Bank's projections are shown.



Source: Roser and Ortiz-Ospina (2019).<sup>337</sup> Original data source: World Bank

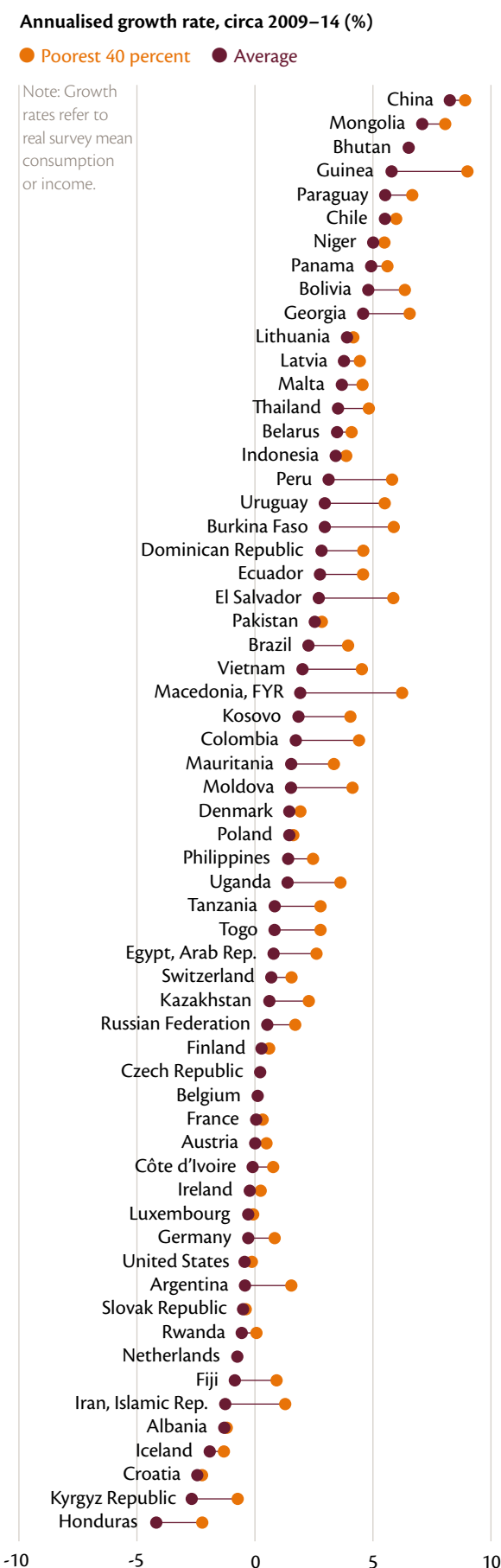
Average income inequality appears to have fallen slightly in Latin America and the Caribbean and in sub-Saharan Africa relative to its level in the early 1990s, while it has grown in South Asia and the Middle East/North Africa regions over the same period.<sup>337</sup> In another study of 61 countries, recent average annualised income growth was found to be higher among the poorest 40% of households than the national average. This means that in countries such as Guinea, Peru, El Salvador, Uganda and Fiji, income gains were greater than average among the poorest families (see Figure 6.3).<sup>341</sup>

Unfortunately, there were 34 countries in which income growth for the poorest 40% of households lagged behind national averages, including Madagascar, Benin, Sri Lanka and Cameroon.<sup>341</sup> In these countries, many families struggle to afford even a minimally adequate diet in nutrient terms. The specific needs of low-income and otherwise vulnerable individuals, households and communities must be addressed if the goal of healthy diets for all is to be achieved.

These trends confirm the need for careful pro-poor management of economic growth to protect food consumption of the poorest (see Section 6.5). The message for policymakers is that measures that support economic growth and tackle poverty levels and income inequality are all important in helping to make sustainable, healthy diets affordable. This problem cannot be overstated.

A substantial proportion of the growth in global GDP up to 2030 is projected to accrue to low- and middle-income countries. By that year India's economy is projected to be on par with that of the European Union.<sup>342</sup> What is more, many recently very poor and disaster-affected countries in sub-Saharan Africa including Mozambique, Rwanda and Ethiopia, were (before the coronavirus pandemic) also expected to more than triple the size of their own economies.<sup>342</sup> Thus, across LMICs there is huge potential for more inclusive growth that supports purchasing power, making higher quality diets more affordable.

**Figure 6.3: In 61 countries income growth among the poorest was faster than average**



Source: World Bank (2018).<sup>341</sup> Original data source: World Bank Global Database of Shared Prosperity. WDI

## 6.2 The cost of sustainable, healthy diets

Poor households everywhere are already struggling to buy adequate food, so supporting them to consume diets that are healthy and sustainable presents a formidable challenge. This is because nutrient-rich foods typically have relatively high prices compared to staples (cereals and roots/tubers), and compared to many ultra-processed packaged foods which are low in nutrients but high in unhealthy fats, sugar, and salt.

Numerous studies have shown that healthy diets are unaffordable today for most poor families in countries such as Afghanistan, Bangladesh, Pakistan, Sri Lanka,<sup>343</sup> Uganda,<sup>344</sup> and Nepal.<sup>345</sup> Indeed, an assessment of local market price data for 680 foods and non-alcoholic beverages in 170 countries in 2017 showed that most of sub-Saharan Africa and large parts of Asia simply cannot afford healthy diets as defined by national governments.<sup>14</sup> Countries such as Mozambique, Central African Republic and Burkina Faso face a cost of diet that is two to four times average per capita expenditure on food (see Figure 6.4).<sup>15</sup> In Niger, the healthy diet cost is more than four times what people currently spend on food. In other words, lack of affordability of even minimally healthy diets represent a major challenge in LMICs.

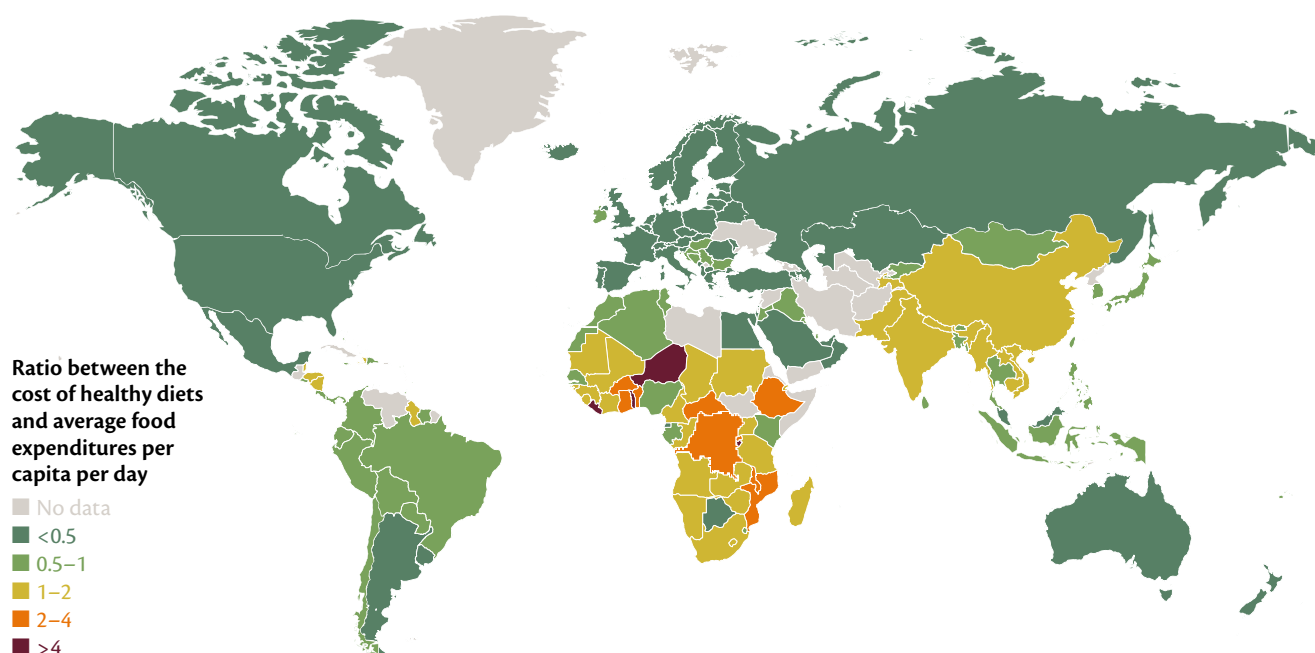
What is more, the coronavirus pandemic will have made nutrient-rich food prices even higher in many LMICs owing to widespread income losses and price volatility.<sup>261</sup> For example, in some urban food markets in India prices of chicken, mutton and tomatoes have increased dramatically since the beginning of April 2020.<sup>346</sup> Similarly, in Bangladesh vegetable prices have soared, mainly due to transport difficulties.<sup>240</sup>

From a supply side perspective, investments in agricultural research could increase the productivity of fruits, vegetables, legume crops (that offer the benefit of natural nitrogen-fixation in the soil), and nuts/seeds, and could help develop precision agriculture, reduce food loss/waste and improve storage technologies that better protect perishables along the entire value chain. Each of these factors could contribute to relative price shifts in the 2020s, but much will depend on the extent to which they are prioritised by the public and private sectors.<sup>331</sup>

“ The cost of the diet increases incrementally as the diet quality increases and this is true across all regions and country income groups. The cost of a healthy diet is 60% higher than the cost of the nutrient adequate diet, and almost 5 times the cost of the energy sufficient diet. ”

FAO, IFAD, UNICEF, WFP and WHO (2020)<sup>15</sup>

**Figure 6.4: The cost of a healthy diet as a ratio of average food expenditure per capita**



Notes: The maps show affordability expressed as the ratio between the cost of each of the three reference diets (energy sufficient, nutrient adequate and healthy diets) and average food expenditures per capita per day in a given country. Affordability is shown for 170 countries in year 2017. Each diet is considered unaffordable when the ratio between the cost of the diet and average food expenditure in a given country is greater than 1. A ratio greater than 1 shows how many times a diet is more expensive than the average food expenditure.

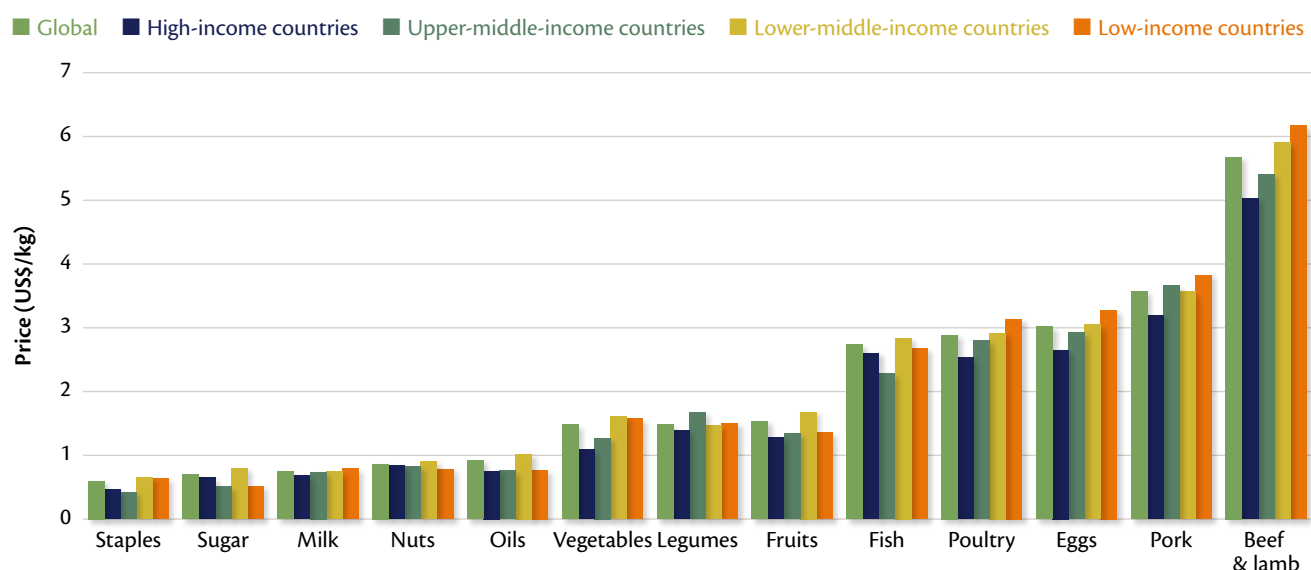
Source: FAO (2020)<sup>15</sup>

Currently, there is a wide gap between the price of the kinds of foods that should be more present in sustainable, healthy diets and other foods that are either starchy staples (providing mainly calories) or foods that should be less present in some people's diets (such as red meats). Figure 6.5 shows that this pattern is consistent globally and across national income categories. The most expensive foods on average are animal-source foods (various meats, eggs, and fish), followed by fruits, pulses, and

vegetables. Less costly on average in terms of price per unit weight are staple foods and sugar.

It is important to note that while not all LMICs are fully integrated into global food trading systems, most are. As a result, 90% of the world's poor that have an income below US\$1.25/day live in countries where domestic food prices are closely linked to international prices. For roughly 360 million poor people,

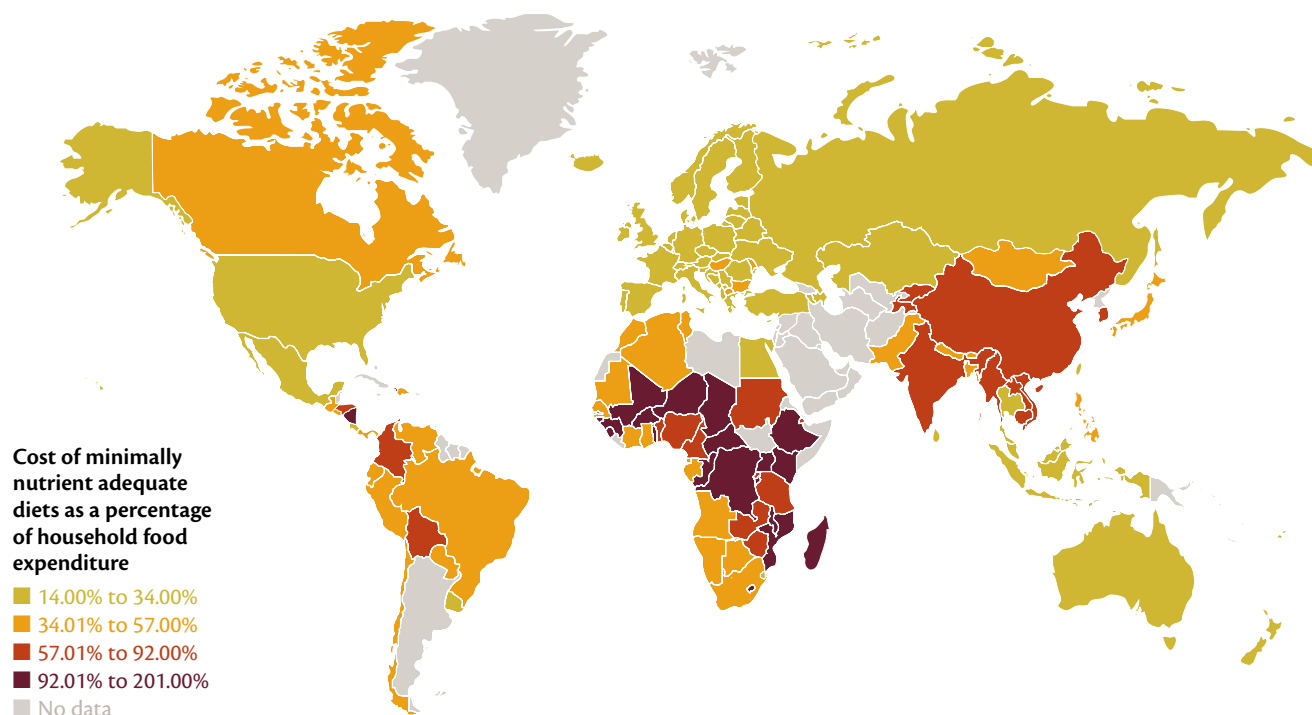
**Figure 6.5: Projected food commodity prices in 2030 by income region**



Source: Springmann et al. (2020)<sup>347</sup>



**Figure 6.6: Cost of nutrient adequacy as a percentage of household food expenditure**



Notes: The cost of nutrient adequacy was defined as the minimum daily cost of meeting nutrient and energy requirements for a reference healthy adult woman. This was then calculated as a percentage of daily per capita household spending on food and non-alcoholic beverages.<sup>334</sup>

Source: Food Systems Dashboard (2020)<sup>334</sup>. Original data source Alemu et al. 2019<sup>349</sup>

international food prices are transmitted to their local markets within three months.<sup>348</sup> This confirms the role of trade not just in re-distributing food around the globe, but also in affecting domestic food prices which are an important factor in the affordability of healthy diets.<sup>247</sup>

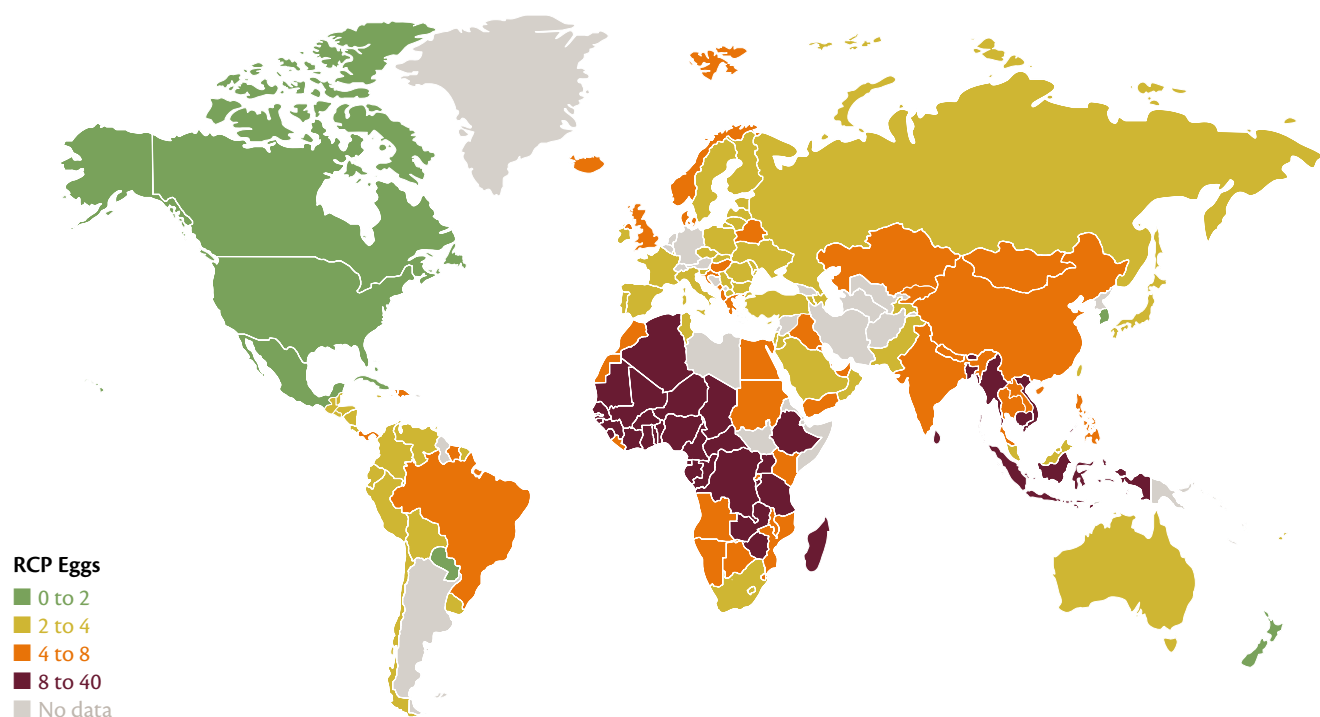
Poor households rationally seek to optimise the amount of calories they can serve to the household for a given (constrained) amount of money available to spend. Feeding comes before nourishing; that is, allaying hunger is a first-

order priority for the poorest households, and for many LMIC governments. Adding diversity and quality to a diet is often seen as a relative luxury that comes with rising income. In terms of the cost of different types of foods on a calorie basis, the cheapest sources are of course grains, but also sugar, oils, and fats. According to data from the Food Systems Dashboard, the cost of a diet of minimum nutrient adequacy (Cost of Nutrient Adequacy) can be up to 200% of a household's food expenditure in countries such as Niger and the Democratic Republic of Congo (see Figure 6.6).<sup>334</sup>

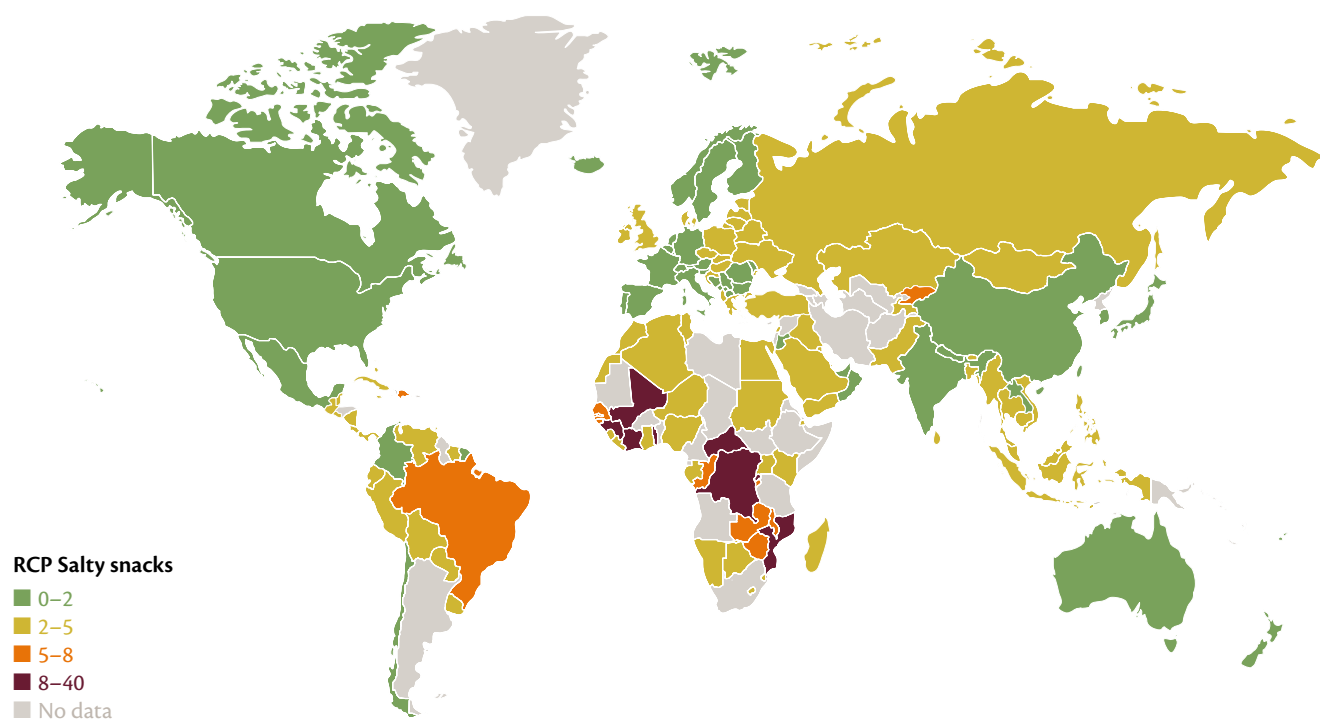


**Figure 6.7: Global variation of relative caloric prices of eggs and salty snacks in 176 countries, 2011**

### A: Relative caloric price (RCP) of eggs



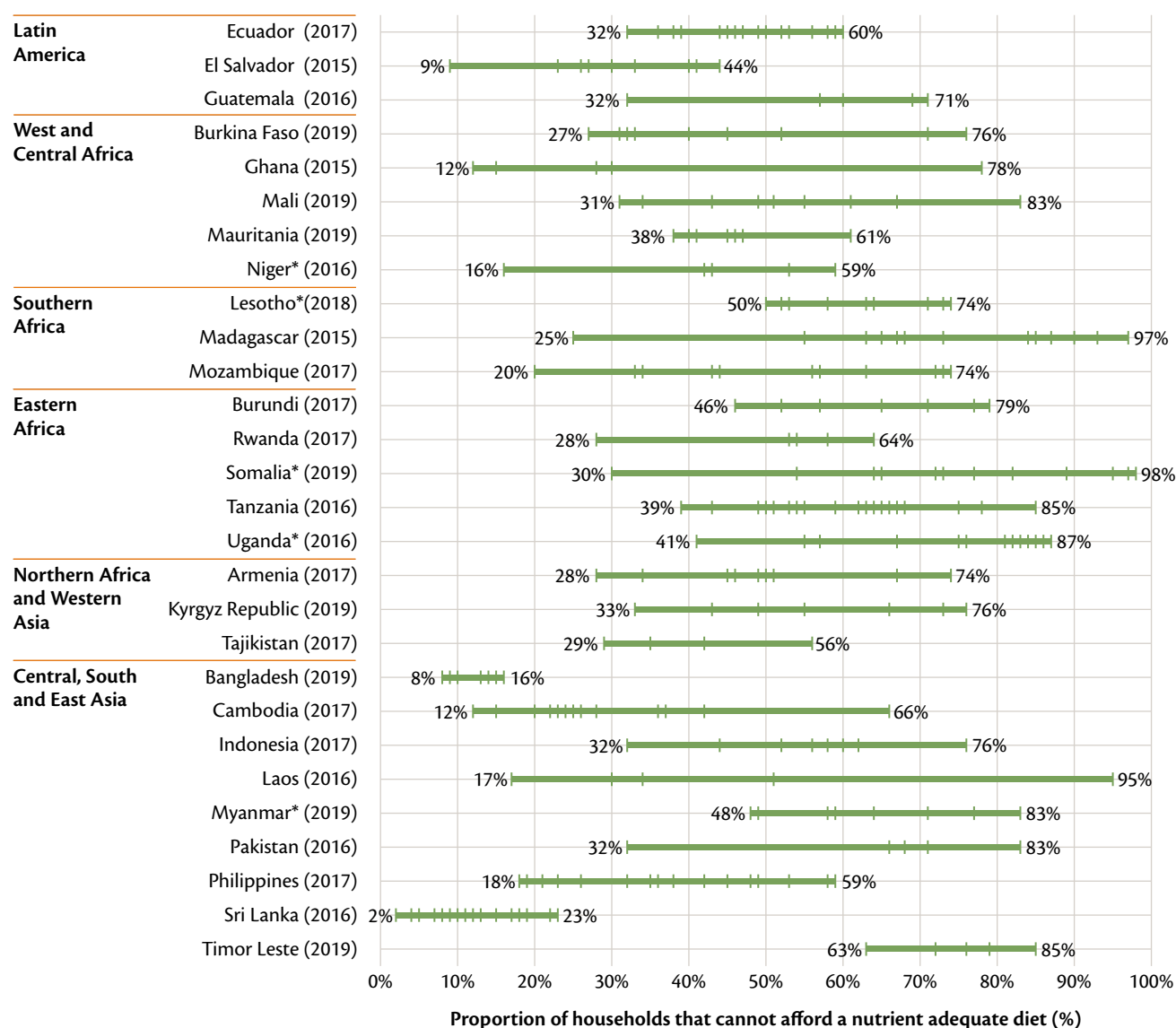
### B: Relative caloric price (RCP) of salty snacks



Note: The statistics reported are population-weighted means of the RCPs for each income or regional group, shaded according to the colours described in the legend.

Source: Headey and Alderman (2019)<sup>350</sup>

**Figure 6.8: The affordability of a nutrient adequate diet varies widely within many countries**



Notes: The figure indicates the range of unaffordability of a nutrient adequate diet across different countries and different years. Unaffordability is measured by the proportion of households in a country whose food expenditure is not sufficient to afford a nutrient adequate diet in their local environment. The nutrient adequate diet includes, per person, the average energy needs and the recommended intake for protein, fat, four minerals and nine vitamins. The modelled household varies by country, but typically includes one breastfed child aged 12–23 months, one school-aged child (6–7 years), one adolescent girl (14–15 years), one lactating woman and one adult man. Each data point represents an area of the country. Each vertical line in the range represents a particular administrative area, e.g. a province or district. The asterisk denotes that there was a consumer price index (CPI) adjustment made to expenditure data to match the year for which the food price data were collected. Source: FAO (2020).<sup>15</sup> Original data source: WFP (see WFP. 2019. Fill the Nutrient Gap [online]. Rome. [Cited 27 April 2020]. [www.wfp.org/publications/2017-fill-nutrient-gap](http://www.wfp.org/publications/2017-fill-nutrient-gap) for published country data)<sup>50</sup>

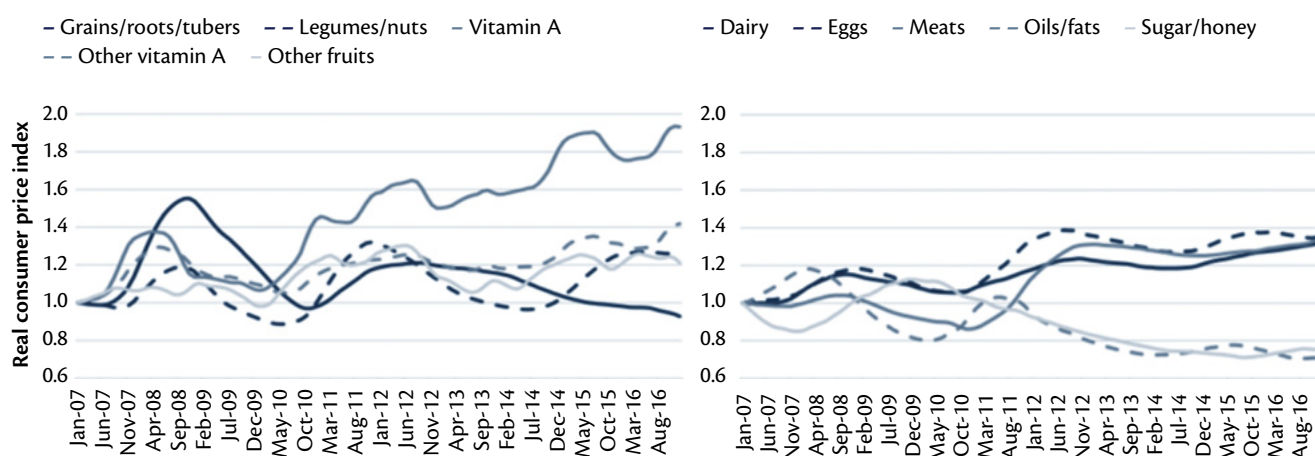
That said, when considering the price per calorie delivered by each type of food rather than by weight as discussed above, the same study found that relative costs are not universal. Fruits and nuts, for instance, are particularly costly in the Asia and Pacific region, but much less so in sub-Saharan Africa and the Middle East. The same holds true for vegetables and pulses. Conversely, dairy products and eggs are most costly (per calorie) in Africa and the Middle East, but less so in Asia and Pacific countries. Significantly, nutrient-poor foods that deliver calories are the least costly everywhere, with little regard for geography.<sup>349</sup>

Mapping the price of nutrient-rich foods relative to the cheapest local source of calories easily explains why so many poor

households in LMICs spend so little of their scarce resources on nutrient-rich foods like eggs, compared with salty snacks, added sugars and oils and fats.<sup>350</sup> Figure 6.7A shows that the market price of eggs relative to the cheapest available staple food is very high across most of Africa and Asia. By contrast, Figure 6.7B indicates that packaged salty snacks are much less costly relative to staple food sources of calories across most of the world, and hence are also purchased by the poor because they offer ‘cheap’ calories that do not require preparation or cooking. They are therefore convenient to give to small children asking for food, and they are perceived as desirable due to colourful packaging, enhanced taste, and advertising linking products like these to aspirational lifestyles (these issues are discussed in Chapter 7).



**Figure 6.9: Price trends by food group in Ethiopia, 2007–2016**



Note: All price indices are set to 1.0 in January 2007, the first month in the price data series used here. Price index values above 1.0 mean that real prices for foods in that food group increased in aggregate, while values below 1.0 imply that foods in the food group have become cheaper over time in real terms.

Source: Bachewe et al. (2019)<sup>351</sup>

That said, it is also important to recognise that affordability often varies widely within countries (see Figure 6.8). For example, in Madagascar, the proportion of households able to afford a nutrient-adequate diet is as low as 25% in some regions, and as high as 97% in others. The range is from 12% to 78% in Ghana. Some possible solutions for narrowing gaps in affordability within countries include lowering prices locally, increasing the availability of nutrient-rich foods in specific areas, introducing biofortification or fortifying staple foods, and modifying social safety nets to help the most vulnerable.

When trends in prices are considered, real prices in many LMICs have seen a rising trend with inter-seasonal and inter-annual spikes which directly affect the effective purchasing power of poor households. For example, one study showed that while the cost of staple foods (grains, roots and tubers) remained flat from 2007 to 2016 (aside from spikes that coincided with food price crises in 2007/2008 and 2011/12), the price of non-staples rose steadily over the same period, making staple calories increasingly cheap relative to more expensive nutrient-rich foods such as pulses, eggs, fruits and vegetables (see Figure 6.9).<sup>351</sup> Nutrient-rich foods tend to be more expensive in most countries because of high input costs (labour, water, pest management), high demand in most markets, and high perishability which constrains total supply.

While keeping the price of staples steady represents a policy success for any LMIC with a rapidly rising consumer base (such as Ethiopia) the gains represented by tackling hunger risk being off-set by growing unaffordability of quality diets which are diverse and high in nutrients.

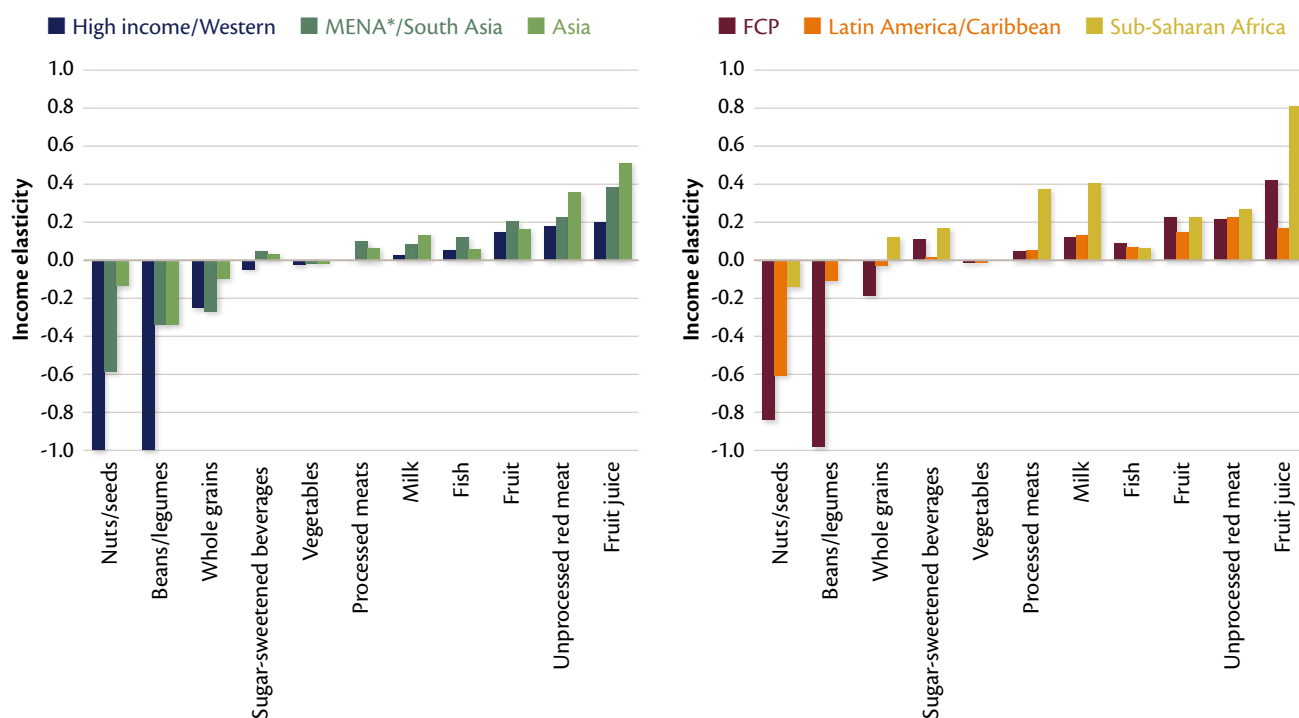
An analysis of food intake data for 164 countries examining how income and food prices relate to food intake globally found that while the combination of income and prices is always an important underlying driver of dietary choice, their influence varies by food item and by location<sup>352</sup> (see Figure 6.9). For example, rising incomes raised milk intake most strongly

in sub-Saharan Africa, while fruit intake was most strongly linked to increased income among older women globally. An important finding was that income elasticities of demand for foods such as processed red meats and sugar-sweetened beverages (SSBs) are higher in Africa and South Asia than in high-income countries, meaning the purchasing of these products is more sensitive to changes in income in Africa and South Asia. Indeed, mean consumption of SSBs is already higher in Africa than in high-income countries (see Figure 6.10).<sup>352</sup>

The same study found that the poorest households (first income decile in Figure 6.11) are more responsive to an increase in income in relation, say, to milk consumption than are wealthier households (tenth decile in the income distribution).<sup>352</sup> For poorer households, a 10% increase in income is associated with a large increase in demand for milk, processed meats and SSBs, while a similar 10% increase in income among wealthier households generates greater demand for fruit and a negative response to milk, processed meats, and SSBs.

In other words, product prices matter, but demand for various products is heavily conditioned by constraints to purchasing power. Currently, the poorest households within the 164 countries studied have sub-optimal diets, and the concern is that even a small rise in income leads them to consume more foods that may *not* make their diets healthier. Indeed, other studies have also shown that policymakers cannot simply assume that income growth will suffice to shift consumption patterns towards healthier diets. For example, it has been found<sup>61</sup> that in the context of global reduction in poverty, the consumption of healthier diets has improved in most contexts (in resource-poor and resource-wealthy countries alike), but the intake of food products offering limited nutritional value has also increased in these countries at the same time. Thus, while the cost of nutrient-rich foods has to come down in absolute terms, and the relative price of such foods compared with ultra-processed alternatives must also come down, the purchasing power of all consumers, but particularly the poorest, must rise.

**Figure 6.10: Income elasticity of demand estimates for different food groups across regions**



\*Middle East and North Africa.

Source: Muhammad et al. (2017)<sup>352</sup>

## 6.3 Who can afford improved diets?

A key question is: what would be the cost of a healthy diet today?

A recent assessment of costs suggests that the number of people unable to afford even the cheapest locally available healthy diets is roughly three billion in total.<sup>14,15</sup> This is essentially because healthy diets are estimated to be, on average, five times more costly to purchase than diets that meet only basic dietary energy needs through starchy staples (such as grains and tubers). This puts the cost of a healthy diet considerably above the international poverty line, established at US\$1.90 purchasing power parity (PPP) per day, so it is not surprising that most of the people unable to afford healthy diets live in Asia (1.9 billion) followed by Africa (965 million).<sup>15</sup>

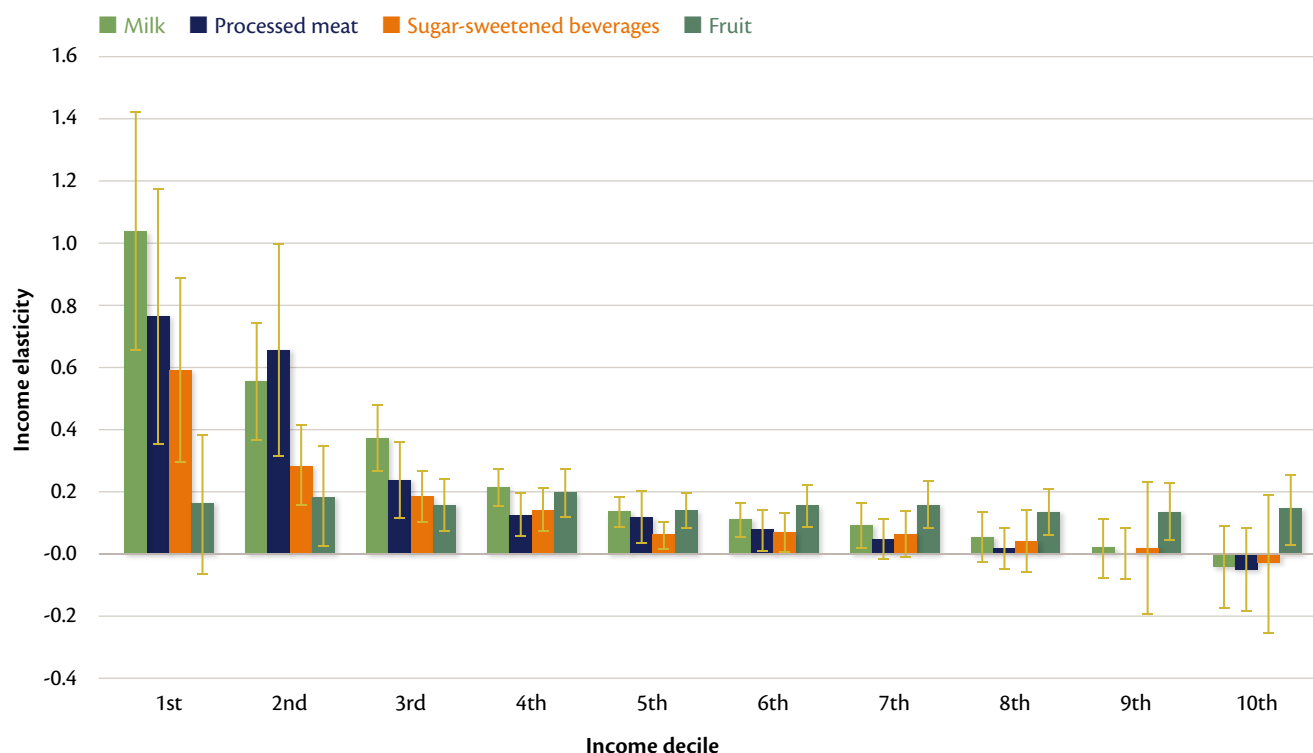
The Global Panel is not proposing a single reference diet for all societies. The focus here is on helping policymakers identify how to make a range of enhanced diets affordable in their local context, while bringing attention to bear on how costs can change when factoring in the impacts of diets on both human and planetary health. For example, a recent study on the potential joint impacts on environment and human health of shifts in the diet of Swiss families found that a transition towards a healthier diet (that adhered to guidelines of the Swiss Society of Nutrition) would be more sustainable than current dietary patterns (a 36% lower environmental footprint). It would also cost 33% less than their current food expenditure, and generate roughly 3% fewer adverse health outcomes (in terms of disability-adjusted life years – or DALYs – associated with NCDs).<sup>353</sup>

Similar work commissioned by the Global Panel for this report assessed costs associated with a shift towards a range of different diets with varying environmental and human health impacts to consider how this could affect diet costs in future decades.<sup>347</sup> This work calculated the costs of diets in 150 countries from all world regions using 2017 prices, covering 463 food items for the benchmark, and projected demand changes and price effects to 2030 and 2050.<sup>347,354</sup> The dietary patterns modelled include ones that contain more fruits, vegetables, whole grains, fish, and dairy, and less meat, sodium, trans fats and added sugars than today. Two variants were assessed for each of the diet patterns to account for at least some geographic and cultural variation in food norms. In the flexitarian dietary pattern, for example, fruit and vegetable intake would involve an increase of about one-third globally, ranging from 28% in high-income countries to 100% or more (from very low levels) in low-income countries. Intake of pulses and nuts would rise three-fold, with larger increases in high-income than in low-income countries. Consumption of animal-source foods would fall by roughly a third globally, ranging from 11% in low-income countries to 60% in high-income countries.<sup>xii</sup>

To determine the 'external costs' of dietary choices, two important components were added: the costs associated with climate change and the costs of illness relating to sub-

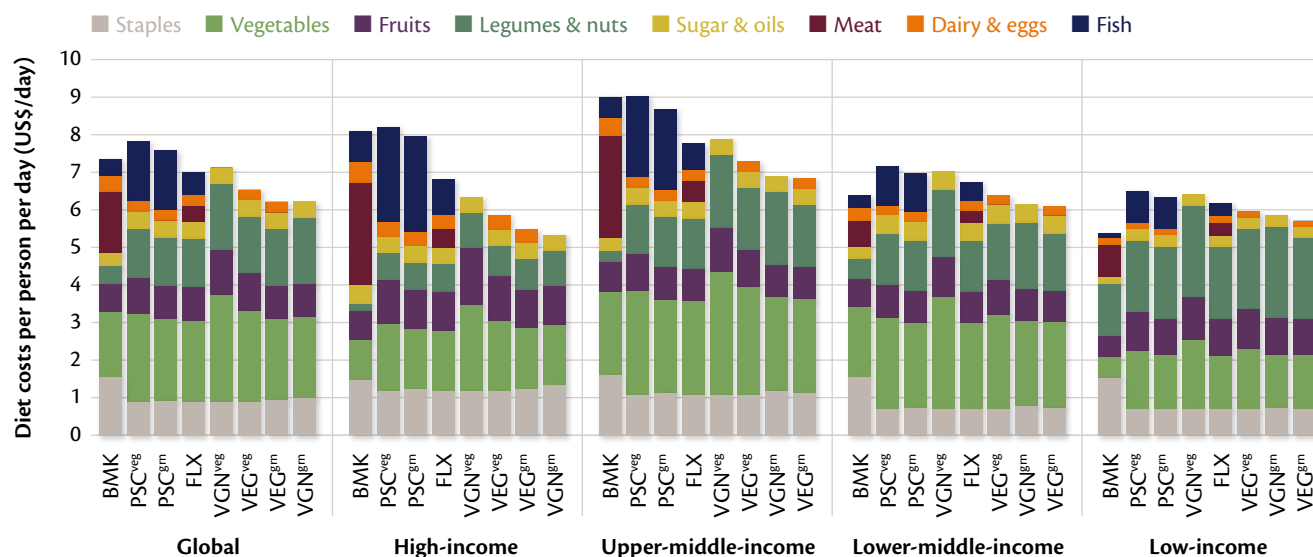
<sup>xii</sup> The flexitarian diets (FLX) included at least 500g/day of fruits and vegetables of different colours and from different food groups (the composition of which is determined by regional preferences), at least 100g/day of plant-based protein sources (such as legumes, soybeans, nuts), modest amounts of animal-based proteins (such as poultry, fish, milk, and eggs), limited amounts of red meat, refined added sugar representing less than 5% of total energy per day, and a low quantity of vegetable oils high in saturated fat.

**Figure 6.11: Income elasticities for select food categories by income decile**



Source: Muhammad et al. (2017)<sup>352</sup>

**Figure 6.12: Daily cost of diets in 2050 per person by diet scenarios, commodity, and income region**



The diet scenarios include:

- Benchmark diets (BMK) – business as usual based on current dietary patterns and prices,
- Flexitarian diets (FLX),
- Pescatarian diets in variants with high fruit-and-vegetable content (PSCveg) and high whole-grain content (PSCgrn),
- Vegetarian diets in variants with high fruit-and-vegetable content (VEGveg) and high whole-grain content (VEGgrn), and

- Vegan diets in variants with high fruit-and-vegetable content (VGNveg) and high whole-grain content (VGNgrn).

The diets are displayed in decreasing order of expenditure per region. Values represent population-level averages in each region with 1.2 billion people in high-income countries, 1.1 billion in upper middle-income countries, 4.7 billion in lower middle-income countries, and 1.4 in low-income countries.

Source: Springmann et al. (2020)<sup>347,354</sup>



optimal diets. Previously published diet-related greenhouse gas emissions (GHG) were paired with food demand estimates for the different diet scenarios, differentiated by region of the world.<sup>354</sup> Those were then combined with estimates of the social cost of carbon, which represents the economic cost caused by an additional tonne of GHG emissions. On the health side, relative disease risks associated with dietary factors were paired with mortality estimates country-by-country. The ‘health costs’ derived accounted for both direct and indirect costs associated with treatments for a specific disease, including medical and healthcare costs, and the costs of informal care and income foregone due to lost working days.

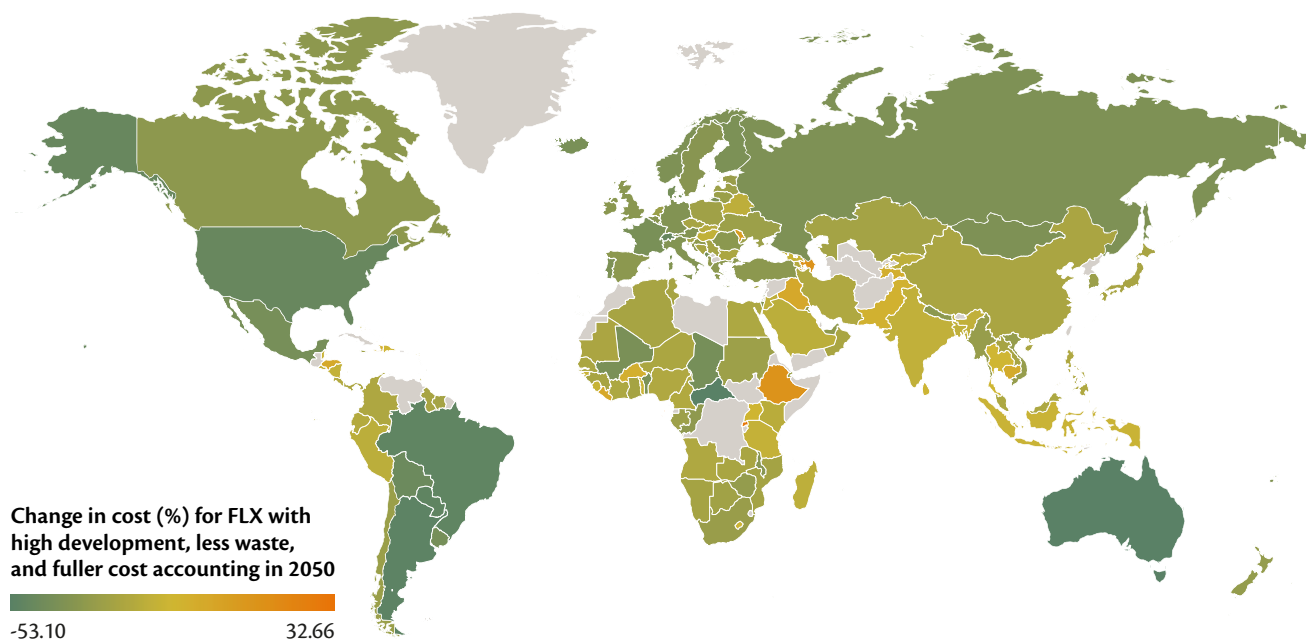
Figure 6.12 indicates that at the global level, and in most parts of the world, the daily cost of various enhanced diets that incorporate the joint goals of reduced impacts on planetary and human health would on average be lower than today. Under this fuller cost accounting, the relative costs of healthier diets were reduced by 12-22% in 2050. This ranges from a decrease in diet costs by 4% in lower middle-income countries and by as much as 28% in high-income countries as people spend more on fruits, vegetables, pulses, and nuts, and much less on meat, milk, and eggs. The modelled changes at country level ranged from a reduction of almost 50% in countries with currently high expenditure on animal-source foods (including Mongolia, the US, Israel, Denmark, and Greece) to increases in low-income countries in which poor households already consume inadequate diets (such as Eritrea, Ethiopia, Yemen, and Chad). It is in the latter countries that dietary improvements to meet intake of all required nutrients would have the greatest impacts on tackling both hunger and malnutrition in all its forms. And it is in those kinds of LMICs where most effort would be needed to make sustainable, healthy diets affordable.

Overall, a shift away from current dietary patterns would mean that improved diets would *cost less* in 86 countries (with a combined population of 4.2 billion), while a shift to significantly improved diets would *cost more* (at current prices) in 71 countries with a combined population of 4.1 billion. The latter finding is not surprising given that three billion people in LMICs are already unable to afford a healthy diet at today’s prices, so any improvement in the quantity and quality of their diets will add to the notional cost over current patterns. This is why policy actions to make improved diets affordable to all poor families in all countries is such a high priority as part of the food system transition.

Importantly, however, if policy actions and investments recommended in this report were to be implemented quickly and at scale, their combined effects on prices would be to reduce the overall cost of sustainable, healthy diets *including in LMICs*. This costing study also included the potential effects of two additional cost-qualifying factors: 1. reduced food loss and waste by up to 50% from current levels. Halving loss and food waste in line with the SDG target reduced the cost of current diets by 14% on average (9-17% across regions); and 2. growth policies that have positive effects on desired outcomes, including higher rates of poverty reduction, stricter land-use regulation, lower barriers to food trade, and a trend towards lower meat consumption *just in high-income countries*. This scenario was compared with business-as-usual and a less optimistic scenario that includes changes in the opposite direction.

The outcome of all variables combined – desirable shifts in dietary demand, a fuller accounting of the diet-related costs of climate change and healthcare, significant increases in foods available due to reduced loss and waste, and implementation of policies that promote positive socioeconomic outcomes over time – result in a much reduced cost of, say, a flexitarian diet in

**Figure 6.13: The projected change in cost of a flexitarian diet between 2017 and 2050**



Source: Springmann 2020<sup>354</sup>



2050 relative to 2017 across most of the world (see Figure 6.13). In this projection, there are still some outliers where more work would need to be done to ensure that everyone could access this particular diet variant (including Ethiopia, Burkina Faso and Iraq), but progress towards the goal of sustainable, healthy diets for all would already be huge.<sup>354</sup>

The policy actions underpinning greater affordability of diets are therefore not only based on making more nutrient-rich foods available (see Chapter 4) and physically accessible (see Chapter 5), but also on ensuring greater purchasing power of the poor (this chapter) and stimulating demand (see Chapter 7).

In other words, significantly reduced food loss and waste and investment in socio-economic development pathways that better tackle income inequality are essential. Both would help increase the affordability of sustainable, healthy diets, especially in middle-income and many low-income countries, while a fuller cost accounting that included the diet-related costs of climate change and healthcare in the cost of diets would further increase the relative affordability to all countries, including low-income countries. It is the combined effects of bringing about a sea-change in how food prices are determined (whether or not they account for externalities), and policies that promote pro-poor income growth and reduced leakage of food from all value chains that make the goal of sustainable, healthy diets for all a realistic vision.

Much more analytical work of this kind is needed in the years ahead to better inform and guide policymakers everywhere of the range of potential costs and gains to be had from actions aimed not just at promoting more sustainable and healthier diets, but comparing them to the cost of diets today. Governments and food industry stakeholders have critical roles to play in ensuring that nutrient-rich foods, sustainably produced, are made accessible at price points that make appropriate dietary patterns affordable to all. Some of the known approaches that need to be prioritised are explored further in the following sections.

## 6.4 Coherent public policy actions to ensure that sustainable and healthy diets are affordable

There are several policy instruments which must be considered by governments which embrace the goal of making healthy diets are affordable for all. They operate at different parts of the food system and beyond, although the extent to which each is already pursued by individual countries varies.

- 1. Pro-poor income growth:** to support greater purchasing power (Section 6.5).
- 2. Carefully designed consumer-level taxes and subsidies on key food categories:** to shift relative prices towards to nutrient-rich foods needed in healthy diets (Section 6.6).
- 3. Refocusing of safety nets to support diet-quality goals:** i.e. redesign social protection instruments to go beyond income support to facilitate better knowledge and purchasing power linked to diet quality goals (Section 6.7).
- 4. Reduction in the cost of nutrient-rich products through technology and innovation:** i.e. investments in agricultural research to increase yields of fruits, vegetables, legume crops and nuts/seeds; precision agriculture; reduced food loss/waste; and improved storage technologies that better protect perishables along the entire value chain (Box 4.5).

Each of the above is essential, given the scale of the challenge of ensuring affordable, sustainable, healthy diets for all, especially the poorest in society. The aim should be to ensure that these lines of action work in concert and that their combined effect ensures the affordability of nutrient-rich foods for everyone throughout the transition to transformed food systems.

“ Ensuring a more equitable distribution of income within and across countries is indispensable in the quest for food security, better nutrition and environmental sustainability of food systems. ”  
FAO (2018)<sup>55</sup>

## 6.5 Pro-poor growth policies

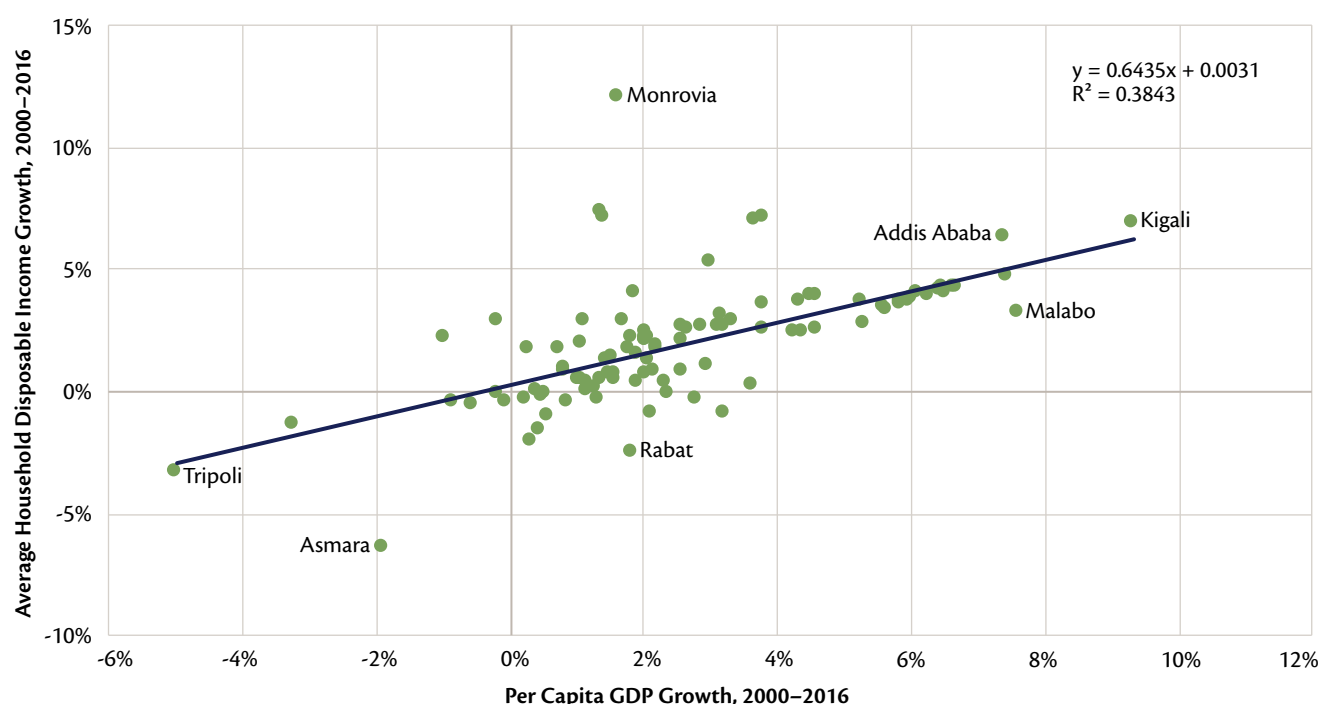
Promoting economic growth, and therefore growth in incomes, is an obvious means to help tackle the affordability of sustainable, healthy diets. However, this can be a somewhat blunt policy instrument unless two key conditions are met.

First, it is the poorest in societies that struggle most to access these diets, but the benefits of economic growth even in low-income countries can be distributed very unevenly across different socio-economic groups. It is therefore essential that policies to support economic growth are ‘pro-poor’. This is very important to ensure that large numbers of poor people can experience the consequential health benefits of those diets, but also to maximise the benefit to the natural environment by ensuring *everyone’s* diets are sustainable. Any approach to tackling inequality must understand how prevailing power relations across food system actors may help or hinder change. A focus on multi-win strategies and common benefits will facilitate broad-based support.

Second, it has been widely documented that income growth is associated over time with reduced undernutrition among poor families. But other nutrition gains, for example associated with micronutrient deficiencies and overweight and obesity, are much less certain. These wider gains are linked to diet quality and tend not to accrue to the poor unless supported by government policies targeting the most disadvantaged regions and households. For example, accompanying measures would seek to make sustainable, healthy diets desirable, and to inform and empower individuals to make better dietary choices (see Chapter 7). Empirical evidence from the United Kingdom shows that “poor nutrition and diet-related chronic diseases such as obesity follow a socio-economic gradient, with worse diets and a greater prevalence of obesity among the poor and less educated”<sup>355</sup> By contrast, most of the published literature suggests the relationship between obesity and SES (socioeconomic status) is the opposite in LMICs: the wealthier are more likely to be overweight. Similarly, higher rates of anaemia are seen in lower socioeconomic groups.<sup>356</sup>

While sub-Saharan Africa continues to record the highest share of poverty globally (absolute and relative), rates of poverty are falling across the continent, even though Nigeria may have overtaken even India in terms of the total number of poor people (in absolute terms) in recent years.<sup>357</sup> The relative poverty rate in sub-Saharan Africa has fallen significantly since 2000.<sup>358</sup> Countries in Africa that have recently seen the highest GDP per capita growth also have the highest mean household income growth, and some of those (such as Rwanda and Ethiopia) have also seen significant improvements in resolving undernutrition<sup>236</sup> (see Figure 6.14).

Figure 6.14: Per capita GDP growth versus household disposable income growth, 2000–16

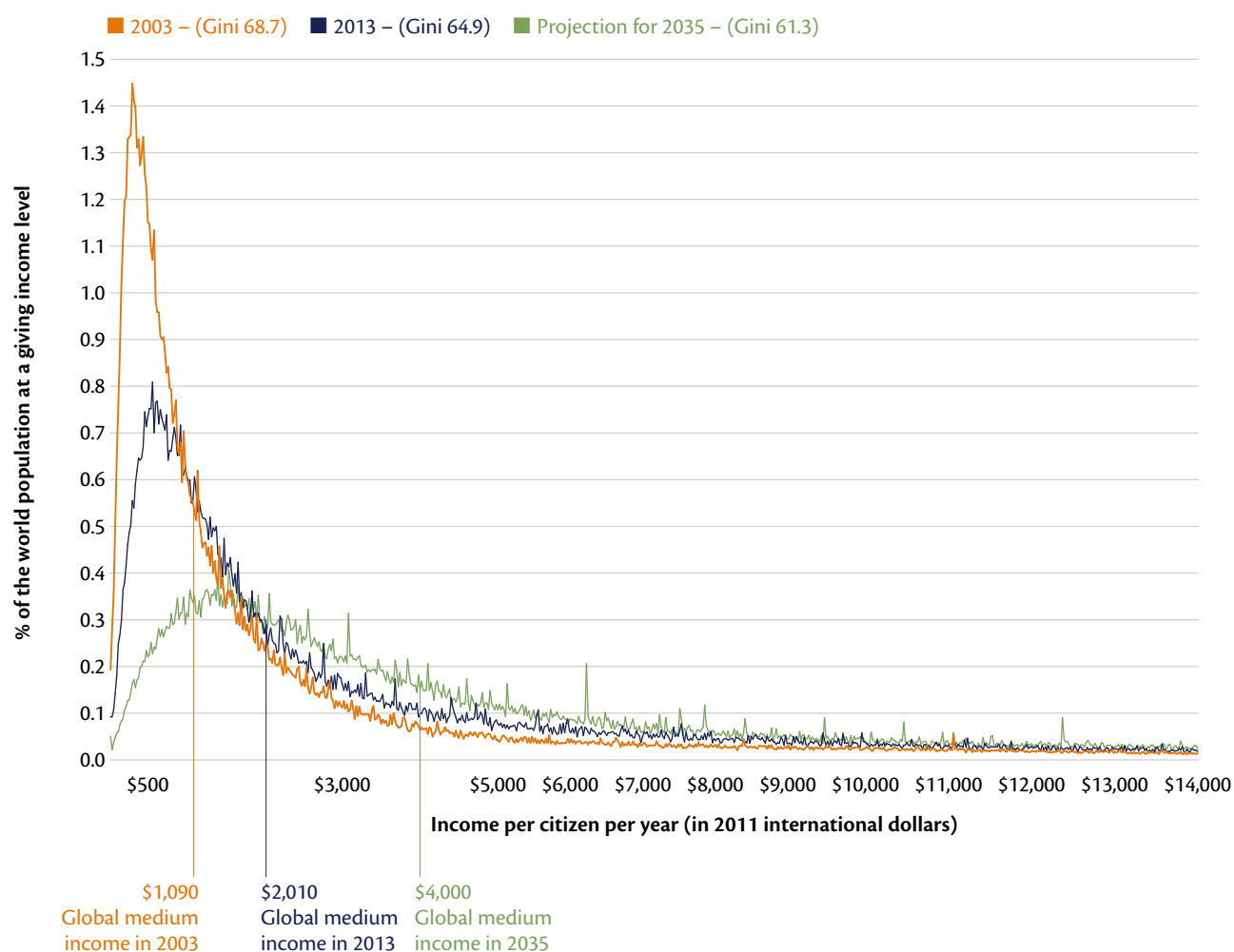


Source: World Economic Forum (2017)<sup>236</sup>

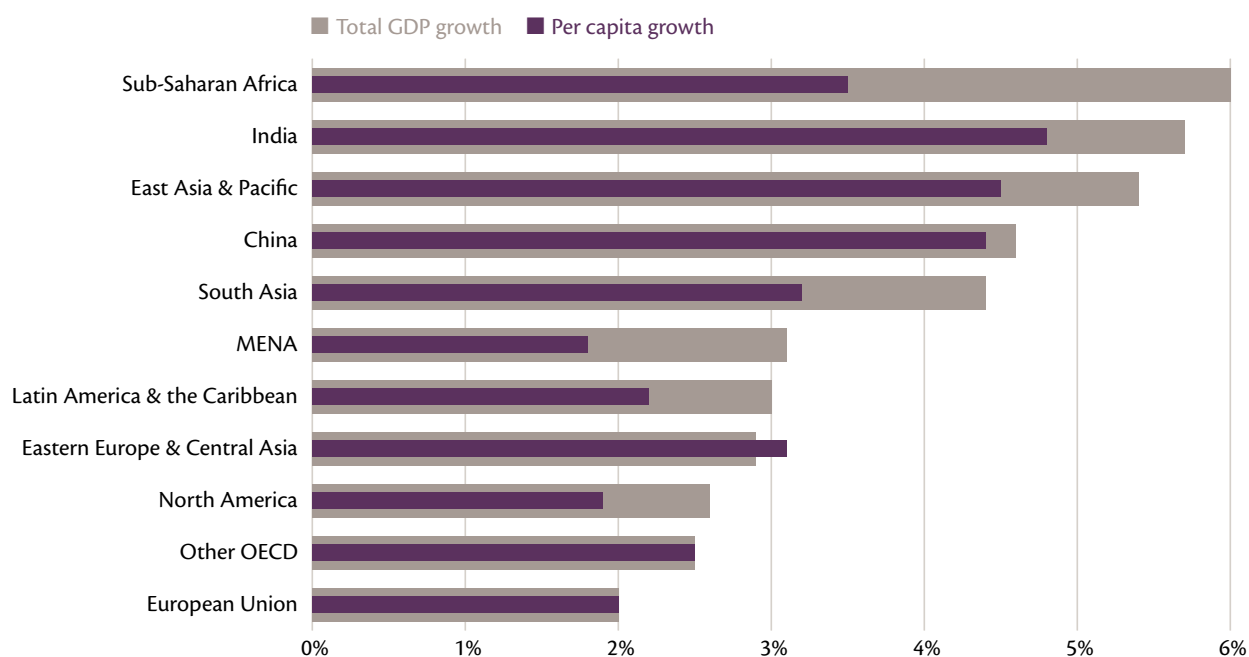


**Figure 6.15: The global income distribution in 2003, 2013, and the projection for 2035**

Incomes are adjusted for price changes over time and for price differences between countries (purchasing power parity (PPP) adjustment)



**Projected annual growth rates between 2013 and 2035 weighted by the initial population**



Note: Projections do not allow for impacts of the COVID-19 pandemic.

Source: Roser and Ortiz-Ospina (2019).<sup>337</sup> Original data from Hellebrandt and Mauro (2015).

In terms of income inequality, there is disagreement about whether this will rise globally, as it has done in recent years,<sup>359</sup> or fall.<sup>360</sup> The Gini coefficient of global inequality has declined (from 69 in 2003 to 65 in 2013), and that trend has been projected to continue downwards to 61 in 2035 (see Figure 6.15).<sup>361</sup> Figure 6.15 suggests that while sub-Saharan Africa is expected to achieve the greatest growth in total GDP up to 2035, that region's more rapid population growth will see its GDP growth per capita fall behind that of India, China and other parts of Asia and the Pacific. Importantly, the biggest beneficiaries of more equitable income growth are likely to be middle-income economies.<sup>361</sup>

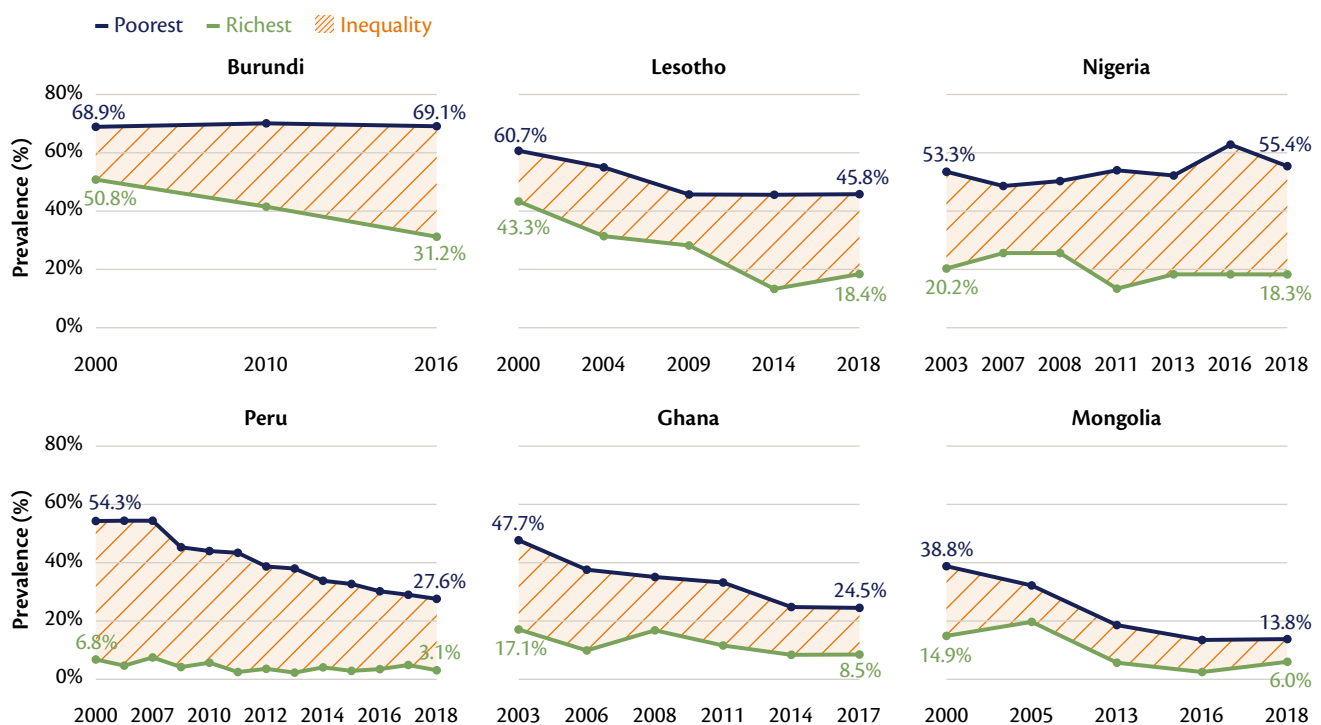
At the same time, it is important to remember that while China and India experienced strong economic growth that has lifted millions of people out of absolute poverty, this simultaneously allowed rising levels of in-country income inequality.<sup>362</sup> For example, income inequality (measured using the Gini coefficient) rose in China from 0.35 in the 1980s (below that of India) to more than 0.5 in 2015 (above that of Brazil).<sup>363,364</sup> Economists continue to disagree on the potential for inequality to impair economic growth. For example, China has continued to grow despite its rising inequality, while South Korea has seen its overall pace of growth slow over recent decades while its inequality fell sharply.<sup>365</sup> Nevertheless, the 2015 report from the Organization for Economic Cooperation and Development (OECD) on inequality made the case that in many countries "inequality is today at its highest since data collection started".<sup>366</sup>

The OECD's position is that since "income inequality tends to drag down GDP growth...inequality can no longer be treated as an afterthought. We need to focus the debate on how the benefits of growth are distributed."<sup>366</sup>

It is important to acknowledge that income inequality is itself a global challenge of the highest order. For example, income inequality has risen seven-fold across OECD countries in the past 25 years, with the income of the richest 10% of the population roughly nine times higher than that of the poorest 10%.<sup>362</sup> Only in Turkey, Mexico and Chile has inequality fallen since the mid-1990s, but in the latter two countries mean income among the wealthiest households is still 25 times higher than those of the poorest.<sup>367</sup>

While there is disagreement about the macroeconomic benefits of inclusive versus inequitable growth, there is little doubt about the societal benefits of the former, particularly in terms of nutrition. Governments focused on improving nutrition in the poor, such as Brazil in the 1990s and early 2000s, have managed to reduce the gap in nutrition benefits between richer and poorer households at the same time. However, while Bangladesh achieved national progress in reducing stunting, the relative gap in benefits between wealth quintiles remained the same in the absence of effective nutrition programmes that were framed in terms of equity.<sup>65</sup> Sub-national inequalities come in many forms, not just income, but also in terms of the distribution of undernutrition, commonly in the form of child stunting (see Figure 6.16).

**Figure 6.16: Prevalence of stunting in children under five by wealth for select countries, 2000–2018**



Source: Global Nutrition Report 2020<sup>5</sup>. Original data source: UNICEF/WHO/World Bank Joint Malnutrition Estimates Expanded Database Stunting, Wasting and Overweight (March 2019, New York)

In considering the importance of pro-poor income-growth policies, it is important for policymakers to understand the major influence of income on dietary choices, and how these are constrained by other claims on household expenditure. This is particularly important because of the relatively high non-food costs in many low-income countries, including housing, electricity and water utilities, and quality education.<sup>236</sup> Also, out-of-pocket spending on healthcare represents a huge burden to low-income households, particularly those in low-income countries.<sup>368</sup>

As argued in Chapter 1, while the absolute costs of healthcare and lost productivity foregone due to poor quality diets are much higher in high-income settings, the relative burden for lower-income countries is much greater. Overall, food affordability is a relative concept that encompasses the market

price of food in relation to other household expenses and household income.<sup>369</sup> An analysis of World Bank prices of food versus other household expenditure across 159 countries showed a declining cost of food relative to housing or transportation as incomes rise (in terms of gross national income).<sup>349</sup>

Finally, while incomes and relative prices both matter to purchasing power, so too does predictability in purchasing power, which can be eroded by runaway inflation. National policies are required to better track and manage inflation and to ensure that food and non-food items are affordable.

## 6.6 Fiscal policies to address affordability and shift consumption patterns

The World Health Organization (WHO) views shifting price policies that address affordability and purchasing incentives as a key policy agenda.<sup>370</sup> While some governments and donors are reluctant to promote public sector engagement in markets that would potentially ‘distort’ price signals, there is growing evidence that targeted product-specific taxes and consumer-focused subsidies (linked to fresh and/or nutrient-rich food procurement) can be a viable option for promoting health outcomes.<sup>371</sup> For example, the United Arab Emirates plans to introduce a 50% excise tax on sugar sweetened beverages (SSBs); the aim is to “reduce consumption of ‘unhealthy products’”<sup>372</sup>

The WHO highlights that “evidence suggests that price policies applied to food can influence what consumers buy and could contribute to improving health by shifting consumption in the desired direction and supporting healthier diets”.<sup>370</sup> In that sense, the main effect of price intervention is to influence point-of-purchase decision-making by shifting relative prices among products (not by setting prices). This can encourage the purchase of the more nutrient-rich foods and close substitutes. Accumulating empirical evidence from around the world shows that the impact of any price intervention is determined by the extent to which the price increase or decrease is passed on to the person buying the food. The de facto effects of taxes and subsidies depend on the way that they are designed, and there is likely to be a knock-on effect for foods and/or nutrients beyond those that are targeted.

Taxes seem to be most effective when applied to foods that do not support healthy diets, for which there are similar untaxed nutritious alternatives. Targeted subsidies on fruits and vegetables also appear to be effective at increasing the consumption of those foods.<sup>370</sup>

For example, where taxes are concerned, a systematic review analysing about 100 studies suggested that when implementing taxes, the price of products deemed to be ‘unhealthy’ should be increased by at least 20% to reduce consumption.<sup>373</sup> One







randomised experiment in New Zealand changed the relative prices of foods for 1,132 shoppers by imposing a tax on SSBs and on foods with high sugar, sodium, and saturated fat content, and/or a subsidy on fruits and vegetables.<sup>374</sup> The authors found that price increases on foods high in saturated fat, sugar, and salt led to a rise in 'healthy food' purchases, and that "a combination of different tax and subsidy policies might be the most effective way to improve diets and decrease diet-related chronic diseases".<sup>374</sup> Indeed, a review by UNICEF of high-income country case studies where sugar taxes have been applied concluded that while the large-scale effects of these taxes as a means of reducing child obesity will take more time to be measured, most countries have so far applied tax rates which are "much lower than recommended". Also taxes alone will typically need to be part of a system-wide approach that applies complementary policy and programme interventions to be successful.<sup>375</sup>

Similar examples are emerging in middle-income settings, such as local authorities in Jakarta offering tax breaks (representing indirect subsidies) for restaurants that make calorie counts explicit on menus, and Nigeria's reallocation of long-standing fuel subsidies towards maternal and child health and nutrition programmes.<sup>376</sup> There are also examples of 'twinning' initiatives such as the 'Nutrition Smart City' activity pursued jointly by the cities of Pune in India and Birmingham in the United Kingdom; these city authorities engage bilaterally to define policies and pilot programmes that are intended to tackle all forms of malnutrition.<sup>377</sup>

To date, many such initiatives show promise, but there are still few examples in low-income countries. That said, a recent modelling exercise used import tariffs which tend to be applied differently to processed versus unprocessed foods, as a proxy for 'taxes' which shift relative prices between the two categories. The study considered how price interventions could affect health outcomes across sub-Saharan Africa.<sup>378</sup> It was found that an increase in tariff differences between highly processed and less processed foods could indeed be an effective measure to reduce obesity even in low-income African settings, but that these kind of policy interventions must be applied with great care.

As with all policy actions which focus on one food or nutrient, there can be potential unintended outcomes due to people substituting one or more foods in their diet because of changed relative prices. Taxes on foods deemed to be unhealthy will affect some families, but not all. The same applies to subsidies on consumer prices supporting nutrient-rich foods. While national policies must seek to tackle multiple nutrition and health problems simultaneously, single policy instruments alone rarely solve complex problems.<sup>379,380</sup> An integrated approach, using multiple policy instruments that account for possible side-effects, is usually preferable when seeking to encourage people to eat differently. Encouragingly, the number and quality of studies and reviews of interventions is growing fast, leading some researchers to conclude that it can already be agreed that measures seeking to modify the prices of targeted nutrient-rich foods are "effective in improving population diet by modifying





what people buy”, and that contextual complexity should not stop policymakers from adapting policy instruments, including fiscal interventions, to improve people’s diets and health.<sup>381</sup>

As such, it is important that economic assessment of policies should consider the impact on purchases of targeted and non-targeted products and on dietary patterns. Policymakers must also consider whether policies should target the whole population or specific groups, since the former offers an opportunity to generate higher tax revenues which can be spent by governments to implement transition steps, while the latter could be easier to implement due to less consumer or food industry lobbyist push-back. Targeted approaches generate less income but can achieve more lasting behavioural change. Both represent important opportunities for action in this area, but public support will also depend on how people perceive the value of public actions using taxpayers’ money. A recent study on the acceptability of policy bundles in China, Germany and the US found that public support may be enhanced by earmarking revenue from taxes, particularly if the revenue is put towards programmes for low-income households.<sup>380</sup>

## 6.7 Social protection to support healthy diets

The importance of effective income transfers to the poor cannot be underestimated. Besides playing a key role in promoting social protection and greater equity of purchasing power, they can also help protect the most vulnerable during the transition, when food price uncertainties may arise.

Diverse social programmes – including conditional cash transfer programmes, labour and production inclusion programmes and social pensions – have long been implemented under the broad rubric of social protection, particularly in Latin American and Caribbean countries. The aim of these programmes has traditionally been to end poverty, enhance food and non-food consumption in ways that promote well-being, and sometimes to reduce inequalities.<sup>382</sup> Many governments introduced these measures, with shorter-term goals of income and livelihood support, in response to the economic shock resulting from the coronavirus pandemic (see Boxes 6.1 and 6.2).

### Box 6.1: COVID-19 and the economic downturn

The coronavirus pandemic has caused a substantial global economic shock. The resulting global economic downturn increased unemployment and loss of incomes, particularly among low wage earners in all sectors, and forced the hand of governments to try to compensate through a variety of fiscal stimulus packages. The global outlook in terms of growth was projected by the International

Monetary Fund (IMF) to fall by 3% in 2020 (as of mid-April 2020<sup>383</sup>), compared with a January 2020 projected increase of 3.3%.<sup>384</sup> Recent projections of the economic ramifications of the pandemic suggest that at least 181 million people will have been pushed into poverty (earning less than US\$1.90/day), and that the majority of these will be in sub-Saharan Africa.<sup>339</sup>

### Box 6.2: Ehsaas Emergency Cash: a digital solution to protect the vulnerable during the COVID-19 crisis in Pakistan

The coronavirus pandemic has impacted livelihoods on an unprecedented scale. According to one estimate, it has negatively affected roughly 160 million people in Pakistan. In response, the Government of Pakistan allocated 203 billion Pakistani rupees (Rs.) (US\$1.23 billion) to deliver one-time emergency cash assistance to 16.9 million families at risk of extreme poverty.<sup>19</sup> Given family sizes, this represents nearly 109 million people or half the country's population, representing the largest and most extensive social protection intervention in the history of the country. Each family received Rs. 12,000 (around US\$75) to provide immediate nutrition subsistence needs.<sup>388</sup>

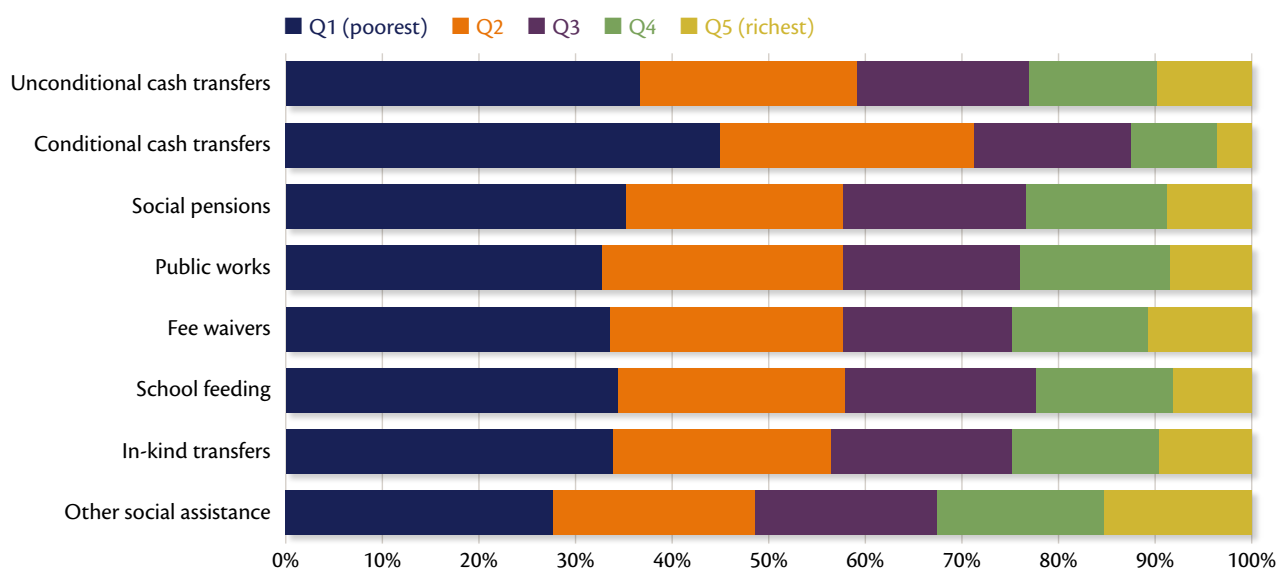
Digital capabilities established over the past year as part of *Ehsaas*, Pakistan's new poverty alleviation framework, were adapted to deliver *Ehsaas* Emergency Cash. This enabled payments to be linked to unique national identification numbers, the National Socioeconomic Registry and wealth proxies (travel, taxes, billing, assets ownership data and government employment status). Payments were biometrically verified.

The programme demonstrated that by combining phones, internet connectivity, and national IDs, a demand-based system can be created to enable those in distress to seek social support during times of crisis. As such, it may provide useful lessons for other countries which utilise unique personal identification systems.

As of mid-June 2020, 195 countries had introduced or were planning some sort of social protection activity specifically to buffer the economic impacts of the COVID-19 emergency: more than 270 interventions involved cash transfers (across 131 countries), and roughly 143 were based on voucher or in-kind food transfers through schools.<sup>385</sup> In a sample of 18 countries that expanded coverage of cash transfers from pre-coronavirus levels, the expansion represented a 233% growth in participants on average, with countries such as Nigeria and Myanmar increasing their coverage by more than 1000%. The value of all such interventions (if well designed, implemented and funded) includes buffering and enhancing food demand, as well as applying any work conditionality to activities that support more effective food system functioning.<sup>239</sup> A few examples tracked by the IMF:<sup>386</sup>

- Afghanistan saw food price spikes in early 2020 as Pakistan closed its border and panic buying ensued, until the government sought to shift its wheat imports from Pakistan to Central Asia and worked with private wholesalers to release food stocks to bring prices down.
- Kenya allocated 40 billion Kenyan Shillings to emergency social protection and cash transfers, food relief, and a range of medical priorities. It also proposed a package of tax relief measures, including full income tax relief for persons earning below the equivalent of US\$225 per month.
- In The Gambia, emergency powers were invoked by the President to freeze prices on essential food (including rice, meat, fish, and cooking oil) as well as non-food items, such as soap, and sanitisers.

**Figure 6.17: Share of social security programmes benefiting each population quintile, most recent survey in 2008–16 (%)**



Source: World Bank 2018<sup>341</sup>, data based on 120 countries from World Bank ASPIRE: Atlas of Social Protection Indicators of Resilience and Equity 2018



### Box 6.3: What do we know about affordable diets? The case of Chile

Chile has been successful in achieving substantial economic growth and as a high-income country, now has one of the lowest rates of undernourishment in the region<sup>xiii</sup> (3.3% in 2015–2017).<sup>391</sup> Meanwhile, adult obesity has more than doubled since 1980, reaching 28% in 2016, the highest in South America.

Following this economic success, the country has embarked on a search for ways to make healthy diets affordable to all. An analysis in Chile from 2015 shows that the costs for the government to achieve this goal would be almost 2% of the annual government budget.

The Chilean Ministry of Health, Pan American Health Organization (PAHO/WHO) and United Nations Economic Commission for Latin America and the Caribbean (ECLAC) compared the Basic Food Basket (BFB), (calculated from periodic household expenditure surveys<sup>xiv</sup>), with a constructed Quality Food Basket (QFB). The analysis estimated what share of the population in different income brackets could afford the more nutrient-rich foods.

The construction of the QFB was achieved by adjusting weights of items in the BFB to improve overall nutrient composition. Based on Chile-specific dietary guidelines,<sup>xv</sup> some of the changes made in the diet were:

1. reduce simple carbohydrates, added sugars, and highly-processed foods;
2. increase the share of 'healthy' proteins, while reducing red meat;
3. reduce the consumption of sugary drinks;
4. increase high-quality fibre; and
5. limit consumption to 2000 kcal/day.

Having constructed the QFB, it was valued (using official information from the National Institute of Statistics). The per capita monthly cost of the higher quality diet was roughly US\$84, or almost 35% higher than the cost of the basic diet. The capacity to afford the QFB is based on the minimum income that a household would need to have to be able to afford this diet, estimated at approximately US\$224.5. Overall, 27% of Chile's population could not access the QFB, and this share was far higher for the poorest sectors, reaching to over 85% of the poorest 20%. The cost of a policy that would subsidise the gap between both baskets for 27.1% of the population would represent almost 2% of the annual government budget.<sup>392</sup>

<sup>xiii</sup> After Uruguay, Brazil, and Cuba.

<sup>xiv</sup> Since 1990, Chile has used the BFB as an indirect way to measure poverty. The Ministry of Social Development estimates and publishes the cost of the BFB on a monthly basis.

<sup>xv</sup> Among others, consumption of five portions of fruits and vegetables per day, dairy three times per day, and pulses twice a week.

While many of these government initiatives have been unavoidable, the cost of public sector protection and/or stimulus programmes, coupled with the downward pressure on incomes, has added significantly to the pre-existing burden of poverty across Africa and Asia (and parts of Latin America), further increasing the pressure on low-income governments and poorest citizens. As of April 2020, more than 90 countries had applied to the IMF for emergency funding to deal with the crisis.<sup>387</sup>

There are many non-crisis examples of governments using cash or other income transfers to poor and vulnerable groups (with or without various forms of conditionality). Some support the purchase of nutrient-rich foods (e.g. in Bolivia, for poor pregnant and lactating women) and/or promote positive health outcomes more generally (e.g. Mexico). In Latin America, there are currently an estimated 130 million beneficiaries of conditional cash transfer programmes, which include income support measures associated with undernourished children (see Box 6.3).<sup>389</sup> However, these programmes are less widespread in Africa and Asia, and many have yet to be designed to address diet quality effectively as well as nutrition. For example, most social safety nets still need to be redesigned to include counselling on healthy diets and health education, to facilitate access by beneficiaries to nutrient-rich foods (and nutrient-rich snacks and beverages) or introduce rewards for transfers or vouchers spent on nutrient-rich foods.<sup>390</sup>

Globally, conditional cash transfer activities of various kinds are particularly effective at targeting the poorest, compared with

unconditional cash transfers, free meals in schools or public works, including cash-for-work or food-for-work (see Figure 6.17).<sup>341</sup> There is therefore a case for governments and donor organisations to focus on income-transfer interventions tied to accessing nutrient-rich foods, provided they are well-designed and well-implemented.<sup>393</sup>

The redistribution of income through taxes, cash transfers and social protection has been shown to reduce income inequality in OECD countries. The resulting reduction in inequality, after transfers, can be relatively small in a country such as South Korea, where incomes are already more equitably distributed, or Mexico which has high initial inequality and where transfers make some but limited difference. By contrast, in countries such as Ireland, Greece and Austria, the role of transfers is significant in reducing inequality through effective pro-poor transfers.<sup>367</sup> In other words, to increase the purchasing power of the poorest households, resources have to be adequate and well-targeted to those at the bottom of the inequality curve. Only this way will they be able to afford to eat foods that are today relatively more costly than others.

In the next chapter, the importance of making affordable, healthy diets *desirable* is considered. Even if consumers are able to afford sustainable, healthy diets, they will not necessarily choose them if they are not deemed desirable. A range of actions for policymakers are therefore suggested to encourage people to make more informed choices.

## Box 6.4: Pathways to multiple ‘wins’: sustainable development of China’s Loess Plateau<sup>394</sup>

The Loess Plateau in China’s Northwest is home to 50 million people. Centuries of overuse and overgrazing led to one of the highest erosion rates in the world and widespread poverty. The restoration project, which began in the 1990s and involved the World Bank and the Chinese authorities. It aimed to return this poor part of China to an area of sustainable agricultural production, to increase incomes, and to restore the Plateau’s ecosystem, considered by many as beyond help. Many lessons have been learned and the successes were many and varied:<sup>395</sup>

- **Over 2.5 million people were lifted out of poverty.** Incomes doubled, and people in project households saw their incomes grow from about US\$70 per year per person to about US\$200 through enhancing agricultural productivity and diversification.
- **Employment rates increased.** More efficient crop production on terraces and the diversification of agriculture and livestock production created new on-farm and off-farm employment. During part of the project, the employment rate increased from 70% to 87%, particularly increasing opportunities for women to work.
- **Food security increased.** Previously, frequent droughts caused crops cultivated on slopes to fail, sometimes necessitating emergency food aid. Terracing increased

average yields, and significantly lowered their variability. Agricultural production has changed from generating a narrow range of food and low-value grain commodities to high-value products. During the second project period, per capita grain output increased from 365kg to 591kg per year.

- **The project significantly contributed to the restructuring of the agricultural sector.** This included adjustment to a market-oriented economic environment and created conditions for sustainable soil and water conservation.
- **The project encouraged natural regeneration.** This restored grasslands and tree and shrub cover on previously cultivated slope-lands. Replanting and bans on grazing allowed perennial vegetation cover to increase from 17% to 34% (see Figure 6.18). The project also led to enhanced soil conservation and carbon sequestration.<sup>396,397</sup>

The physical and economic development of the Loess plateau with sustainability as its goal demonstrates what can be achieved through close partnerships, appropriate policies, technical support, and active participation of the people. It is estimated that as many as 20 million people have benefited from the replication of the approach throughout China.

Figure 6.18: The re-greening of China’s Loess Plateau



With thanks to Xenia Zia Morales from The World Bank Institute. Images provided by Yan Jinmin.



# 7

## Encouraging demand: making sustainable, healthy diets desirable





# Key messages

Each of the actions proposed in this report will have limited effect if people choose diets that do not promote health and/or cannot be pursued sustainably. A range of actions is needed to encourage individuals to make more informed choices without being prescriptive or impinging on consumer aspirations. These changes, working through consumers' collective purchasing power and influences on food industry priorities, open up potential for market growth which supports healthy affordable diets for all, rather than one in which demand is frequently influenced in favour of cheap and convenient products with lower nutritional value.

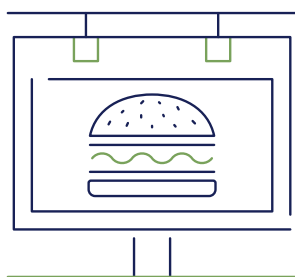
Specific actions include:

- **Implement policy-based behavioural nudges via carefully designed consumer-focused taxes and subsidies.** These offer the potential to influence behaviour substantially at relatively low cost. Some governments are already implementing a range of product-focused taxes or subsidies in high-income countries (HICs), although further research is needed for the context of low- and middle-income countries (LMICs).

- **Better regulate advertising and marketing, particularly to children.** Both strongly influence dietary aspirations and food choices. Policymakers should focus on regulations to restrict companies from encouraging people to make dietary choices which do not support sustainable, healthy diets, especially inappropriate marketing of ultra-processed foods to children, and breast milk substitutes to adult women of reproductive age. Voluntary regulation has not proved successful in many cases.
- **Upgrade food based dietary guidance and promote enhanced knowledge about implications of dietary choices.** Governments must do much more to empower individuals to make more informed dietary choices. Food Based Dietary Guidelines (FBDGs) can generate substantial benefits, but they are still underused, in part because they are not designed to be user-friendly, they rarely account for issues of sustainability, and many do not reflect the best available science and evidence. Also, FBDGs should be used to inform government policies. Additional forms of guidance and messaging to enhance people's

understanding of the human and planetary implications of food choices must be explored.

- **Define principles of engagement between public and private sectors, and clearly articulate responsibilities in moving towards common goals.** The food industry should not be demonised or ignored; at the same time, nor should it be allowed free rein to pursue narrow profit motives where these are antagonistic to wider societal goals. Companies need to accept greater responsibility for their part in driving the global trend of fast-rising consumption of ultra-processed food, and the damage to health it causes. It is therefore important to incentivise actions which support government policy agendas on public health and environmental sustainability. A comprehensive framework for engagement is needed. In particular, food business enterprises of all kinds should be required to abide by national and international standards, but for this to be effective, there must be appropriate, funded systems in place to track, monitor, and hold actors accountable.



Dietary aspirations and food choices are **strongly influenced** by advertising and marketing



Self-regulation via voluntary guidelines has been **largely ineffective** in reducing the number of food advertisements promoting ultra-processed foods



**Two-thirds** of national FBDGs were shown to be incompatible with either the Paris Agreement on climate change or goals aimed at the prevention of NCDs

**People may decide not to adopt sustainable, healthy diets even when they are accessible and affordable. This is because many other factors influence consumer demand beyond price, including advertising, taste, convenience, nutritional information, and social and cultural norms. A range of evidence-based actions is needed to encourage individuals to make more informed choices without being prescriptive or impinging on consumer aspirations. While little evidence is available on the effectiveness of policy actions in this domain in LMICs, there are several approaches which are worth pursuing. In other cases, it will be important for policymakers to trial different approaches, and carefully monitor their effectiveness, to inform whether they should be rolled out further. Enabling citizens to make better dietary choices will have major benefits. It will support the health of consumers themselves and, by promoting consumption of foods which are sustainably produced, it will benefit environmental systems. More generally, it will help to drive the transition towards transformed food systems.**

“ To support a market for diverse and nutritious food, consumer demand and preferences need to be aligned with a healthy diet. In order to stimulate this demand and shift food preferences, the food system and food environment must be supportive and healthy. ”

FAO (2018)<sup>398</sup>

This chapter discusses how to enable people to make informed dietary choices in line with health and sustainability goals. It explores some of the most important influencers of choice beyond price, and how various actions by the public and private sectors could do more to achieve positive outcomes. While the major determinants of demand are well known, evidence of effective approaches to promoting healthy dietary choices from LMICs remains limited.<sup>399</sup> There are many studies on willingness-to-pay for different food attributes or price points, assessments of the effects of advertising, analyses of product placement in supermarkets, and analyses of people's understanding of the content of labels. But most of these have been undertaken in high-income countries, heavily driven by concerns about rising obesity and non-communicable diseases (NCDs). Also, these studies often fail to include effective policy guidance or recommendations.<sup>400–402</sup>

Although much more needs to be known about how dietary choices are made in LMICs beyond the issue of affordability, governments need to act today by identifying the best policy options available to achieve better health and sustainability outcomes for their populations. The following sections review the current evidence.

## 7.1 Advertising and other marketing practices

Dietary aspirations and food choices are strongly influenced by advertising and marketing. Policymakers should focus on regulations to restrict how companies encourage potential consumers to choose foods which are not conducive to sustainable, healthy diets. This is especially important for inappropriate marketing of ultra-processed foods to children and breast milk substitutes to adult women of reproductive age.

Evidence suggests that self-regulation in the form of voluntary guidelines has been largely ineffective in reducing the number of food advertisements promoting ultra-processed foods, snacks and toy-branded fast foods aimed at children. This can in part be ascribed to companies seeking to be profitable in a competitive commercial space where one firm does not want to take risks if others do not. A study in Brazil, for instance, showed that during 432 hours of free-to-air TV broadcasting on three channels, 80% of 1,610 food and beverage advertisements did not meet Pan-American Health Organization or WHO standards and were considered eligible for marketing restrictions.<sup>403</sup> Over 90% of the advertisements that failed to meet nutrition standards were from just 10 trans-national and domestic local food and beverage companies, two international fast food chains, and two of Brazil's largest supermarket retailers.

Nevertheless, government action can influence behaviour. For example, legislation in South Korea has led to a decline in exposure of children to food-related marketing.<sup>404</sup> Indeed, a recent review of 79 countries that have implemented policies to restrict the marketing of 'junk food' found a drop in sales per capita after implementation, compared to countries without such policies, which saw an increase in sales.<sup>405</sup> This approach

has been relatively effective in large part because of the 'level playing field' effect in which food companies are willing to take collective action where the individual risk of loss of market share is taken out of the equation.

By contrast, an assessment of self-regulation of the food and beverage industry's application of 'nutrition criteria' in Canada concluded that the nutrition and 'health value' of most products advertised to children on television (on 27 channels between 2013 and 2016) remained poor, and that "mandatory regulations are needed".<sup>406</sup>

Reduced advertising to children (via television), and more active marketing of 'healthy diets' as an aspirational norm should be a priority for all nations.<sup>407</sup> However, it will be important for policymakers to carefully assess context when deciding on mandatory and/or voluntary regulations and guidelines. For example, with food placement in supermarkets, it is important to understand the complex relationships which can exist between food producers and retailers. Supermarkets in some countries require payments to position a food producer's high-profit products favourably (e.g. in terms of shelf height, position in aisles, proximity to checkouts, position relative to the supermarket's low-cost own brand, etc.). Therefore, it is unlikely to be straightforward to persuade a supermarket to remove ultra-processed and other snack foods from children's height and away from check-out stations (see Box 7.1).

A guiding question for policymakers should be: what are the appropriate incentives that would 'persuade' commercial food companies and retailers to make the required changes? Also, when persuasion is ineffective, is regulation required? The tired mantra of 'we sell it because it's what consumers want' must be challenged. It does not account for the many drivers of consumer choice, many of which are influenced by firms themselves.

## 7.2 Taste, convenience, and perceptions of food product traits

Consumers are, of course, not only swayed by lower prices or marketing. There are serious constraints to choices in most food environments around the world: for example, competing demands associated with paid work, commuting, and childcare affect the frequency of shopping outings (and hence continued access to fresh produce). They can also affect the time for

cooking and eating meals. Some people also have limited storage and refrigeration capacity to keep foods in good condition and reduce food waste.

These factors show that 'choice' is influenced by a number of drivers and that the outcome may not be the individual's preference, but rather one that 'works'. For example, one study explored the issue of 'value conflicts' among mothers in the Netherlands when purchasing snacks for their young children.<sup>409</sup> The mothers reported feeling conflicted when they provided snacks perceived as 'unhealthy', but their choice was based on convenience. They were also conflicted when giving snacks between meals to keep a child from crying, or because other mothers were using one product over another.

Importantly, this is not simply a 'rich country' quandary. There is ample evidence in LMICs that mothers engaged in agriculture have significant time constraints for childcare, including the time that can be spent on nutrient-rich meal preparation for appropriate infant and young child feeding.<sup>410</sup> One study in India concluded that the persistence of undernutrition among children is "tied closely to the high workload and consequent time constraint of mothers who are increasingly pursuing income-generating activities".<sup>411</sup> Similarly, in rural Guatemala non-farm employment raised incomes, but also involved a decrease in the amount of time spent by mothers on buying food from the market, meal preparation and overseeing their children's meals.<sup>412</sup> The same can be true in cities. In an urban setting in Brazil, for example, recent research showed that income and time constraints competed with mothers' understanding of healthy diets, leading to patterns of food choice that increasingly included ultra-processed food products.<sup>413</sup>

There is also growing evidence that citizens in resource-poor settings choose certain packaged products and more modern retail outlets because of assumptions about higher standards of food quality and safety. Perceived food safety represents an important, relatively new dimension of the overall food security policy agenda of many lower-income governments and their development partners.<sup>414</sup> Recent work has shown that poor families living in informal settlements in Kenya and Uganda are willing to pay a higher price for food products that they can trust to be nutrient-rich and safe.<sup>415</sup> Since there are hundreds of millions of households at the base of the income pyramid globally who allocate between 50% and 75% of total spending on food, these people represent a vast market. Their willingness to pay for nutrient-rich, safe foods offers potential for market growth which supports healthy affordable diets for all, rather

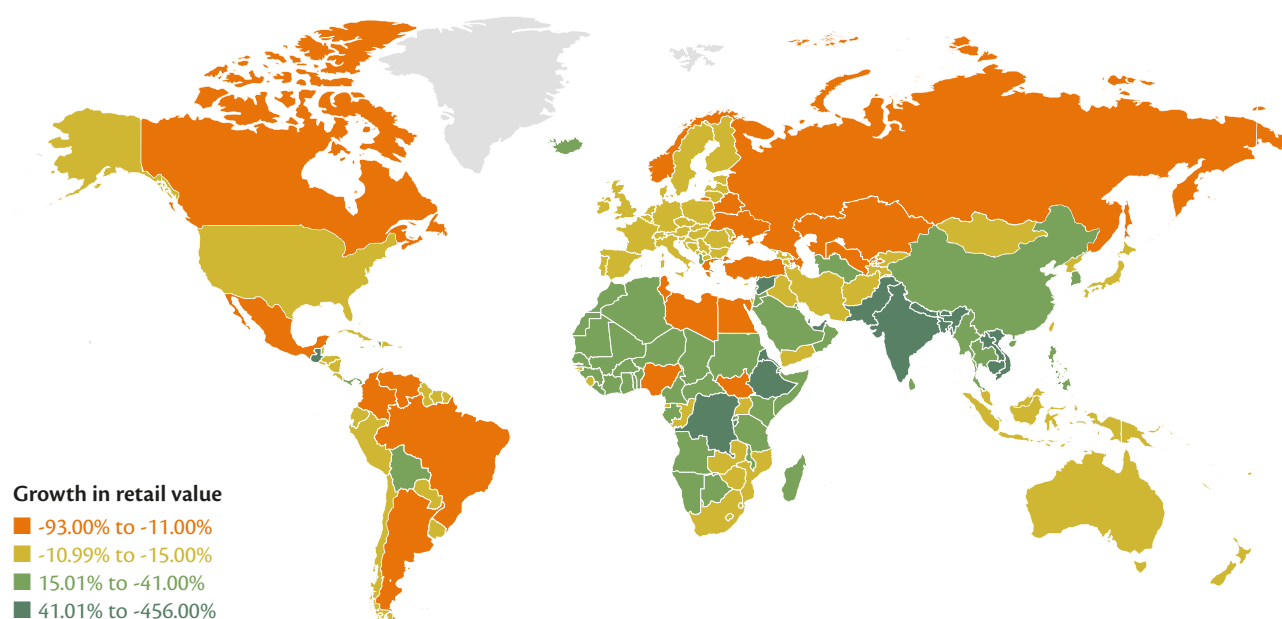
### Box 7.1: In-store marketing practices for adults and children

UNICEF's Regional Office for Latin America and the Caribbean has showed that "in-store marketing practices such as product placement and pricing do sway customers' purchases, across different countries, retail outlets and socio-economic groups".<sup>408</sup> Adults revealed that pricing was the main factor that caught their attention and helped

them make their decision to buy. But for children, the decisive factor affecting desirability was the packaging. The common techniques designed to attract children include eye-level placement of products in retail settings, encouragement to purchase linked to potential prizes, and the widespread use of licensed film and cartoon characters.



**Figure 7.1: Growth in retail value of ultra-processed foods from 2013–2018**



Source: Food Systems Dashboard (2020).<sup>334</sup> Original data source: Euromonitor International

than one in which demand is influenced towards cheap and convenient products with lower nutritional value.

However, consumer demand is not static. Individual foods or ingredients can become widely popular and either enter the mainstream of diets (for example quinoa, kale, and gluten-free products) or disappear. It remains a substantial challenge for governments to encourage and incentivise private food companies to play a significant role in influencing choices that support healthy and sustainable diets.

## 7.3 The special case of ultra-processed foods

There is growing concern about the increasing uptake of ultra-processed foods in diets. For many people, ultra-processed products, snacks, and drinks are tasty, attractively packaged, require no preparation, are relatively cheap and widely accessible. They are also heavily promoted via advertising, free gifts for children, and forward placement in supermarkets. Many urban food environments in which large numbers of people make food purchases rely heavily on ultra-processed foods of all kinds to attract customers and profits. But since they have a long shelf-life and are relatively cheap, they are increasingly eaten by infants and children even in remote rural areas of LMICs such as Cambodia, Senegal and Nepal.<sup>416</sup> The retail value of ultra-processed food continues to grow in LMICs (see Figure 7.1). For example, from 2013–2018 the retail value of ultra-processed foods grew by 87% in Syria, 80% in Bangladesh and 74% in Laos.<sup>334</sup>

Ultra-processed foods are manufactured products that are typically energy-dense and nutrient-poor, and offer large amounts of energy, fat, sugar, or sodium. The term ‘ultra-processed’ and its definition are still widely debated. This issue

deserves greater policy attention since the consumption of such products has been identified as a risk factor for obesity and NCDs. As defined by the NOVA classification, ultra-processed food formulations typically have five or more ingredients which may include added sugars, oils, fats, salt, antioxidants, stabilisers, and preservatives, as well as other substances not commonly used in culinary preparations, although more consensus is needed around definitional parameters.<sup>417</sup> These foods include snack products such as chips or crisps, some ready-to-eat cereals, sugary drinks, and some forms of confectionery.<sup>31</sup> They belong to a ‘class’ of products that dominate the discussion of what is apparently desirable (for a variety of reasons) to many people, but deemed to be undesirable by many in the public health and nutrition communities around the world.<sup>418–420</sup> How red meat alternatives, which have grown in popularity recently because of their perceived health and environmental benefits, fit into such a classification remains to be determined.

These ultra-processed products have been created to be tasty, cheap and ubiquitous, and therefore attractive and accessible.<sup>31</sup> Properties that may promote overconsumption of such products include their “hyper-palatability and quasi-addictiveness for susceptible individuals”.<sup>421</sup> They are now widely found in even the most remote, rural markets of Africa and Asia. For example, recent data from 11,537 children aged six months to five years of age in Burkina Faso, Cote d’Ivoire, Mali, and Niger showed that between 26% (Niger) and 45% (Cote d’Ivoire) had consumed at least one commercial snack food or beverage in the prior 24-hour period.<sup>422</sup> In Nepal, high intake of ultra-processed foods and beverages is associated with poor micronutrient status of the consuming child.<sup>423</sup> Those from higher-income households were obtaining almost 50% of total energy intake from such foods.

Many food businesses also favour ultra-processed packaged foods since they have a longer shelf life than fresh foods, are easily transported, and can be produced at low cost on an industrial

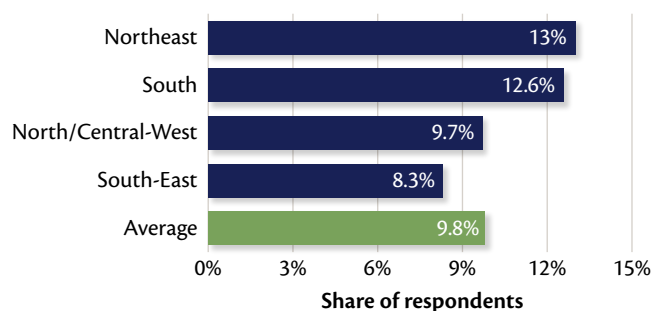
scale. These features lead to larger profit margins and long-chain distribution networks, and to more aggressive marketing than for perishable foods. As UNICEF points out, ultra-processed foods are skilfully marketed, widely available and affordable to many, while nutrient-rich foods are often more expensive and out of reach.<sup>44</sup> In many settings, the food environment does not lend itself to supporting nutrient-rich diets, nor is it incentivised to do so.

Efforts to shift demand away from ultra-processed foods are made more difficult by attitudes to fresh foods in some emerging economies. For example, in Brazil, fewer than 10% of consumers in a 2018 survey said they like to eat “healthy, fresh, nourishing foods” (see Figure 7.2).<sup>424</sup> This preference supports the commercial impetus to:

1. deliver ultra-processed products rather than nutrient-rich fresh foods at prices that make them more attractive and
2. to resist voluntary product reformulation.

A similar trend is being observed in low-income countries. A recent survey of households in urban Zambia found that two-thirds use modern and traditional retailers simultaneously, but wealthier households are more likely to rely on supermarkets for their food purchases. The use of modern retailers is strongly linked to higher consumption of ultra-processed foods (even after controlling for income and education).<sup>303</sup> The same trend is increasingly true for rural markets in LMICs. For example, a study in 2014 of the adequacy and appropriateness of diets of young children in the Banke district of Nepal (a remote rural area located in far Western Nepal) found that two-thirds had been fed ultra-processed foods, such as biscuits or dried noodles, during the previous day.<sup>425</sup> As a result, sales of ultra-processed foods and beverages per capita across South and South-East Asia

**Figure 7.2: Share of consumers who prefer healthy, fresh and nourishing food in Brazil in 2018, by region**



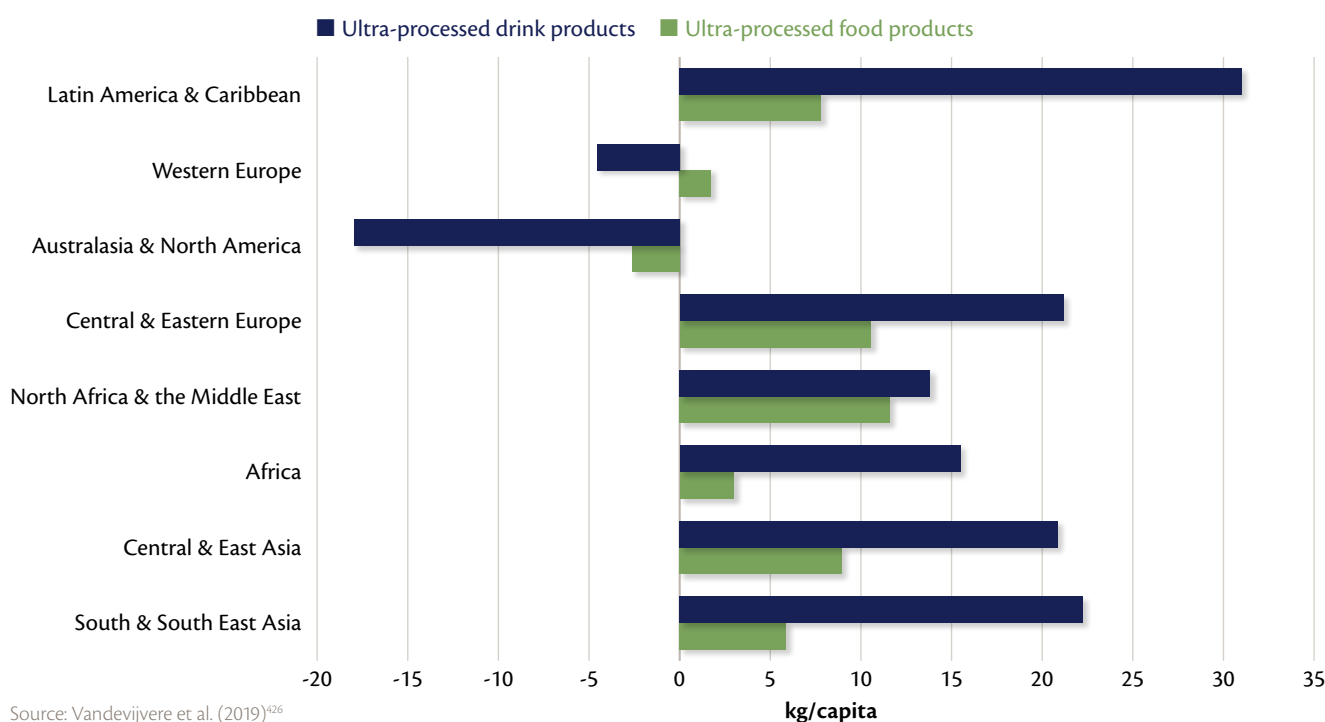
Note: 2018; 1,090 respondents; 16 years and older.

Source: Akatu (2018)<sup>424</sup>

are expected to have almost doubled by 2024 compared to 2012 (from 18kg to 33kg, respectively); similarly, Africa is projected to see per capita sales of ultra-processed products rise from 33kg in 2012 to 46kg by 2024.<sup>421</sup> In both regions, the bulk of increased sales of beverages is in the form of carbonated soft drinks.

Reversing these trends is possible, as seen in the declining levels of consumption of ultra-processed food in North America and Western Europe between 2002 to 2016 (see Figure 7.3). However, policymakers should remain vigilant: significant damage may have already been done in those two regions, while the rest of the world continues to follow in the same direction.<sup>426</sup> Shifting consumer demand away from ultra-processed foods towards nutrient-rich fresh foods in LMICs therefore requires a major strategic shift by governments who need to show robust

**Figure 7.3: Global consumption of ultra-processed food and drink products (change 2002–2016)**



Source: Vandevijvere et al. (2019)<sup>426</sup>

## Box 7.2: Consumer sovereignty

It has long been known that “public policies have been strongly influenced by private interests of large corporations”<sup>427</sup>, particularly in relation to policies that may raise prices, limit advertising, or regulate products that are otherwise commercially profitable. Many factors impede effective national governance in this space, including lack of institutional (policy analytical) capacity, party political ideology, the sway of economic arguments around notional job losses in the wake of policy change, and contested science on health or societal outcomes. There are few examples of companies selling profitable products that are thought to be associated with human harm (such as tobacco-related products, certain chemical agricultural inputs, etc.) voluntarily removing such products from the market. Legislation and/or legal actions have been required. Since commercial companies need to generate profit and seek to protect market share, governments must incentivise

changes to business models that support national public health goals.

However, there is also the concept of consumer sovereignty to consider. Citizens have the right to choose the type and quality of foods they would like to purchase. While some people make choices which contribute to a sustainable, healthy diet or one that is healthy, many do not. Consumer sovereignty recognises the right of individuals to make their own autonomous choices, even if those choices may ultimately do them harm, as for example in the case of a diet biased towards the consumption of high levels of ultra-processed foods. When food industry players do voluntarily remove or reformulate harmful products currently on the market, it is usually because they recognise the interest in certain features and decide to incorporate this into their marketing strategy.

“Improving the capacity of individuals or groups to act independently and make free choices about what they eat and how their food is produced is critical for addressing key challenges which are affecting the ability to meet the SDGs.”

High Level Panel of Experts on Food Security and Nutrition (2020)<sup>325</sup>

leadership in pursuing what are major public health goals, currently neglected for a variety of reasons (see Box 7.2).

Overall, governments can attempt to redirect consumer demand from ultra-processed foods through a range of policy instruments, including information dissemination and behavioural nudges, improved and refocused dietary guidance (having relevance across all parts of government policy), and enhancing the food environment so that the choice of sustainable, healthy diets is made easier for individuals. But alternatives need to be made available which offer similar convenience, taste and trust while being both nutrient dense and sustainably produced. And, crucially, people have to *want* to purchase those healthier items.

## 7.4 The role of governments in shaping dietary demand

Most governments continue to shy away from adopting an active role in the dynamic space where most people obtain their food; namely, food environments. One recent study of the political feasibility of food policy interventions argued that success depends heavily on citizens’ perceptions of costs and benefits, and that while individuals may misperceive the real costs or benefits of various policy actions, it is perceptions that determine public support. Consequently, government-led interventions can flounder in the absence of public acceptance.<sup>380</sup> Governments are certainly

willing to regulate food safety, because of public health and trade concerns, but active engagement in markets and with consumers to improve the sustainability and quality of diets remains minimal.

Discussions in LMICs in preparation for this report confirmed that some governments are less active and less impactful than they would like to be. Those governments that do act have used diverse approaches. Some set restrictions on food ingredients such as trans-fats, define marketing limits (such as bans on inappropriate marketing of breast milk substitutes), or establish economic incentives and disincentives (including taxes and subsidies on defined foods or container sizes). Others provide information (via public campaigns) or mandate the nature of food procurement and provision, including many forms of institutional meal provision.<sup>428</sup>

However, these efforts are too frequently constrained by a lack of human, institutional and investment capacity<sup>429</sup> to meet three key requirements:

1. Funding for relevant interventions;
2. Uncontested political space for manoeuvre;
3. An ability to monitor changes.

For example, the capacity to enforce food safety restrictions is limited in countries such as Nepal which has only 40 certified food inspectors for the entire country.<sup>430</sup> Similarly, funding for rigorous scrutiny of alternative sets of cost-effective policy actions typically gets little or no support.



Governments need to do much more to enable people to make more informed dietary choices. The starting point should be to agree on that goal across relevant parts of government, and to establish a common policy agenda. In so doing, it will be important to articulate the critical role of poor diets in driving the escalating costs of healthcare and environmental impacts on entire food systems on which all countries depend. Overall, the aim should be a better understanding at policy level and among citizens of the true cost of food choices for people's health and for planetary systems.

It is also imperative that governments establish productive working relationships with the food industry. Those national strategies that do exist and which are aimed at influencing consumer choice seldom include a clear articulation of the roles and responsibilities of the public sector relative to businesses. Diverse commercial actors (e.g. smallholder farmers, agribusinesses, food and beverage manufacturers, food retailers, food service providers and industry and trade associations) have a substantial role to play in achieving the goal of making healthy and sustainable diets universally desirable, as well as affordable.<sup>283</sup> The challenge for policymakers is to realise that potential.

## 7.5 Using policy-based behavioural nudges to influence dietary choices

The behavioural economics literature has shown that consumers have many competing preferences, and that even nutrition-conscious individuals balance perceived trade-offs between long-term health benefits and immediate gratification of tastier but less nutrient-rich food products.<sup>431</sup>

While most actions to 'nudge' dietary choices have so far been pursued in middle- and high-income settings, governments in resource-poor countries facing multiple burdens of malnutrition are increasingly considering the potential of similar policy instruments.<sup>432</sup> However, while this area of intervention remains promising, there is still almost no empirical evidence of successful interventions in LMIC settings.<sup>433</sup> This is an important information gap concerning consumer behaviour which must be urgently filled.<sup>434</sup>

There are examples where governments have already explored actions that may tip the balance in favour of healthier outcomes by influencing the food environment and hence individual consumer choices. These have included public advertisement campaigns which put obesity on a par with cancer (United Kingdom), encouraging less food waste and greater fruit and vegetable consumption by offering imperfect, perishable foods in supermarkets (France, Canada), and food package labelling initiatives (Chile). Other behavioural nudges include: the provision of healthy meals in public sector institutional canteens in schools, the military, hospitals and prisons; improved nutritional labelling of products; highlighting differences in portion sizes; requiring full-service restaurants to include nutrient facts on menus; and using regulations to ensure nutrition claims

on food packaging are accurate as health claims.<sup>407</sup> However, the extent to which behavioural nudges would affect home consumption patterns in LMICs requires further study. This is a top priority for governments seeking to find locally appropriate, cost-effective solutions to diet-related diseases in their countries.

## 7.6 Nutrition knowledge: the unfulfilled potential of food-based dietary guidelines (FBDGs)

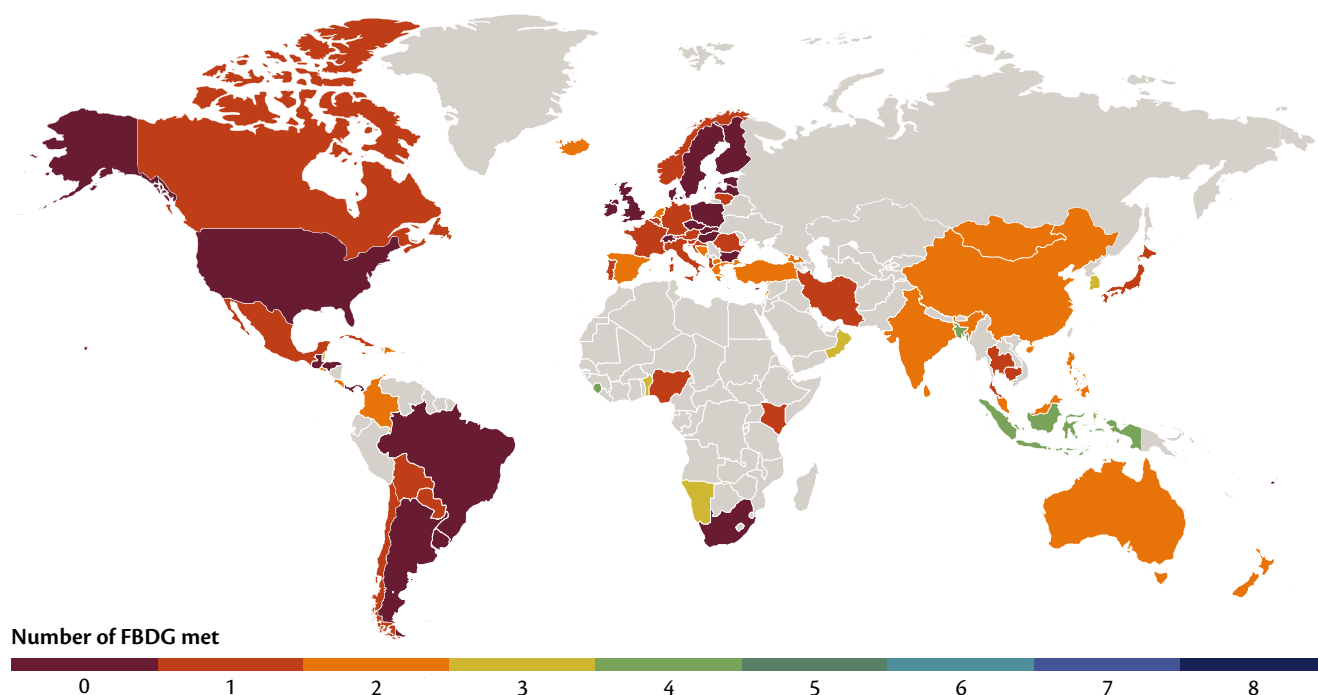
Knowledge of nutrition and healthy dietary choices can contribute greatly to improved nutrition outcomes, and could do much more to bring food systems in alignment with sustainability and climate change goals.<sup>435,436</sup> But citizens need authoritative, trustworthy advice that cuts through the erroneous, conflicting and changing advice that is sometime prevalent in the media and on the internet. There is a role for governments to develop and make much more effective use of FBDGs. The aim of these is to encourage better-informed choices and hence healthier, and more sustainable, dietary patterns.<sup>437</sup>

New analysis commissioned by the Global Panel has considered the health and environmental implications of existing national FBDGs.<sup>210,347,438</sup> This analysis has highlighted fundamental issues which need to be addressed. Many countries still lack formal FBDGs: of the 85 countries identified as having guidelines, only 21 were LMICs. Also, many existing FBDGs lack understandable and actionable advice. They are rarely used to inform government policies and there are wide gaps between national guidance and conformity with WHO recommendations for intake of recommended foods (e.g. fruits and vegetables), or for limited intake of discouraged foods (e.g. sugar, salt). Over 80% of the 85 countries met only one or none of these recommendations; just five countries met three.

A further deficiency is that the majority of FBDGs fail to incorporate proper consideration of the environmental implications of dietary choices.<sup>91,439</sup> If they were to do so, the real 'cost' of food production in relation to environmental parameters would become more apparent, and FBDGs would have a more explicit and defined role in influencing the design and goals of government policy as well as understanding of the implications of food choices.

Few FBDGs take account of global environmental targets relating to dietary choices: just three FBDGs (Guatemala, Kenya, Sierra Leone) are in line with the Paris Agreement emissions target for limiting the global temperature increase to two degrees Celsius; three (Cambodia, Kenya, and Sierra Leone) are aligned with global land-use targets; and six are aligned with fresh water targets (Slovakia, Guatemala, Paraguay, Kenya, Namibia, and Nigeria). Just one (Nigeria) aligns with targets for nitrogen. As a result, two-thirds of the national FBDGs included in the analysis were shown to be incompatible with either the Paris Agreement on climate change or goals aimed at the prevention of NCDs.<sup>438</sup>

**Figure 7.4: Number of food based dietary guideline recommendations that are met in each country**



Source: Springmann (2020)<sup>438</sup>

## “ Most national dietary guidelines are not ambitious enough to bring food systems within planetary boundaries. ”

EAT (2020)<sup>436</sup>

A final concern is the extent to which people adhere to the advice embodied in FBDGs. Analysis of the overall degree of conformity of diets with national FBDGs when averaged across the relevant country is shown in Figure 7.4. Overall, most countries have very low compliance with national FBDGs, with most countries meeting less than three recommendations. Asia and the Pacific have a relatively high attainment of recommendations relating to fish (40% of countries), but less so for red meat (33%) and sugar (27%). Europe fares relatively well for fish, fruits, and vegetables, while North America does not meet any of its own national guidelines. Five countries do meet three of their own recommendations: Spain (fruits and vegetables, nuts & seeds, sugar), Malta (fruits and vegetables, nuts and seeds, fish), Bangladesh (fish, sugar, red meat), Benin (nuts and seeds, sugar, red meat), and Sierra Leone (fish, sugar, red meat).

These examples show that FBDGs are addressing a real need to change dietary choices, but also that they need to be much more effective (see Box 7.3). They should be redesigned to guide the intent and design of policies on sustainable, healthy diets, rather than just informing consumers, where they have little impact. Most FBDGs are disconnected from the policy actions that drive food systems and are therefore divorced from the reality of what people can eat and why.<sup>438</sup>

A new generation of FBDGs informed by the evidence of policy impacts on consumer demand, patterns of intake

of various foods and nutrients, and the relative health benefits of different food choices offer policymakers a valuable tool. Redesigned, they have the potential to be part of a broader strategy to strengthen the whole domestic food system, and not only the health of individuals.

### 7.6.1 Potential benefits to be gained from next-generation FBDGs

The commissioned modelling for the Global Panel shows the considerable benefits that could accrue if FBDGs were redesigned to focus on national policy directions. If fully adopted in the 85 countries with FBDGs, premature mortality could be reduced by 12%. Over half (55%) of this reduction would be due to improved weight – including a 17% reduction in the global prevalence of adults being underweight (low BMI), and a very substantial (almost 25%) drop in obesity. Dietary changes were responsible for the remaining reduction in mortality, mainly through higher intake of vegetables (19%), fruits (11%), nuts and seeds (5%), pulses (4%), and fish (4%), as well as a reduced intake of red meat (3%). (See Box 7.4 for a discussion of the shifts in consumption of unprocessed red meat in the United States and elsewhere.) By geography, the predicted reductions in mortality ranged from 7% in Africa, where much of the health burden is still associated with communicable diseases, to 18% in North America, where high prevalence of obesity is a major health issue.

### Box 7.3: FBDGs – the next generation

National food-based dietary guidelines (FBDGs) need to satisfy the following:

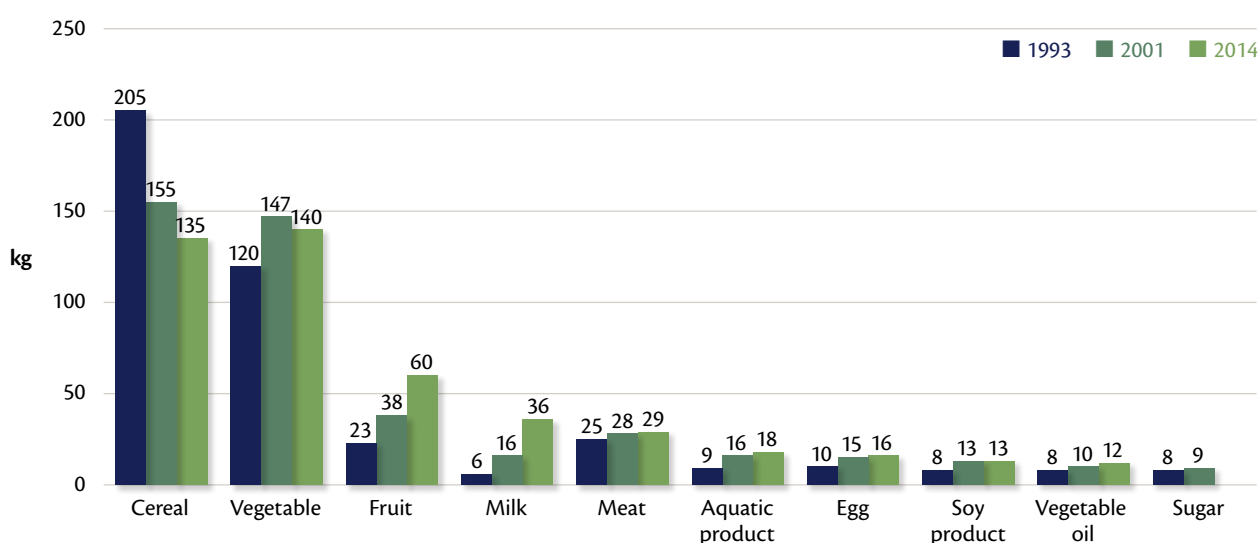
1. To be based on the best available science, while taking account of local circumstances.
2. Not to be static. Policymakers should expect them to change as science and local conditions change. In China, the government has progressively adapted its guidance in the light of prevailing conditions and new health-related evidence (see Figure 7.5).
3. To take account of the environmental implications of the recommended diets, as well as health.
4. To influence directly the goals and instruments of national policies and investments. For example, what is currently produced and made available in countries which have FBDGs is, in most cases, very distant from what is recommended in those FBDGs. That mismatch is a valuable signpost of where

policymakers need to focus in order to transform food systems.

5. To be feasible for citizens to act on, thus going beyond giving aspirational advice.
6. To help shape the incentives/disincentives of the economic environment in which commercial entities play a leading role.
7. To be effectively communicated to citizens, to businesses involved in the food system, and to relevant policymakers.

Finally, FBDGs also need to be integrated into national food system action plans which should be formulated by governments and engage all stakeholders in their design and implementation. Funding to local authorities should be earmarked for tailoring of local action plans, effective implementation, and the transparent collection of data on impacts and costs. Plans will necessarily define which bodies have a role in achieving specific targets by when.

Figure 7.5: China's guidance on annual food intake



Source: IFPRI (2019)<sup>440</sup>

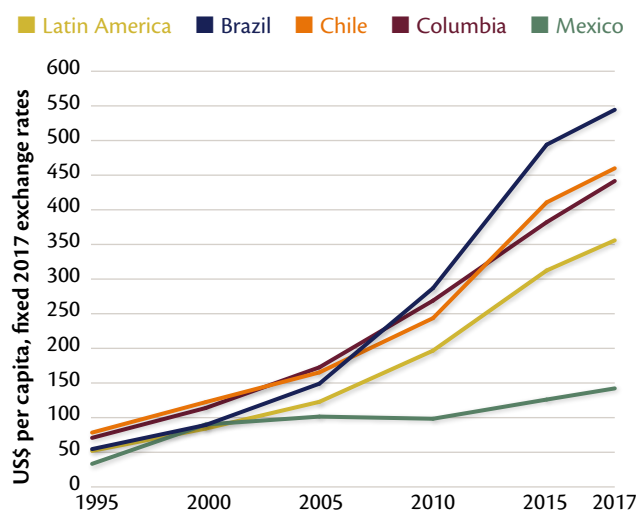
The economic value of the reductions in mortality are estimated at US\$7.2 trillion to US\$8.9 trillion – equivalent to between 10% and 15% of global GDP. If a less conservative approach were to be taken (including child undernutrition and sickness rather than mortality alone), the impacts would be greater still.

These totals do not take account of the environmental costs averted by adoption of the same FBDGs. It was found that full adoption of national FBDGs in the 85 countries considered would reduce food-related GHG emissions by 11%.<sup>438</sup> Most of that improvement would be driven by reductions in ruminant

meat consumption. To achieve this, cropland demand would increase by around 8%, driven by increased acreage to expand the output of milk, legume crops (including soybeans, green beans, and peanuts), and fruits and vegetables. This would be partially offset by a reduction in land area currently dedicated to production of food for beef cattle and other ruminant livestock aimed at meat consumption. Overall, demand for fresh water would be reduced by 4% under this scenario of full adoption of national FBDGs, despite increased demand for fruits and vegetables, pulses, and milk. The reason for this is less demand for (and hence production of) sugar, staples, cereals and tubers, and various animal-source foods.



**Figure 7.6: Per capita away-from-home food and non-alcoholic beverage yearly expenditures, 1995–2017**



Source: Popkin and Reardon (2018)<sup>442</sup>

## 7.7 Social and cultural norms – the places where people eat is changing

Culture has a major role in influencing people's beliefs on what constitutes a healthy diet. Importantly, cultural norms and patterns of food choice across all segments of society are changing. This is partly manifest in where people shop (with global shifts from open wet markets to supermarkets), and what they buy (an increasing share of food purchases comprising ultra-processed, packaged foods and sugar-sweetened beverages). However, there are also significant shifts in where people eat.

In many countries the norm of family meals in the home is shifting in favour of street foods and eating at fast and full-service restaurants. Diverse factors are driving this trend: they include relative prices, taste, peer pressure, convenience, and the opportunity cost of time.

Today, more people eat away from home than at any time since humans were hunter-gatherers. For example, in South Korea, families already allocate about 48% of their total food spending to meals outside the home.<sup>441</sup> Figure 7.6 shows the substantial increases in per capita expenditure on food consumed away from home in four Latin American countries.<sup>442</sup> Increases in Brazil, Chile and Colombia are particularly large. These graphs illustrate how the world's population is cooking less, and eating out more due to lifestyle changes and aspirations.

Eating away from home, or having meals prepared by a food service and delivered to the home, matters to diet quality. Some restaurants and fast food outlets do not support healthy diets. One study of eating habits in the United States found that less than 0.1% of the meals sold in full-service restaurants were of high quality (based on the American Heart Association's diet quality score),

and that around 50% of meals sold were of 'poor' or 'intermediate' quality.<sup>443</sup> Another study found that the share of adults buying fast food for children has been growing (see Figure 7.7).

However fast-food restaurants are not automatically worse in terms of diet quality compared to full-service restaurants. Some are already seeking to offer 'healthy choice' alternatives to meat-based processed food. Furthermore, a study of the caloric content of full-service meals conducted in 111 randomly selected restaurants serving popular cuisines in Brazil, China, Finland, Ghana, and India found that they contained 33% more dietary energy (calories) on average than fast-food meals.<sup>445</sup> For example, restaurant meals in Ghana and India were shown to contain average levels of calories as high as those in the US. In other words, while fast-food outlets and packaged snacks have long been of concern to the public health community, the high energy content of restaurant meals must also be considered as a contributor to the obesity epidemic.<sup>445</sup>

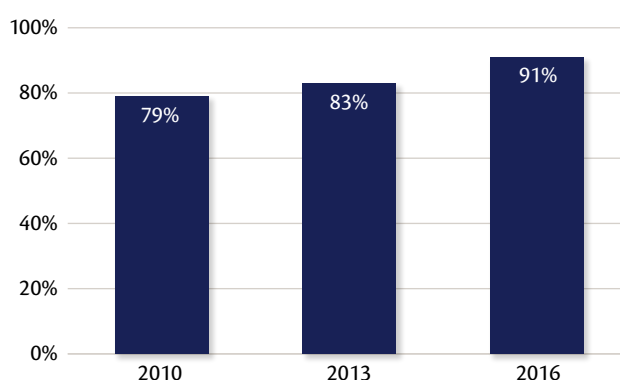
## 7.8 Businesses must contribute to making sustainable, healthy diets desirable

The WHO acknowledges that:

“The environments in which people develop their dietary behaviour and make their food choices are a significant influence on what they purchase and, in turn, what they eat.”

WHO (2015)<sup>370</sup>

**Figure 7.7: Share of adults buying fast food for their children in the past week in the United States from 2010 to 2016**



Source: Rudd Center for Food Policy and Obesity at Yale (2018)<sup>444</sup>

## Box 7.4: The dietary shift from meat to plant-based foods

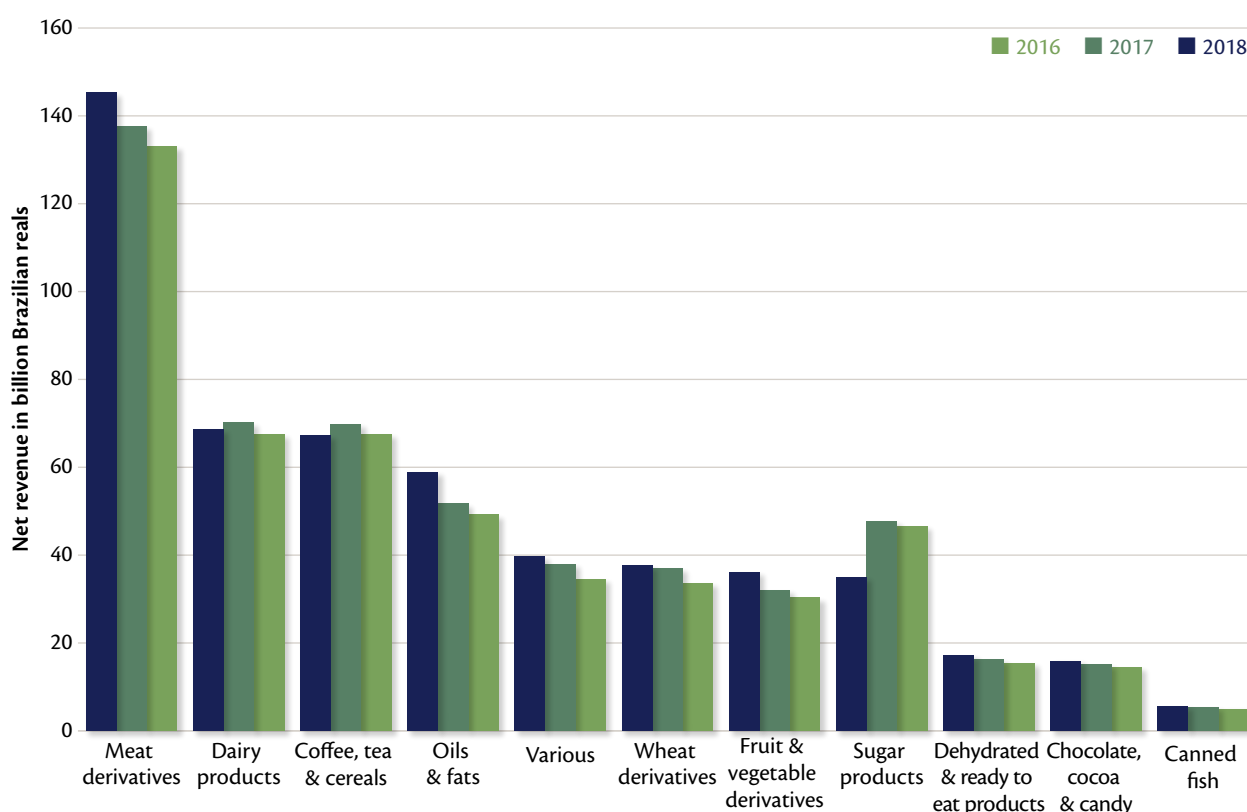
A fall in unprocessed red meat consumption is already occurring in the US, where growing awareness of health and environmental consequences has led to reduced demand. This has been the case particularly among higher income, more educated consumers who have either shifted to other meats (poultry and fish) or to meat alternatives.

The food industry has responded to the growing demand for meat alternatives with large research and development (R&D) investments and the recent roll-out of multiple, carefully branded products at competitive prices. While some meat-alternative products could be classified as highly if not ultra-processed, this recent development shows that

a combination of altered behaviour and change in retail priorities can support population-wide shifts that could be beneficial to health and, indirectly, if coupled with reduced red meat production, also beneficial in terms of climate and environmental resources.

There has been an expansion of business lobby groups promoting plant-based foods<sup>447</sup> and many restaurants in the US are already offering plant-based meat alternatives on the menu. However, these trends are not yet apparent in countries such as Brazil where meat and dairy products, but also oils and fats, represent the largest net revenue streams within the food sector (see Figure 7.8).

**Figure 7.8: Net revenue of the leading sectors in the food industry in Brazil from 2016 to 2018**



Source: Associação Brasileira das Indústrias da Alimentação (2019)<sup>446</sup>

Nevertheless, as in the past with policy initiatives aimed at curbing tobacco use, requiring seat belts, and restricting the marketing of breast milk substitutes, new proposals often meet with significant opposition from key stakeholders.<sup>370</sup>

The major class of stakeholder that could oppose change in this case comprises food industry companies; that is, the diverse commercial interests, local and global in size and reach, that play the lead role across the food system, from where food is produced to where it is obtained. It is widely argued that policymakers are constrained by industry lobbying activities

and/or promote the position that dietary practices are based on 'individual choice', and therefore that only neoliberal market and governance models are appropriate for tackling dietary concerns.<sup>31</sup> Changing this will require:

- 1. Scientific evidence of cost-effective policy actions** that can indeed shift dietary choices towards more sustainable, healthy outcomes. These might include price levers via taxes (for example on certain ultra-processed foods) and price subsidies (on nutrient-rich foods), alongside better enforcement of regulations. This points to a need for

improved mechanisms to independently and rigorously assess evidence and knowledge gaps, facilitate common understanding of the policy implications of key findings, and generate consensus around key actions and targets. In effect, this means providing similar functions to that provided by the IPCC, but concerning food systems and nutrition.

## 2. Conscious moves to incentivise commercial interests

(large and small, local, and transnational) to act in support of the public good.

## 3. Establishing novel business models for the 21st century

that use incentives as well as regulations to encourage a shift in business perspectives from a narrow short-term profit focus towards longer-term community, society and planetary goals framed by human and environmental health.

In other words, the food industry should not be demonised or ignored; but nor should it be allowed free rein to pursue narrow profit motives where these are antagonistic to wider societal goals. It is therefore important to acknowledge, and build on, the many positive aspects of commercial activity in the food system and incentivise actions which support government policy agendas on public health and environmental sustainability (see Box 7.5).

## 7.8.1 Entry points for engagement

Public sector organisations and civil society organisations (CSOs) can only achieve their goals to influence diets by engagement with businesses involved in all aspects of food environments that influence dietary choice: i.e. food products and their packaging and marketing, food services, food outlets and the relative pricing of foods.

For example, UNICEF identifies five 'key entry points' for public policy engagement with businesses to improve diets.<sup>452</sup> These require understanding how businesses work (and why) and how their roles offer huge potential to any public sector agenda. They are:

1. Business as a provider of essential services supporting nutrition, e.g. industry support for salt iodisation, mandatory micronutrient fortification of flour, etc.
2. Business as a job creator across the food system, as the locus for employee programmes supporting healthy diets, procurement supporting demand for local food production, etc.
3. Business as a community stakeholder through investments at local level in food product manufacturing, creating demand

### Box 7.5: Incentives for food companies to change behaviour

Food companies are a primary driver of how food systems operate, heavily influencing what foods are available. While the nature of these food companies varies (see the Access to Nutrition Initiative (ATNI) 2018 Global Report<sup>448</sup> and various ATNI country reports), they all respond to the same six incentives.

1. **Demand.** This is the ultimate driver of change, which is why companies spend so much money on advertising. Advertising needs to be better regulated, but public sector behaviour change campaigns also need to be more compelling and have more effective messaging.
2. **Investor behaviour.** There is a growing trend towards investors – large and small – becoming more motivated by corporate performance featuring social impact indicators. Initiatives such as the *Responsible Business Pledge* being developed by the World Business Council for Sustainable Development, Food Industry Asia, International Food and Beverage Alliance, Consumer Good Forum and the SUN Business Network for the Nutrition for Growth Summit can help guide investment towards companies that are doing more to promote the health of people and planet.
3. **Government policy.** Companies are reluctant to be first movers towards improved social outcomes if it compromises commercial returns. Governments can play a role in shifting entire sectors within a nation through taxes and measures to reduce risks for companies.

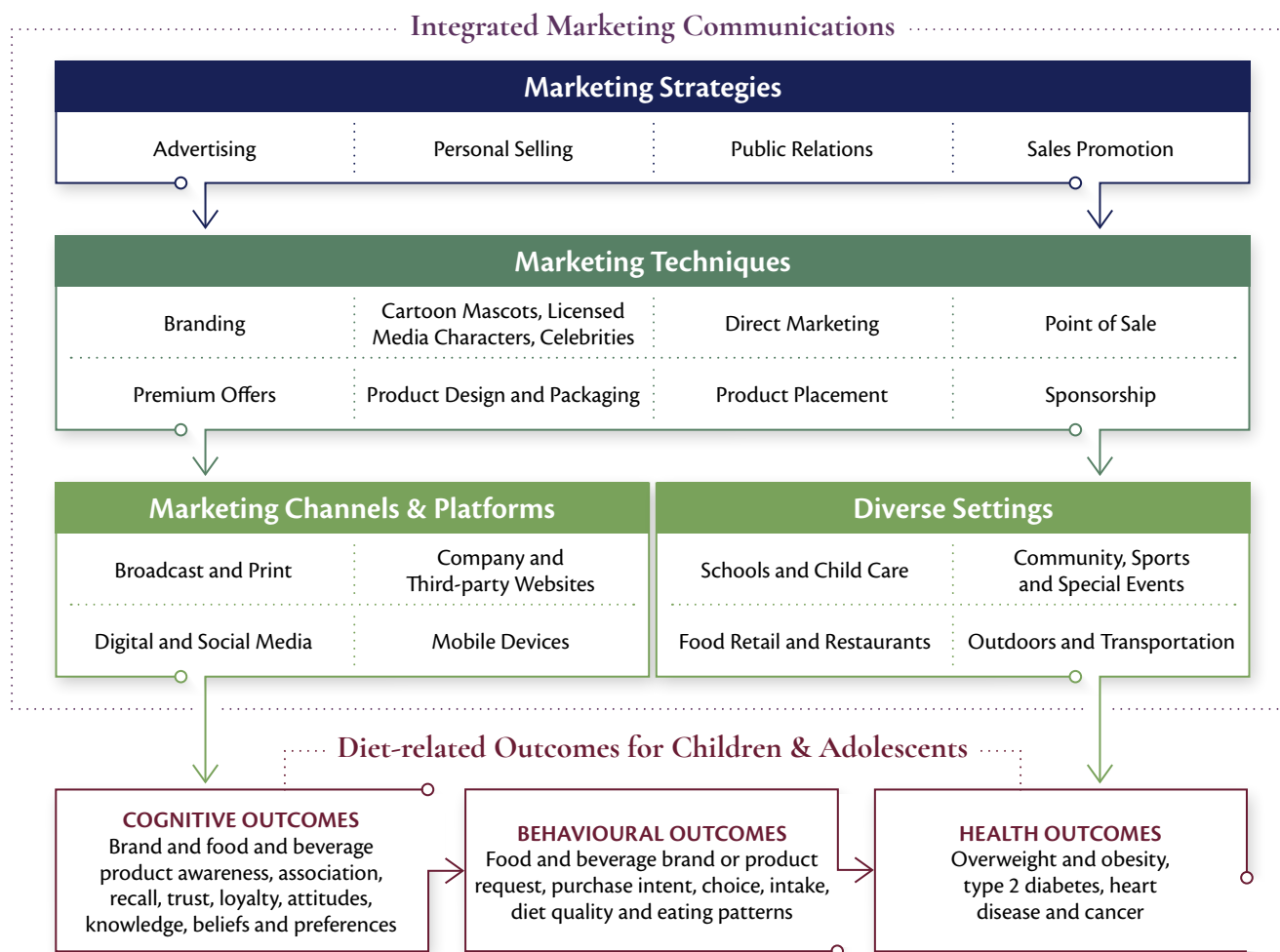
4. **Civil society accountability mechanisms.** There is a plethora of accountability mechanisms which have been generated by civil society organisations (CSOs).<sup>449</sup> Too many may have a negative effect on corporate accountability with the costs of engaging becoming too high for companies. But with the right level of focus, credibility, and engagement these mechanisms can induce behaviour change. ATNI is a good example of what can be achieved.

5. **Employees.** Younger employees are more motivated to work with companies that have credible social goals. A recent study shows that employees will take lower salaries and be more productive in companies with such a purpose.<sup>450</sup>
6. **Champions within the company.** Companies have diverse workforces. Even in the companies that are the worst performers, when it comes to social and economic goals there will be individuals who are motivated to change the *status quo* in terms of diet quality and environmental sustainability. Their contribution to promoting corporate responsibility should be recognised and valued within companies.

Companies of all sizes must be persuaded to play a leading role in the transition. The public sector, including governments, together with civil society organisations must develop these incentives to help deliver corporate behaviour change across the board.<sup>451</sup>



**Figure 7.9: Food and beverage marketing approaches**



Source: Kraak et al. (2019)<sup>454</sup>

for local food products, and supporting local food marketing and supply chains.

4. Business as a leading investor in technology R&D and innovation, strengthening supply chains to support year-round access to nutrient-rich foods, making improvements in shelf-life, processing technology, packaging, storage, increasing productivity and reducing food loss and waste.
5. Business as an influencer of environmental and resource uses, championing recycling, optimisation of national resource inputs to food industry operations, etc.<sup>452</sup>

This set of entry points allows some governments to acknowledge the contributions made by a multitude of business entities in the food system, but also to better identify leverage points where economic or other incentives may help amplify positive effects (i.e. on job creation, scale of coverage of micronutrient fortification laws, commercial R&D supporting public priorities, etc.), or alternatively where taxes or regulations are needed to restrict harmful practices. It has recently been estimated that LMIC businesses “collectively lose between US\$130 billion and US\$850 billion a year through malnutrition-related productivity reductions”. In other words, the nature of public sector interaction with the food industry is critical

to determining the characteristics of the food environment, but industry collaboration with governments is in its own interest because of the losses borne by industry players due to the impaired nutrition and health of their workforce.<sup>453</sup>

### 7.8.2 A framework for engagement: commitments, principles, and accountability

Food-related corporations of all sizes, processing industries, retailers and food service outlets should all be engaged as part of a strategy by national and local governments to agree concrete measurable commitments for which each food industry stakeholder would be held accountable (see Figure 7.9).<sup>454</sup> Governments must also be held to account for their actions in holding businesses accountable.

It will be important to establish measurable context-specific principles of engagement to which all stakeholders can adhere as a foundation for strategic engagement. The top priorities in this domain include:

1. Agreement among key stakeholders on a high-level set of principles for public private engagement around food systems and nutrition. These must define rights and responsibilities, accountability frameworks, approaches to target-setting,

etc. They must also acknowledge that the public sector has secondary interests to be taken into account, such as future electability, donor-driven research agendas, and engagement with the priorities of non-governmental organisations, as well as with lobby groups focused on the agriculture and trade sectors, and pharmaceuticals.

2. Agreement on ways to operationalise guidelines which already exist, including the WHO Codex Alimentarius on Nutrition and Labelling, Voluntary Guidelines on the Right to Food, Principles for Responsible Investments in Agriculture and Food Systems, and the UN Global Compact's Guiding Principles for Business and Human Rights.
3. Agreement around a Compact on responsible investment in food systems, as well as the application of best practices in manufacturing, marketing and distribution of all foods and food products, with sustainable, healthy diets established as a common goal.

One important opportunity for progress on this front is offered by the upcoming Nutrition for Growth (N4G) Summit in Tokyo, planned for 2021. Plans are underway to launch a *Responsible Business Pledge for Better Nutrition* at N4G. As a framework for business sector commitments, this pledge will be open for signature by any company or business organisation with an impact on diet quality and nutrition. Industry stakeholders that sign the pledge will commit to making nutrition a long-term, board-level priority. That will involve putting in place corporate strategies to help achieve SDGs 2 and 3, while establishing measures to ensure that investments in nutrition take into account broader food system concerns, including accessibility,

affordability, and environmental stewardship of resources relating to food production. Companies must also undertake to report regularly on progress through the N4G Accountability Framework.

Given the need for clearer accountability frameworks for commercial activity, the N4G business pledge is one step in the right direction, but much more is needed. There is a role for philanthropic and consumer-focused watchdog organisations to ensure monitoring and evaluation of marketing practices by all participating (signed up) and non-participating businesses. This is especially important where governments remain reluctant to monitor, let alone regulate, food industry marketing and retail activities. There is also a need to disaggregate 'the private sector' so that component parts can be better legislated for and tracked in terms of compliance. For example, in the domain of food and beverage marketing alone, there are many approaches, modalities and targets pursued across businesses of different kinds. These go far beyond conventional television, radio and poster messaging and therefore require interaction with a much broader set of stakeholders, and attention to a much wider range of potentially positive or harmful activities.

In other words, food business enterprises of all kinds should be required to abide by national and international standards, but for this to be effective, there must be appropriate systems in place and funded to track, monitor, and hold actors accountable. Indeed, food industry players must demonstrably meet national regulations to ensure food is safe and of adequate quality and satisfies appropriate ethical considerations (see Box 7.6). Coordination of regional and local actors is critical and should be led by public authorities.

### Box 7.6: Ethical considerations

While food companies already play a central role in influencing the desirability and choice of individual foods, some analysts see aspects of the food industry's influence as unethical. It has been argued that "it is naive to ignore the reality of the global political economy, whereby some businesses actively work against population health by virtue of their products or when it threatens their political and economic interests".<sup>455</sup> For example, only two in five infants under six months of age are exclusively breastfed, as recommended, and the promotion of breast milk substitutes in low-income settings is widespread. Sales of milk-based formula foods grew by 41% globally between 2008 and 2013.<sup>44</sup> Even if children are old enough to eat family foods, roughly 44% of children aged six to 23 months globally are not fed fruits or vegetables and only 20% of those children in poor rural households are fed a recommended diverse diet.<sup>44 xvi</sup>

This reality must be acknowledged, and governments must overcome their apparent reluctance to tackle such

negative outcomes while also seeking out positive roles for business partners. It has been argued that "commercial food systems rely heavily on high volume sales of foods high in unhealthy ingredients to generate profits and value for shareholders".<sup>456</sup> This reliance will not change without strong actions at the policy level to incentivise alternative goals and agendas, and effectively regulate commercial activities that lead to significant externalities borne by society as a whole, including healthcare costs deriving from diet-related diseases, ecological degradation, the impacts of climate change, etc. Many policymakers are understandably cautious about transformative actions in the food industry because they are concerned about economic growth, employment, tax revenues, and the potential for significant political repercussions.

<sup>xvi</sup> This report does not claim that poor diets are the only cause of undernutrition or indeed of diet-related non-communicable diseases (NCDs). These are, nonetheless, major contributors.

## PART III

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# How to manage the transition



# 8

## Managing the transition

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# Key messages

**There is growing acceptance that food systems need to be fundamentally transformed:** so that they deliver diets of a high quality (diverse, nutrient-rich and safe) which are available and affordable for everyone; become sustainable; and achieve shifts in dietary patterns.

**But the steps necessary for a successful transition are stalling. This is for diverse reasons which include:**

1. The complexity of food and environmental systems in a context where policy actions on food, health, agriculture, and climate are currently siloed.
2. Competing priorities for:
  - governments who have to make difficult policy choices
  - private companies making investment choices on product portfolios or retail strategies, and
  - households making food-purchase choices.
3. Uncertainty about and mistrust in scientific evidence, sometimes exacerbated by political polarisation.

**Managing transition steps is the first order of business.**

- All governments should engage

politically with the collective global agendas which set goals based on the best available science (such as the climate change targets).

- There is an urgent need for improvements in the quality and coordinated uses of scientific information to inform policy decisions. Governments should facilitate engagement with stakeholders to define a national vision for a transformed food system.

**Policymakers need to think through how to navigate the difficult trade-offs** which will need to be decided upon – some of these are within the food system, but others go much wider – for example how to balance resource expenditure between education, stimulating economic growth, and investing specifically in food systems. Budgetary allocations and institutional strengthening (in terms of human as well as capital resources) are essential to enable public sector actors to engage fully in the process of food system transition, partnering with business entities as appropriate.

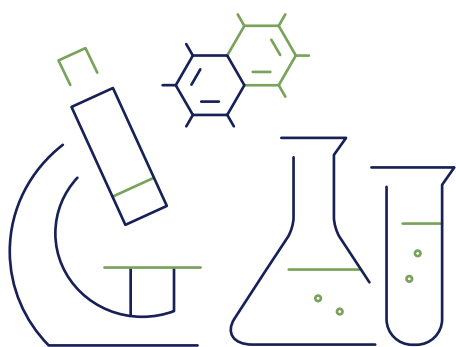
**Several factors are impeding necessary progress on policy change**

**and need to be addressed.** These include the emphasis on production at the expense of the wider food system; the historic bias in favour of producing staples; agriculture-sector subsidies; research biases; and how environmental externalities should be reflected in food systems.

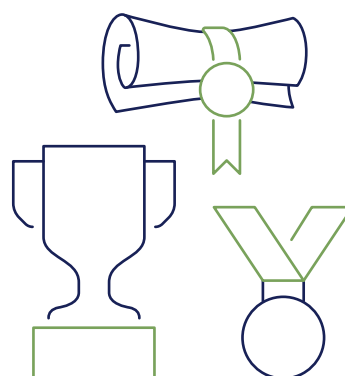
**A food system transition needs to be conditioned on several priorities.**

These include: do no harm and avoid closing off options for the future; invest in strengthening institutions and capacity building; ensure transparency; base decisions on evidence and transparent expectations; and establish feedback mechanisms for adjustment.

**The costs of the transition need to be assessed and managed from production through to retail.** There also needs to be an articulation of how those costs, and the ensuing benefits, will be distributed among stakeholders – the public and private sectors, and citizens. A dedicated Global Financing Facility, supporting resource mobilisation and incentivising increased allocations of domestic resources, should be explored – as an innovative way to mobilise funds supporting transition.



All governments should engage politically with the **collective global agendas** which set goals based on the **best available science**



Policy makers should seek **multiple benefits** or 'wins' across all policy and investment decisions

Part I of this report shone a light on inter-linked and deepening crises. First, food systems are currently failing to deliver healthy diets, which has profound impacts on human health and national economies. Second, food systems are contributing substantially to the climate crisis and to ongoing degradation of natural resources. Third, the climate crisis and resource degradation have significant impacts on the capacity of food systems to deliver sustainable, healthy diets for all. But how these inter-linked crises unfold in the decades ahead is not pre-determined. Part II of the report set out the categories of actions that must be pursued, particularly by policymakers in low- and middle-income countries (LMICs) who are the most affected, to underpin the process of transition. However, all nations, including high-income countries (HICs), need to act without delay.

Part III now focuses on the political and economic realities of change. Much will depend on the political will and courage of leaders to challenge the *status quo*, to act boldly, and to drive a process of transition on the basis of evidence. In the absence of high-quality leadership, the necessary transition will not be achieved. For any leader, there will be challenges, policy trade-offs and political hurdles to overcome. These are real but not immutable. The transition process must be pursued with a vision of alternative possible pathways forward, a clear explanation of tangible benefits to be expected, and an understanding of the costs of inaction relative to the price tag of necessary investments.

## 8.1 Beginning the transition to sustainable food systems

Since the Global Panel's first Foresight report in 2016 recommended serious policy attention for repositioning food systems to deliver healthy diets, similar calls have been growing (see Box 8.1).<sup>172,457</sup> However, inadequate progress is being made, as explained in Chapters 2 and 3.

There are many reasons for the lack of action around the globe, including absence of political consensus, institutional inertia, vested interests defending existing policies, the lack of coherent strategies which unite common interests across public sector and businesses, and the daunting complexity and assumed costs of the task.

This report argues that the aim of sustainable, healthy diets for all is achievable – but the transition of food systems will be complex and difficult, with inevitable winners and losers. This calls for bold and courageous action by policymakers and food-industry stakeholders. It is not easy to transform any system as complex and dynamic as one that influences and is influenced by food supply, distribution, processing, and demand. Seeking to bring about fundamental change in any part of a food system has profound economic and political implications. This is because multiple and sometimes conflicting goals need to be considered simultaneously. This calls for an in-depth analysis of trade-offs or possible synergies

### Box 8.1: Calls for a transformation of how we produce and consume food are growing

Several agencies of the United Nations (UN) recently acknowledged that food systems must be 'reformed' to ensure the sustainable production of, and access to, foods which make up healthy diets.<sup>16</sup> UNICEF and Global Alliance for Improved Nutrition (GAIN) have called for food systems to be 'realigned' with the dietary needs of nutritionally vulnerable people around the world.<sup>17</sup> The Eat-Lancet Commission concluded that "global efforts are urgently needed to transform diets and food production collectively".<sup>18</sup> Similarly, the World Resources Institute (WRI) and the Food and Land Use Coalition (FOLU) have both argued for a 'transformation' of food systems to meet health, climate and poverty goals simultaneously.<sup>6,19</sup>

In response, some donor agencies have reorganised to reflect the 'new' agendas facing LMICs and the world as a whole, including the United States Agency for International Development (USAID) which created a cross-agency centre focused explicitly on nutrition, drawing on expertise across the entire organisation. Similarly, the World Bank is currently finalising a new action plan on climate change (building on its 2016–2020 strategy), which includes a focus on supporting climate-smart agriculture in regions most affected by both high burdens of malnutrition and increasingly negative environmental impacts on food systems.



among healthy diets, sustainable resource management, more resilient food systems and equitable development.<sup>459</sup>

Many governments do not have the capacity necessary for such in-depth analyses or, if they do have capacity, do not use it to revise policy approaches to existing food system problems (see Box 8.2). It is a difficult task for any policymaker to start down the road to a different future without a good understanding of what this will entail, what the benefits could be, and how possible benefits would be distributed relative to expected costs.

“ The global food system needs to be transformed into one that is nutrition- and health-driven, productive and efficient, environmentally sustainable and climate smart. ”

Fan (2018)<sup>458</sup>

## Box 8.2: Government capacity constraints in the face of human and planetary health risks

The capacity for governments in LMICs to engage quickly in food system transition may in some cases be hampered by institutional, budgetary, and other constraints. The World Bank reports a set of governance indicators for LMICs based on institutional, fiscal, legal, and human capital capabilities. Countries highlighted in bold in the matrix below are ones listed in the bottom quartile of its Governance Effectiveness Index for 2017. The top left quadrant of the matrix includes those LMICs facing high levels of health losses from all causes (measured in terms of disability-adjusted life years, or DALYs) as well as high climate risks (from many kinds of environmental shocks and resource degradation). The bottom right quadrant includes countries currently with relatively lower health and planetary health risks combined.

What this shows is that 17 LMICs classified as having serious governance constraints are facing both human and planetary health risks. These countries include Afghanistan, Myanmar, and Yemen. Another 26 LMICs with governance constraints face either high human or high planetary health risks. In other words, capacity is limited for between 30 and 40 LMIC governments to deal with ongoing climate shocks and healthcare challenges. This means that their ability to engage fully in a food system transition will be constrained in the absence of a significant effort by nations themselves and by their multilateral and bilateral development partners to build relevant institutional, fiscal, legal, and human capabilities.

Planetary Health Risks (Climate Risk Index)		
Human Health Risks (DALYs per 100,000 population)	High	Low
	<b>Afghanistan</b> , Botswana, <b>Burundi</b> , <b>DRC</b> , <b>Cote d'Ivoire</b> , Ethiopia, <b>Haiti</b> , India, Kenya, Laos, <b>Madagascar</b> , Malawi, <b>Mauritania</b> , <b>Mozambique</b> , <b>Myanmar</b> , <b>Nepal</b> , Niger, <b>Nigeria</b> , Pakistan, Papua New Guinea, Philippines, <b>Sierra Leone</b> , <b>Solomon Islands</b> , South Africa, <b>Sudan</b> , <b>Yemen</b> , <b>Zimbabwe</b>	<b>Angola</b> , Azerbaijan, Benin, Burkina Faso, <b>Cambodia</b> , <b>Cameroon</b> , <b>CAR</b> , <b>Chad</b> , <b>Comoros</b> , <b>Congo-Brazzaville</b> , <b>Djibouti</b> , <b>Egypt</b> , <b>Eritrea</b> , Eswatini, Fiji, <b>Gabon</b> , <b>Gambia</b> , Ghana, Guinea, <b>Guinea-Bissau</b> , Guyana, Kiribati, Lesotho, <b>Liberia</b> , <b>Mali</b> , Mongolia, Namibia, Rwanda, Senegal, <b>South Sudan</b> , <b>Tajikistan</b> , Tanzania, <b>Timor</b> , <b>Togo</b> , Uganda, Ukraine, Uzbekistan, Vanuatu, Zambia
	Low	
	Albania, <b>Bangladesh</b> , Bolivia, Bosnia, Brazil, Bulgaria, China, Colombia, Costa Rica, Dominica, Dominican Republic, Ecuador, Guatemala, <b>Honduras</b> , Indonesia, Iran, Kazakhstan, <b>Kyrgyz Republic</b> , Malaysia, Mexico, <b>Nicaragua</b> , <b>Paraguay</b> , Peru, Romania, Russia, Serbia, Sri Lanka, Thailand, Turkey, Vietnam	Algeria, Armenia, Belarus, Belize, Bhutan, Cape Verde, El Salvador, Georgia, Grenada, <b>Iraq</b> , Jamaica, Jordan, Lebanon, <b>Libya</b> , Macedonia, Mauritius, Moldova, Montenegro, Morocco, Samoa, Suriname, Tonga, Tunisia, <b>Venezuela</b>

Notes: Only countries classified by the World Bank as low- and middle-income are included here. Navy boldface indicates low capacity states. This includes those that fall within the bottom quartile of the distribution on the Government Effectiveness Index of the World Bank's Governance Indicators and reflects high levels of corruption, public sector mismanagement, and societal fractionalisation. High and low for the other two dimensions is based on those countries that fall above or below the average of the data distribution.

Sources: DALYs per 100,000 – Global Burden of Disease (<http://www.healthdata.org/gbd>); Climate Risk Index – German Watch (<https://www.germanwatch.org/en/16046>); Capacity metrics – World Bank World Governance Indicators (<https://databank.worldbank.org/data/source/worldwide-governance-indicators#>). All data are for 2017.

**Table 8.1: Illustration of political and technical considerations associated with interventions supporting improved intake of vitamins and minerals in LMICs**

	High costs relative to benefits for the poor	High benefits to the poor relative to costs
<b>Political viability</b> high relative to technical feasibility	Consumer price subsidy on staple food items in ration shops in rural as well as urban areas.	Conditional electronic cash transfers to low-income mothers with infants, requiring regular health checks and spending on nutrient-rich foods.
<b>Technical feasibility</b> high relative to political viability	Establish from scratch a new nationally driven programme of agricultural research and development (R&D) (over decades) on biofortification of staple grains consumed by poorest households.	Multiple micronutrient supplements distributed to low-income pregnant women via existing clinics.

Source: created by authors

Each country must formulate its own approach and determine a locally appropriate transition pathway. The technical or political feasibility, and the need versus cost, of each of these recommended actions will vary depending on context. Table 8.1 illustrates how various interventions for improving intake of micronutrients by the poor in LMICs may carry different political, technical, and cost-benefit implications depending on the setting (these are in hypothetical quadrants not based on empirical realities and are merely illustrative). It is important when selecting a policy or intervention to understand (in this hypothetical case), the local extent of nutrient deficiencies, relative food prices on the market, availability of staples relative to nutrient-rich perishables, the degree of commercial engagement in industrial fortification of food products, and political interest in spending to bolster the food intake of poor families via government subsidies, and safety nets.

Just as governments have to weigh up political and economic realities when crafting food system policies, they should also take into account how national domestic policies and business strategies relating to food systems are circumscribed by, and interact with, those of the global community. Food systems do not begin and end at the border, just as planetary challenges such as climate change, access to fresh water, and air pollution do not have domestic solutions alone.

To promote mutually beneficial actions across nations, three important commitments have to be made.

- First, all governments should engage politically with the collective global agendas which set goals based on the best available science (such as the climate change targets).

- Second, governments should facilitate local dialogues which engage stakeholders on the implications of the latest science to define a national vision for a transition toward a transformed food system.
- Third, every policy and investment decision taken at the government or commercial level should be focused on ‘gain multipliers’; that is, on actions that can have multiple beneficial outcomes combined, or at least do no harm to related sectors of activity where gains are more narrowly focused on just one domain.

Where necessary, new analytical capacity must be established as a government and/or donor agency priority to support credible evidence of options and the cost-effectiveness of alternative approaches to facilitate a transition process. These commitments are explored in this chapter.

## 8.2 Collective global agendas

There are several international initiatives already underway which address separate parts of the food system transformation agenda. These include initiatives focused, mostly separately, on climate, nutrition, and diet. They need to be aligned in ways that ensure each separate agenda is mutually supportive of the others. Positive impacts on climate change (mainly via reduced emissions) and other aspects of sustainability such as biodiversity have to come from the supply side (how food is sourced) and the demand side (what food is eaten)<sup>324</sup> (see Table 8.2). In other words, a food system transition process has to encourage, guide, incentivise and

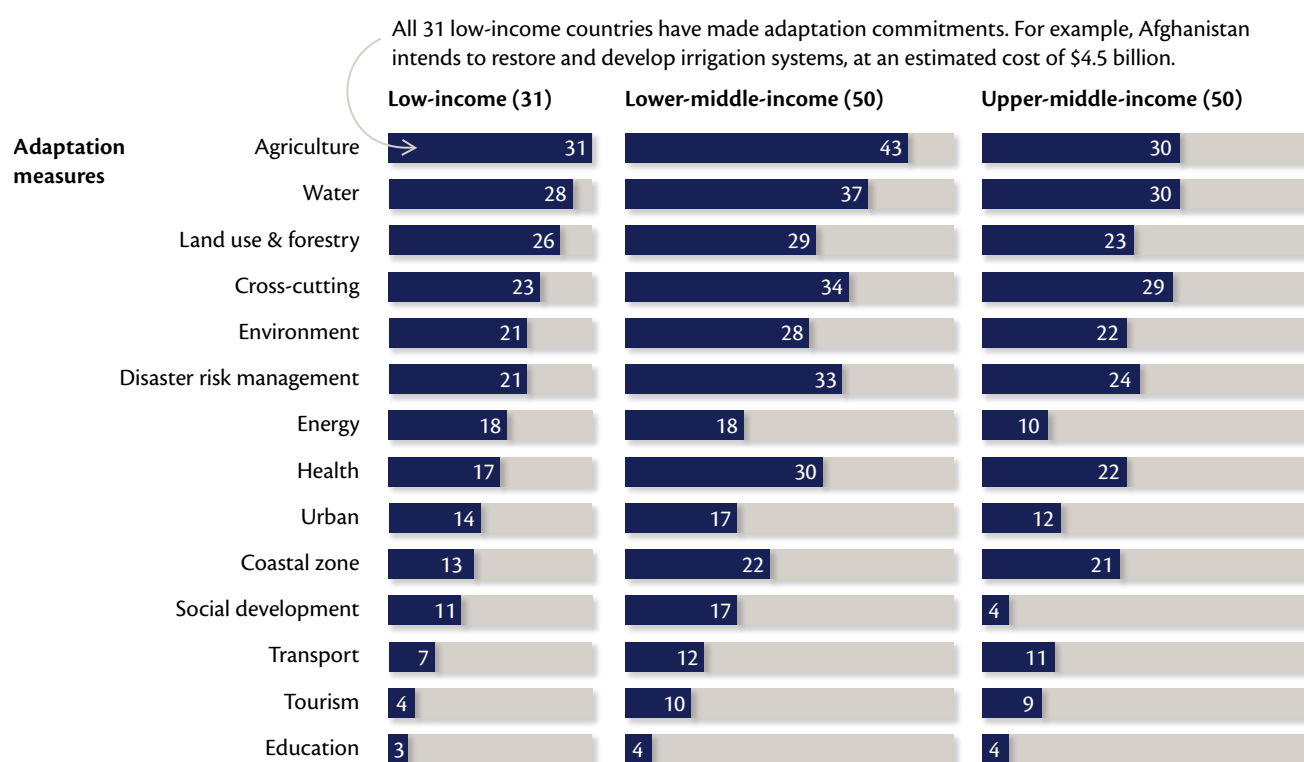
**Table 8.2: Food system supply-side and demand-side technical and economic mitigation potentials**

Mitigation potential	Supply side (GtCO <sub>2</sub> e yr <sup>-1</sup> )	Demand side (GtCO <sub>2</sub> e yr <sup>-1</sup> )
Technical	2.3–9.6	0.7–8.0
Economic	1.5–4.0 <sup>a</sup>	1.8–3.4 <sup>b</sup>

<sup>a</sup> By 2030 at prices ranging from 20–100 USD per tCO<sub>2</sub>e. <sup>b</sup> By 2050 at prices ranging from 20–100 USD per tCO<sub>2</sub>e.

Source: Rosenzweig et al. (2020)<sup>324</sup>

**Figure 8.1: Climate change adaption commitments**



Source: World Bank 2018<sup>341</sup>

reward both dimensions of sustainability and of healthy diets, and this requires all the actions proposed in Chapters 4-7.

### The Paris Agreement on climate change

In view of the diverse challenges associated with climate change, all 31 low-income countries that signed up to the Paris Agreement on climate change (and 43 of 50 lower-middle income countries) made commitments to invest in agriculture adaptation to mitigate the expected impacts of climate shocks and resource degradation in the coming decades (see Figure 8.1).<sup>341</sup> For example, Afghanistan committed to spend US\$4.5 billion on restoring war-damaged irrigation systems and to develop new ones to protect crop production. Such measures are very important and should be amplified globally.

That said, the Paris Agreement commitments share a problem with the Sustainable Development Goals (SDGs) in that the promotion of healthy diets and the sustainability of food systems are not explicitly mentioned. The Paris Agreement commitments are approached largely sector by sector,<sup>486</sup> and the SDGs are approached goal by goal. Also, there is limited attention given to how actions in one area need to be integrated with actions in others. Concerted efforts between different goals or commitments are essential to achieve the desired dietary patterns required to deliver equity, health, and planetary outcomes.

### The International Panel on Climate Change (IPCC)

This independent scientific body was established in 1988 and has 195 Member Countries today. It was created to provide policymakers with scientific assessments relating to climate change, its implications for planetary systems and human well-being, as well as options for adaptation and mitigation.

The Intergovernmental Panel on Climate Change (IPCC) has played a critically important role in influencing the policy agenda, while also informing public sentiment and understanding of the issues. The 2019 report on Climate Change and Land was its first to address explicitly, and in a structured way, the implications of climate change on key issues relating to food systems, including land degradation, sustainable land management, desertification, and greenhouse gas emissions relating to terrestrial activity, including agriculture.<sup>10</sup> However, while some of the implications were explored in terms of aggregate food security, limited attention was given to the feedback loops linking terrestrial economic activity, climate change, diets and health. This represents a critically important analytical and policy gap which needs to be addressed without delay.

### The Decade of Action (2016-2025).

This is co-led by the World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO), and was endorsed by the General Assembly in April 2016. It calls specifically for “sustainable, resilient food systems for healthy diets”. It seeks alignment among actors and actions around the world to accelerate implementation of commitments “in line with the transformative ambitions” of the Sustainable Development Goals, including the nutrition targets established by the World Health Assembly (WHA).<sup>460</sup> The onus for action is on national governments and institutions, and many nations have made new commitments accordingly. For example, Brazil has set itself the goal of reducing obesity while promoting “sustainable production of and access to nutritious and diverse food” and other countries made pledges in 2017 to dedicate domestic funding to the Decade’s agenda, including Côte d’Ivoire, El Salvador, India, Madagascar, Niger, Nigeria, and



“During COVID-19, the bureaucratic, financial, logistical and technological reasons that always seemed to make actions impossible or improbable have fallen away.”

Hawkes (2020)<sup>464</sup>

Zambia.<sup>461</sup> However, by 2018, a set of resource-constrained countries (Ecuador, Guinea, Samoa, Senegal and Tunisia) drafted a formal resolution to express concern that the world was still not on track to eradicate hunger and malnutrition by 2030, and called for additional efforts “to support the transformational change needed”.<sup>462</sup>

Concerns about slow progress towards sustainable diet and nutrition targets are widespread and growing. Despite Herculean efforts by many individual advocates, organisations and some nations, the Decade of Action on Nutrition has reached its mid-way point and there is limited evidence of sustained efforts at global scale to enact the transformative change needed to achieve goals set for 2025 or even for 2030. This is of particular concern since any delays will make the task ever harder in the remaining time available. What is more, it has been argued that “despite the central role of food consumption and production as a major driver in the climate and biodiversity crises, food has so far not been considered central to global policy agendas such as the Paris Agreement, SDGs, or Convention on Biological Diversity”.<sup>436</sup> This lack of attention to food systems and diets in current global agendas represents a major oversight, and a continuing hurdle to much-needed progress.

### 8.2.1 Opportunities for coordinated global action

The UN Secretary General rightly observed in 2019 that commitments and pledges to improve nutrition by governments “are not enough to catalyse change and accelerate progress”.<sup>463</sup> He therefore called on all Member States to “explore the ways in which they can incentivise the evidence-based refinement of their own local diets and national food-based dietary guidelines that promote nutritious, affordable, safe and healthy diets within the bounds of planetary resource availability”.

The UN Secretary General also argued that nations must significantly increase investments “in the areas in which progress has been slow” and seek “greater coordination and collaboration by actors at all levels – from global to local”.<sup>463</sup> This speaks to the current problem that the important international agendas relating to climate, natural resources, food, diets and nutrition are still poorly integrated, with only limited vision of how they need to interface to generate mutually beneficial outcomes for all. That said, at a global level, there are several key events and potentially related actions where these issues are set to be urgently considered.

The first is the **Nutrition for Growth (N4G) Summit** to be held in Tokyo at the end of 2021. The first pledging conference for improved nutrition was hosted alongside the Olympic Games in London in 2013.<sup>465</sup> That meeting involved commitments by national governments, donor agencies and companies. It generated US\$4.15 billion pledged by donors alone for targeted nutrition-specific programmes as well as US\$19 billion for nutrition-sensitive programmes. It also established two significant global activities: the Global Nutrition Report (GNR), which provides regular updates on progress and on the actual disbursement of pledged resources, and the Global Panel on Agriculture and Food Systems for Nutrition which offers evidence-based policy guidance for governments in LMICs, and which has produced this report.<sup>29,466</sup>

The next N4G Summit, hosted by the Government of Japan, will take place with less than a decade to run to achieve all SDG targets. This represents an opportunity to go far beyond ‘another pledging meeting’ (which is needed to accelerate progress on malnutrition in all its forms), to promote far-reaching and long-lasting systemic change through a food system lens. In addition to the usual focus on targets and fiscal resources, there needs to be a set of commitments to more fundamental change upstream from nutrition outcomes, centred on new national policies, company investment strategies and consumer advocacy agendas. The common goal must be a clearer focus on how to deliver sustainable, healthy diets for all.

The second global event is the world’s first **United Nations (UN) Food Systems Summit**. That the United Nations Secretary General has called for this Summit represents clear acknowledgement of the importance of a food systems lens to policymaking aimed at supporting human and planetary well-being. The stated aim of the Summit is to generate momentum to help countries and all stakeholders “unleash the benefits of food systems for all people”.<sup>467</sup> The main challenge for this event under UN the imprimatur is for it to be game-changing. Conventional new pledges will not suffice. Instead, a clear path forward is urgently needed for all nations. Preparations for all necessary agreements to be made at the Summit need to start immediately. In particular, these need to include agreement on

1. the immediate (10-year) actions required by all to take the world through a period of transition towards the transformative change desired, and
2. concrete measures to improve the science and evidence needed to support aggressive policy and investment pathways. In respect of the latter point, the Summit needs to agree: the organisational structures that should be established and charged with delivery of the improvements, necessary funding and governance, and also the intergovernmental backing that will be essential to ensure the resulting science and evidence are acted upon.

Looking beyond the forthcoming international events, there need to be substantial improvements in the ways in which science and evidence support the transition of food systems. These improvements have two distinct dimensions:

**Step 1: Evidence for policy change.** An essential first action is to quickly distil the most current science and modelling relevant to

## “Transition is often challenging rather due to the process of change rather than the object of change.”

Kuokkanen et al. (2017)<sup>469</sup>

a better understanding of the dynamic feedback loops discussed in Chapter 3 (the loops connecting the functions of biological, climatic, and economic systems). The goal is to identify:

1. priority actions which are still not being pursued despite clear and compelling evidence of need but also feasibility and
2. gaps in knowledge that represent urgent priorities for future policy-relevant research.

Both forms of information must be made available to the UN Food Systems Summit stakeholders to frame discussions and commitments. The current and future role of dietary patterns on human and planetary health are both important. Considerably more needs to be understood from a scientific standpoint: what is occurring, what options exist for change, what are the costs and benefits from multiple perspectives? Equally, much more needs to be agreed as a way of developing the broad consensus required to allow for common, cross-national visions of transition pathways.

There is already high-quality research which informs policy development on pathways toward the mitigation of climate change. However, there is considerable potential for the research community to do much better in support of policymakers facing difficult decisions at the intersection of human and planetary health.<sup>468</sup>

**Step 2: Governments and their development partners, the UN and other international organisations should work together without delay to improve and build on existing mechanisms to support science and policy engagement with sustainable food systems transformation.** Effective transition towards a different kind of food system will require decisive leadership, building on existing institutional mandates, supported by robust, broadly accepted evidence, coupled with transparent public dialogues on important issues relating to the policy levers used, costs (borne by whom) versus benefits (for whom), synergies and trade-offs. The key question beyond an agreed global agenda is how to transition towards a common future at the national level. Coordination frameworks will be needed at this level to champion policy formulation, resource mobilisation and coordination of strategy implementation.

## “An approach which prioritises a whole-of-food-system transformation, works to ensure food systems are not only productive in terms of the amount of food they deliver, but they also bring about qualitative improvements across multiple dimensions of the entire system.”

High Level Panel of Experts on Food Security and Nutrition (2020)<sup>325</sup>

In the context of delivering Steps 1 and 2, the Global Panel notes that the idea for a creation of an IPCC-like organisation for sustainable food systems (an ‘International Panel for Sustainable Food Systems’, or IPSFS) has been mooted in recent years. This is one of a number of ideas that could be considered to deliver the necessary improvements.

## 8.3 Visions of the future

In defining what nations should aspire to in the longer term (the food systems transformation agenda), policymakers and food industry stakeholders must keep a clearly articulated set of goals in sight. Four important features should define fully transformed food systems locally and globally:

1. **Shifts in dietary patterns would be achieved by empowering and encouraging people to access healthy diets which are sustainably produced.** It is not enough to make sustainable, healthy diets available and affordable. People must want them. The goal is not a single universal diet for everyone, but dietary patterns which encapsulate cultural traits and entail a marked shift towards enhanced and informed choices favouring nutrient-rich foods produced sustainably.
2. **Food systems would be better aligned to support sustainable, healthy diets.** Major reform is needed, from production through to retail. This will create major challenges, not least around affordability of the improved diets, ensuring a ‘just transition’ (recognising that change always results in winners and losers), and ensuring that the poor are protected during the transition and beyond.
3. **Food system impacts on climate, natural resource depletion and biodiversity loss would be significantly reduced.** This means that they would operate within the boundaries of the planet and its environmental resources. This goes far beyond sustainability in agriculture; it extends to rural livelihoods based on farming, the marketing and trade of food, its processing and packaging, wholesale and retail, and demand.
4. **The resilience of food systems to external shocks of all kinds would be significantly strengthened.** The coronavirus pandemic has highlighted how a single zoonotic disease can have ripple effects across the entire global food system. The ability of producers, traders, food processors, retailers, and consumers to manage all kinds of shocks must be enhanced.



“ We still have some way to go before diets can become healthier and more sustainable worldwide. ”

Editorial comment, *British Medical Journal* (2020).<sup>470</sup>

While this vision is ambitious, it is not unrealistic. But it is not yet shared. Work has to be done to engage across and within nations to determine what is working well today (which elements of current food systems do not need to be changed), and what cannot be left as it is. The ways forward will be many and varied and cannot be prescribed. However, certain broad principles and approaches can be drawn on in negotiating the challenges of the transition process. A number of these formed the basis for scenarios which informed the project and can be found at the end of this chapter, in Section 8.7).

## 8.4 Why has action to transform food systems been so limited?

Part of the answer to this question relates to competing visions which determine the overall direction of national policies and investments. Without a national and local understanding of why current systems must be changed, and what characterises transformed food systems, it is almost impossible for policymakers or corporate leaders to take first steps as part of the transition process.

Given the size and diversity of benefits that could accrue from a successful transition process, the limited actions taken in recent years represents a wasted opportunity. It is important to ask why it has proved difficult for policymakers to make the necessary shifts in policies, companies to shift their approach to food product development and retail, and individuals to shift their dietary choices. Three major challenges are inhibiting progress:

1. The complexity of food and environmental systems in a context where policy actions on food, health, agriculture, and climate are generally managed separately;

2. Competing priorities for:

- governments who have to make difficult policy choices,
- private companies making investment choices on product portfolios or retail strategies,
- households making food-purchase choices;

3. Uncertainty about and mistrust in scientific evidence, sometimes exacerbated by political polarisation.

In view of the complexities of the transition of food systems, it is unsurprising that many policymakers find it difficult to decide where best to focus, which policies to develop, and what actions to prioritise. This Foresight report aims to distil this complexity into straightforward advice on how to manage the necessary transition. But first, the relevant actors have to commit to take the first important steps, focus the transition on pathways towards the ultimate goal, and engage with the trade-offs that will be inevitable *en route*.

### 8.4.1 Constraints, challenges, and trade-offs

If the end point of food system transformation is clear, how to manage the transition from the current *status quo* is much less so. To date, this transition has received scant attention by researchers, yet it is the arguably the most pressing issue for policymakers in LMICs, not least since they are faced with a plethora of challenges.

LMIC government actions are constrained by relatively low levels of investment and finance. For many, food needs are rapidly growing. But at the same time, food production in many of these countries (particularly towards the equator) is increasingly threatened by climate change. Rapid urbanisation is also transforming lifestyles and eating habits. Against this background of multiple constraints and challenges, the transition



to sustainable, healthy diets for everyone will require change throughout food systems. For example, it will require profound shifts in production patterns, innovation in value chains, and shifts in demand, so that people are informed and empowered to make better dietary choices. It is also likely to require change in wider areas of policy such as infrastructure development, a move to sustainable energy sources, and more.

For example, tree nuts are products with a large water footprint. They are water-intensive per unit of mass produced and per unit of protein generated. According to one recent modelling study, almost two-thirds of irrigated nuts are produced in countries facing 'severe water stress', including India, China, Pakistan, and parts of the Middle East. Water stress is monitored as part of Sustainable Development Goal 6 (indicator 6.4.2)<sup>471</sup> which reinforces the need for policymakers in LMICs to determine appropriate approaches to securing adequate quantities of a nutrient-dense foods (be it nuts or fruits or legumes) in environmentally sustainable ways.<sup>472</sup>

An important challenge for policymakers in transforming food systems is the inevitable trade-offs which need to be negotiated when allocating resources and prioritising where to focus attention. Negotiating a way past policy pinch-points is a day-to-day reality for all decision makers, particularly in LMICs where resources are severely constrained. The following examples illustrate just some of the difficult dilemmas to be faced:

- **How to allocate scarce resources between addressing the different forms of malnutrition (undernutrition, micronutrient deficiencies, or overweight and obesity) which may affect a population simultaneously.** Each of these has a different profile in terms of who is affected (by age, gender, religion and socio-economic group) and their different impacts on health and healthcare budgets, their differing consequences for physical and mental development through life, and their impact on peoples' productivity and earning potential as adults.
- **How to strike a balance between investing in agriculture versus other jobs in rural communities.** To what extent should inward investment in the food system be allowed or encouraged, at the risk of the investing country exploiting local environmental resources, and possibly repatriating highly nutrient-rich foods? To what extent should countries promote greater in-country food output and self-sufficiency, versus increased trade in food commodities which might support national-level food security and diversity in the food supply?
- **How to address potentially competing policy imperatives.** There will be hugely significant policy trade-offs between, for example, agriculture policies focused on 'cheap staples' and policies aimed at supporting higher intake of nutrient-rich foods; agricultural exports for foreign exchange versus domestic goals; fiscal policies that facilitate the profitability of food companies versus the affordability of healthy diets for citizens; productivity goals in agriculture

versus efficiency targets for sustainability; and a vision for human and planetary health versus a vision of increased aggregate economic growth.

- **How to balance priorities between avoiding coronavirus-led debt default in the short-term and investing in steps required for longer-term food system transition.** This is important if countries are to achieve the health and economic benefits associated with more sustainable, healthier diets for all.

There is no easy or straightforward way of resolving these trade-offs. Much will depend on diverse factors such as local circumstances, resource constraints, and political choices. It is a reality that an effective food system transition requires a more pronounced role for governments in precisely those countries where the institutional and resource capacities to fulfil such roles are limited. In addition to traditional oversight of fertiliser, seed, land and trade policies, there is a greater need now for government attention to industrial, labour, environmental, and food safety policies as supply chains lengthen and the business landscape becomes more crowded. However broad principles to guide decision making can be identified (see Box 8.3).

## 8.5 Addressing systemic policy distortions

Today's food systems operate against a background of multiple policy distortions. These have a strong influence on the foods that are delivered, their price and accessibility and, in particular, in encouraging the supply, demand and consumption of foods which may be less conducive to healthy diets and to sustainability in food systems. Unaddressed, these systemic distortions will act to maintain the *status quo*, and will make it much more difficult to bring about the required transition.

### Box 8.3: A checklist for analysing trade-offs

- Be clear about the 'ground rules' for assessing the trade-offs. This is about clear definition (and agreement) of objectives, and what is important and what is less so.
- Map out existing policies and how they affect a given trade-off.
- Understand the costs/benefits and who pays/benefits from various strategies; the types of benefits; timescales for investment and 'payback'.
- When considering externalities, it is generally best for costs to be incurred close to where they occur.
- Focus on the future and not just the current situation. Foster collective decisions (important where other areas of policy are potentially involved).
- 'Get prices right'. This is particularly important as most poor people around the world are already unable to access minimally adequate diets just in terms of calories and micronutrients.

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## “ Systematic bundling of different policy measures can help to mitigate the potential trade-off between political feasibility and problem-solving effectiveness. ”

Fesenfeld et al. (2020)<sup>380</sup>

However, addressing these policy distortions is within the gift of policymakers. Important distortions requiring action include the following:

- 1. Emphasis on production, at the expense of the wider food system.** Agriculture will clearly remain vital. However, a new conceptual framing needs to be adopted by policymakers which recognises that all parts of food systems need to work together as a whole if they are to deliver diets that are high quality and sustainable. This policy approach was highlighted in the Global Panel's 2016 Foresight report and is gaining traction, but much remains to be done.
- 2. A historic bias in favour of producing staples.** As explained in Chapter 2, diets in LMICs are typically based on just a few foods, with a heavy reliance on cereals or starchy roots and tubers. Staple foods will remain as core components of diets for millions of people, but the balance needs to shift towards diversity.
- 3. Agriculture sector subsidies.** A high proportion of these are used to support the supply of staple grains. As supply-side subsidies account for an estimated US\$620 billion per year,<sup>473</sup> a relatively small shift in allocation towards nutrient-rich foods could be valuable in developing crop varieties which are more robust to environmental extremes, less perishable, and more affordable through lower cost.
- 4. Research biases.** These also tend to target staples. More generally, research is also biased to agriculture and food production, rather than all parts of the food system.
- 5. Environmental externalities.** Many aspects of food production and food systems more generally benefit directly and/or indirectly from diverse environmental externalities which are not reflected in the price of foods. Examples include the generation of greenhouse gases, depletion of aquifers, pollution, and biodiversity loss due to deforestation and land-use changes in favour of food.
- 6. Do no harm.** It should be recognised that very large numbers of producers, traders, retailers, and purchasers of food are poor (in income terms) but also vulnerable (in terms of nutrition and health risks). Ensure that any transition process involving a resource as critical to their well-being (taking up more than 50% of total spending) as food is carefully calibrated and monitored with a view to protecting those potentially most at risk of harm.
- 3. Invest in strengthening institutions and capacity building.** Evidence-based policy decisions will be critical to managing an effective transition process: one that leaves no-one behind, does not harm what is working well in today's food systems; and optimises efficiency and other gains to ensure that economic returns on investment reinforce government and food industry commitments to necessary long-term change.
- 4. Be transparent in decisions on how, where, and when to act.**
  - Challenge the seemingly impossible.
  - Identify early opportunities for success.
  - Avoid closing off options for the future. Strategies and implementation plans must be flexible.
  - Perform systematic analyses of trade-off options.
  - Consider leveraging other actors – notably by empowering the citizens to drive change through the choices they make.
- 5. Implement change based on evidence and transparent expectations.**
  - Ensure the various parties (actors in the public sector and across the commercial landscape) are all committed to a common plan from the outset, with clear ownership of goals and milestones.
  - Explicitly mitigate risks for different stages of implementation. This includes adopting a 'do no harm' principle.

## 8.6 Priorities for managing the transition

The following should guide policymakers as they implement the various actions laid out in Part II of this report, to change though transition how food systems function:

- 1. Seek multiple benefits or 'wins' across all policy and investment decisions.** Pursue what is feasible, be bold, and

- 7. Implement bundles of measures that promote pathways toward multiple wins.** This is preferable to one-at-a time actions that only tackle individual problems in silos. Coherent multi-sectoral policy strategies will call for system-wide actions rather than small changes in the margins.

## 8.7 Managing the costs of transition

From a food systems perspective, the costs of change will manifest in one or more (most likely all) domains of the system from production, through to trade, food processing, retail, and consumption. The distribution and impacts of these costs need to be identified, understood, and managed effectively.

### 8.7.1 Food production (making more nutrient-rich foods available sustainably)

Cost structures (inputs, labour, output prices) will shift as policy actions move to realign current support systems, including for example a repurposing of long standing, macro-level subsidies for agriculture (commodities, services) from staple cereals towards cost-neutral investments in the sustainable production of nutrient-rich foods (see Chapter 4). Additionally, new technologies, practice innovations and a reorientation of patterns of food demand will all serve to reshape the costs of doing business in food production. Changing cost structures will affect different scales and types of food production entities differently, with various price effects on products being promoted more than in the past, including fruits and vegetables, dairy products, nuts and seeds, pulses, and fish. Traditional grain-centric producers and trade companies could see some costs rise and demand moderate or fall. Obviously, some nations will have greater flexibility to adjust quickly to shifting incentives around production and relative changes in commodity prices.

### 8.7.2 Markets (making sustainable, healthy diets accessible to more people)

Domestic trade costs should decline in line with required investments in infrastructure which better links producers and markets. Increasing the role of international trade in meeting national dietary goals should enhance the use of foreign exchange to support appropriate levels of import of nutrient-rich foods. New technologies will offer higher food income streams linked to reduced perishability of nutrient-rich foods (storage innovations), farm-to-fork delivery apps and urban-based, next-generation production systems (for example hydroponics and other soil-free cultivation, insect-breeding for protein).

### 8.7.3 Food processing, wholesale, and retail (making sustainable, nutrient-rich products accessible and desirable)

Some of the more significant changes from business-as-usual will need to take place where foods are transformed (processed and packaged) and sold (wholesale and retail). The promotion of a range of formerly much higher-value perishable products that require careful handling, minimal processing, and nutrient-retention will pose risks to profitability for SMEs which have hitherto invested in producing products that focus on low costs but provide limited nutrients.



There will be greater costs associated with the marketing of certain nutrient-rich foods in higher demand, requiring food companies to invest in new technologies, new storage and retail locations, and new ways of presenting products. At the same time, the benefits of food system innovation will offer growth potential across a sector which has for too long focused on lowest-price and cost-containment models.

### 8.7.4 Consumption (making sustainable, healthy diets affordable and desirable)

Current food systems around the world were established to deliver high quantity (mainly calories) at relatively low cost. The outcome is a skewed system which has reduced the threat of famine globally, and which feeds more people today than ever before. However, as already discussed, food systems also deliver diets which are having significant negative impacts on human health, the climate, and other aspects of the environment in diverse ways. Shifting production, prices and the promotion of high-quality diets globally will likely increase the cost of diets for many.<sup>474</sup> As the relative price and availability of foods shifts in line with transition steps, the overall price tag associated with healthy diets will likely rise in many contexts. That reality must be well understood and managed by rebalancing relative prices, increasing incomes and the purchasing power of the poor, and bolstering social protection programmes in ways that also support the affordability of healthy diets, as discussed in Chapter 6.

As of today, governments need to do much more to ensure at least minimal food intake for nutritionally vulnerable people. Improved targeting of income support, education, economic policies to tackle income inequality, access to food markets, relative prices of food to non-food essentials – all of these must be tackled by governments willing to take responsibility for the welfare of their citizens.

Also, to embark on the set of actions needed to achieve the Sustainable Development Goals, all nations will have to go much further to protect the poorest people during the transition from a poorly functioning food system which leaves billions behind, to a system that is resilient, environmentally sustainable and



provides healthy diets for everyone. The important message here is that the costs and benefits are predictable. The transition steps will need to be explicit, transparent, and honest about this.

The next and final chapter of this report sets out recommended steps to be taken by governments, business, and individuals. The recommendations represent evidence-based transition steps into a new transformed future for food systems.

## 8.8 Scenarios and policy development in an uncertain world

The world is changing fast from many different outlooks: social, economic, technical, and environmental.<sup>70</sup> The planet's population is still growing rapidly, with more people who are mobile, connected, and less poor. Yet there is also greater and, in some cases, growing inequality between the wealthy and the poor, and a massive draw-down of natural resources (e.g. food, water, energy, soil). At the same time, we are closer to the 'planetary boundaries'<sup>69</sup> beyond which planetary processes may degrade even faster. Climate change is having noticeable effects as extreme weather becomes more common, impacting people through floods and droughts, affecting food supply and market infrastructure.

At the start of the 21st century's first decade, the future looked very different from today. International rule-based cooperation had led to unprecedented stability and global integration, such that there was discussion of the potential of a post-nation state world.<sup>475,476</sup> However, growing radicalism, the threat of terrorism, and a growing inward-looking nationalism, partly driven by inequality growth and immigration, have now led to a very different world. We are radically diverging from the Bretton Woods-based international architecture of inter-governmental cooperation which has underpinned globalisation for decades. These changes are increasingly challenging from environmental and geopolitical outlooks.

Within this 'changing and challenging world' context, some issues are becoming both more urgent (as the time available to drive positive change diminishes) and more significant (as the scale of the challenges grows). These factors set the context for the future of food systems in the decades ahead. Rare but high-impact events – unexpected and perhaps unprecedented – lead to rapid and often long-lasting transformative impacts. The coronavirus pandemic may be one such event; it has distorted the functioning of national economies and social dynamics in ways unprecedented since World War Two.

Global systems are non-linear and complex. Some examples of substantial projects and actions that have yielded (or which have the potential to yield) multiple benefits or 'multi-wins' are presented at the end of Chapters 4–6 of this report. Although the empirical evidence for cost-effective politically viable 'multi-wins' is generally sparse, the evidence of initiatives at all levels

of society aimed at pursuing pathways that are supportive of diets which are both healthy and sustainable is growing. They range from local government initiatives and advocacy agendas, to international agreements and a proliferation of commercial activities (see Box 8.4).

Pathways towards multiple-win strategies and best practices are being studied, and policymakers are increasingly aware of the need to engage not just in food supply agendas, but to meet growing demand for sustainable, healthy diets across all segments of society. From the perspective of governments, some actions would be cost-neutral, but are necessary to catalyse transformative change. Examples include: rebalancing subsidies to better support a wide range of nutrient-rich foods; increasing both the quantity and quality of food-related research and development to protect past gains on cereal productivity; enhancing past gains related to climate-smart needs (for example drought and heat tolerance, pest-resistance); applying equal attention and resources to all non-cereal foods, and enhancing understanding of the economic and policy drivers of sustainability, efficiency, and shifting patterns of dietary demand.

It bears repeating that sustaining output and productivity of staple grains and tubers remains a global priority. In many LMICs, 'zero hunger' agendas remain critically important. But all countries will see falling numbers of absolute poor and undernourished people in the coming decades, and fundamental shifts in dietary demand linked with population growth and poverty reduction are already in underway.

Shifting thinking and practices to be forward-facing is central to a 'just transition' which supports income growth across the whole system, but especially for the poor. The transition must be carefully managed, calibrated, monitored, and financed, with care to do no harm to the world's already most vulnerable people.

### Box 8.4: Initiatives that can support the goal of sustainable, healthy diets

There are many possible innovations and initiatives across food systems which can simultaneously support both objectives. For example:

- New approaches to marketing direct from farmer to buyers to minimise loss of perishables and enhance production returns.
- Growing numbers of technology applications aimed at confined spaces and reduced inputs (particularly water and heat) for urban production of nutrient-rich foods.
- Market information systems and innovations in processing technologies, packaging materials, shelf-life extension combined with food loss/waste reduction.
- Food processing businesses for new markets and consumer-direct services, many of which are SMEs which have grown rapidly across LMICs.
- Full and partial-service restaurants expanding healthy choices and serving as ambassadors for climate- and healthy diet-agendas.

### 8.8.1 Plausible scenarios: strategies under uncertainty

The world's food systems are changing rapidly, but they are also increasingly fragile and at risk from shocks related to the climate crisis, resource degradation, pandemics or financial and humanitarian crises. The challenge for policymakers is to develop policies for a future that is far from predictable. This unpredictability is summed up with the TUNA acronym: Turbulent, Uncertain, Novel, Ambiguous.<sup>477</sup> The future is turbulent because of its fragility and non-linearity, meaning that events can lead to escalating and potentially unmanageable impacts;<sup>175</sup> uncertain because these are often highly unpredictable; novel because technological, social and environmental changes create unprecedented situations; and ambiguous because of incomplete and contradictory requirements. Scenarios provide important insights<sup>478</sup> when past trends cannot be extrapolated into the future with confidence. Each scenario is therefore constructed as its own plausible future, and is typically based on a set of assumptions concerning which drivers of change are likely to be important, and how they might develop. Consideration of individual scenarios can help to assess the effectiveness of specific policies and actions. The usefulness of scenarios is enhanced when several contrasting scenarios are produced and compared in the context of specific policies.

There are a number of ready-made scenarios about the future of food systems which can help policymakers think more strategically about the future of food systems (for example <https://www.foresight4food.net/>) For this report, the Global Panel organised a workshop to discuss a set of four contrasting scenarios presented in Box 8.5.

#### Choosing Foresight scenarios

While scenarios take many forms, a common approach is to frame them around two intersecting drivers of change which are likely to exert a particularly strong influence on future outcomes, but about which there is uncertainty. The two drivers define two axes, with four scenarios determined by the resulting four quadrants, as illustrated in Figure 8.2. For the Foresight 2.0 scenarios, the two drivers chosen were: environmental risks and the nature of economic growth. These were elaborated as follows:

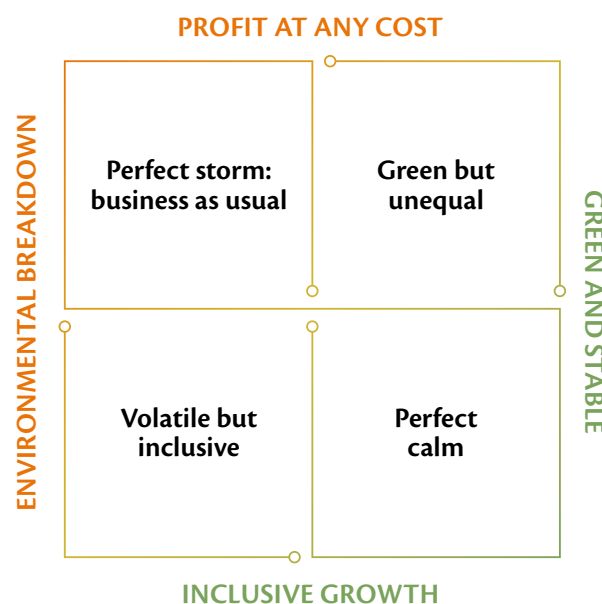
1. **Environmental risks.** In line with the environmental perspectives taken in this report, the risks considered related to climate change, and also the many forms of natural resource degradation that affect the planet's environmental services, and therefore the ability of food systems to function effectively and efficiently. Future



uncertainty was captured in the workshop through discussions relating to questions such as: how severely will agriculture be affected by volatile weather patterns as the climate changes? What will be the future quality of soils? How might biodiversity loss develop? What might be future water quality and availability? Workshop participants used questions like these to discuss possible impacts on crop yields, livestock productivity and food production more generally. The impacts of environmental risks on trade were also considered, given that local food systems interact with international commodity markets and food price signals. Broader social effects were also discussed.

2. **Inclusive versus exclusive growth.** This axis represents a purely profit-driven scenario at one extreme, where economic gain is the only measure of growth and income inequality increases. The other extreme represents an inclusive conception of growth, taking into account many factors other than profit, such as shared prosperity and reduced inequality. At this end of this axis, there is a world with influential civil society organisations, strong social safety nets, highly developed corporate social responsibility, fair employment, pro-poor policies, and a general consensus around the need for green, people-centred and equitable growth.

**Figure 8.2: Four plausible, alternative futures for food systems, based on axes concerning the extent to which growth is inclusive, and the health of the natural environment**



Source: created by authors

### Box 8.5: Outline of future food system scenarios

#### Scenario 1: Perfect storm, business as usual

It is 2040, and predictions made decades ago about the impacts of climate change have turned out to be correct. Average global temperatures have risen by more than two degrees. Sea levels are higher and extreme weather events – such as heatwaves, ‘super-typhoons’ and droughts – are regular occurrences, impacting more people with greater intensity.

Everyone is affected, but especially those living in low-lying continental lands and in small-island states. The biggest losers are smallholder farmers who struggle to cope with extreme and unpredictable weather, as well as the millions of people earning a living downstream in the food system who provide goods and services to those same smallholder households. This puts rural livelihoods under severe pressure, leading many smallholders to abandon farming altogether and migrate to urban areas. The outcome is a shift of most arable land into the hands of a few large-scale agricultural producers.

The lack of resilience of production means that yields, efficiency and profit are prioritised over sustainability and biodiversity, worsening the environmental degradation still further. The result is a shift to cash crops, produced on a vast scale for the world market. Monocropping provides economies of scale and higher profits, but more nutrient-rich crops such as tomatoes, beans, and leafy vegetables have

become riskier and more expensive to grow and buy. Price spikes are common, causing social unrest. Food is a globally traded commodity and a flashpoint for geopolitical tensions.

The unpredictability and volatility of global food production is mirrored in public health and nutrition outcomes. In the world of 2040, disease pandemics have become more frequent due to antimicrobial resistance, vector-borne diseases and cross-species transmission. The continued R&D, investment and subsidy concentration on commodity crops ensures that the world is calorie-rich but remains nutrition-poor. There is a wide and growing gulf between those who can afford healthy diets, and those who cannot, but these diets are unsustainable and contribute a growing share to resource degradation and climate change. Warnings about the double burden of undernutrition and obesity have proven accurate. Every country around the world is now grappling with some form of malnutrition and diet-related disease. In this profit-driven world, anyone can be left behind, and many are. There is little in the way of social safety nets, employment is less secure, and social mobility has slowed down.

#### Scenario 2: Volatile, but inclusive

As in the first scenario, global temperatures have risen and the world in 2040 is experiencing extreme weather events on a more regular basis. But now the prevalent economic model is one aimed at inclusive growth,



## Box 8.5 *continued*

encompassing many objectives other than profit. Growth is measured in broad terms, not just financially, and the goal of national policies is that no one be left behind. Climate costs, and other environmental risks, have increased. To cope with the dual burden of malnutrition, governments have acknowledged that old ways of working are untenable. Many countries have restructured their economies to ensure inclusivity and sustainability as policy priorities, as opposed to profit-taking by and for the better off. Smallholder farmers in LMICs are facing the brunt of erratic weather patterns, as they are the least resilient to droughts, floods, soil erosion and pests. More nutrient-rich crops are riskier to produce which means they have become more expensive, adversely affecting the diets of the wider population.

While opportunities to limit the extent of climate change were missed decades ago, this is also a world that believes in inclusive growth above anything else. This means that the worst impacts of climate change on the rural poor have been mitigated to some extent. For example, at the start of the 21st century, the problem of weak or non-existent land tenure had been recognised as a threat. Through land reform, the development of large-scale farming has worked in tandem with smallholder farmers, rather than simply displacing them. Smallholders have benefited from the provision of public extension services as well as private support when they work as contract suppliers to larger agricultural producers. Women farmers, in particular, have benefited from these changes and have been able to significantly increase their productivity and income earning potential.

### Scenario 3: Green, but unequal

In this scenario early action to tackle environmental breakdown leads to a world resembling today's, but one in which the climate crisis has been somewhat abated. At the same time, a rising GDP is still the top priority and the sole measure of growth, leading to more extreme inequality and a wide spectrum of sub-optimal health outcomes.

The environmental warnings issued in the early part of the 21st century have been heeded, so weather extremes have been somewhat muted. However, social objectives are largely irrelevant. Agriculture is focused on extracting the most value, but through relatively clean, hi-tech efficiency and economies of scale, with larger farms dominating the picture. We might think of it as a new Green Revolution, but genuinely green, rather than one that prioritises yields.

In 2020, certain Asian countries already had a growing presence in sub-Saharan Africa. This raised questions about how far foreign ownership of land and resources was desirable. In 2040, smallholders with weak or non-existent

land rights have been evicted or bought out with relative ease. Some still work as farm labourers for large foreign-owned producers, while others have migrated to cities.

Inequality manifests itself in extremes of wealth and poverty at a national level, but also globally, with a greater and rising gap between rich and poor countries. Poorer countries in 2020 saw agriculture as an engine of development, and expected over time to diversify their economies and move into services and value addition. Instead, today they are still largely producers of raw materials exported to HICs. They have a natural advantage as producers of rice or other staples, especially under the stable environmental conditions, but they are not capturing most of the value.

In poorer countries, power and wealth are concentrated narrowly at the top. Health and nutrition are also treated much more as commodities than as public goods. With less crop diversity, fewer people working in agriculture, and a weaker social safety net, it is more difficult for many to access a good diet. Local farming still exists, but small-scale farmers are excluded from the skills, inputs and technologies that large producers use. Those that grow leafy vegetables for the local market must sell at high prices. A good diet is still available, but only to those who can afford it, and overall, the nutritional outcomes are poor.

### Scenario 4: Perfect calm

This represents the most positive scenario. The effects of climate change have been mitigated, or even reversed, thanks to measures put in place long ago and natural resources are managed in optimal ways. Successful economic growth is measured in broad terms, not just financially, and no one is left behind. It was recognised that progress towards the SDG 2030 agenda had stalled, leading to a resurgence of effort to deal with many development problems. It was recognised that GDP-based growth, and 'trickle down' economic policies, underpinned the inequality which undermined progress towards the goals.

Significant actions were taken in the 2020s to achieve the objectives of the Paris Agreement. Global warming remains comfortably below the most extreme projections, and economic restructuring has also reduced inequality. There are farms of all sizes (including urban and peri-urban production). Some large farms do exist, but they grow a variety of crops. This is because there have been shifts in a range of factors which influence diets (subsidies, tax structure, public procurement, and health, agricultural, and trade policies) to facilitate adoption of healthy diets. Demand for fruit and vegetables has risen while the demand for processed grains has declined – partly because people eat fewer ultra-processed foods based on traditional commodity crops, and partly because, on average, livestock produce is eaten less, so demand for livestock feed globally has fallen.

### Box 8.5 *continued*

Agriculture is thus more geared towards diversity than it had been in 2020.

Smaller farms are economically viable. They have access to appropriate forms of financing, and invest in inputs and technology. Farmers have market information and infrastructure is in place, meaning they can respond to demand and access the market for their crops. Well-planned urban development means there is strong demand in cities for healthy, varied agricultural products. A diverse diet is both accessible and affordable. Fair trading terms are in place for overseas markets, providing reliable income earning opportunities.

Environmentally harmful production processes are a thing of the past. Agroecological farming systems are common, with many farms using 'closed loop' systems as much as possible to reduce the need for artificial fertilisers and pesticides. Economic, ecological and social factors are all measures of success and well-being in this scenario. Equality is particularly important. As a scenario it suggests the achievement of health and resilience through diversity in all sorts of different ways: a diversity of localised farming landscapes, environmental biodiversity, and social diversity with maximum opportunity for nutrition achieved through dietary diversity.

### 8.8.2 Making policy decisions today: lessons from these scenarios

Each of the four scenarios that were produced at the workshop is plausible; together they reveal the extent of the uncertainty facing global food systems over the next few decades. Also, since the scenarios workshop took place in 2019, the global challenge of the coronavirus pandemic has arisen, highlighting the urgency to strengthen resilience of food systems to future uncertainties. The key question for policymakers is: what do the four scenarios mean for decisions being taken today?

Certainly, the extent of climate change remains a critical uncertainty. But the above scenarios argue the need for policymakers to also consider carefully the type of growth that their respective countries should pursue. Gross Domestic Product has long been a measure of growth, but other measures have gained traction in recent years. Some leading economists consider GDP a poor indicator of progress, and have argued for a change to the way economic and social development is measured.<sup>479</sup>

In all the policy interventions described above, the issue of land ownership stands out because it is such a pervasive problem. Addressing it would enable other forms of progress. Small-scale farmers are a large demographic, responsible for the majority of food production in most LMICs, but in many countries the laws governing their land ownership are weak or unclear. The problem has been recognised, but more action will be needed. The UK's Foreign, Commonwealth and Development Office (FCDO) has been tackling it through LEGEND (Land: Enhancing Governance for Economic Development), a global programme designed to improve land governance as an essential basis for economic development, and to improve land rights at scale. Programmes such as this will need to be accelerated.

Stronger land tenure is an important way of improving resilience, but other interventions are also key, such as access to finance. A simple example is access to loans with a six-month grace period, to give farmers a chance to harvest a crop before they have to start repayments. At present, such loans are difficult or impossible for many farmers to secure. Banks in LMICs are sometimes undercapitalised and see farming as high risk, which

then prevents farmers from investing in measures which could make their risks more manageable. That cycle needs to be superseded by new approaches which provide farmers with the ability and confidence to move beyond subsistence farming and diversify into higher-value, nutrient-rich crops and livestock, which can improve their income and increase dietary diversity at both a household and local/national level.

Other financial services are also important: climate risk insurance, for example, in which pay-outs to farmers are triggered based on an index or set of parameters, such as rainfall or temperature within a defined place and time. In 2015, Germany, under its G7 Presidency, launched the 'InsuResilience' initiative: a commitment to increase climate risk insurance protection to an additional 400 million people in developing countries by 2020. At the 2015 United Nations Climate Change Conference in Paris, G7 countries reaffirmed their support for the project by pledging US\$420 million; this amount was increased to US\$550 million at the Marrakech Summit in 2016. Maintaining these commitments will be important.

A move towards preventative healthcare coupled with agricultural policy that is more nutrition-centred could see a significant reduction in the strain that diet-related ill health currently places on national health systems. More diverse production and more diversified farming will also build climate resilience. Green technology emerges in these scenarios as a pathway to sustainable agriculture, although accessibility is a concern. For example, drones can be used to scan fields and detect water stress or pest infestations. This may be suitable for large landowners, but less relevant to smallholders. The challenge is to identify and scale-up solutions that work at different levels. Solar-powered irrigation systems specifically designed for smallholders already exist. Again, finance can be a barrier, but prices are declining. For the benefits of green technologies to be felt, they must be diverse enough to offer solutions to small urban gardeners in Kampala as well as large agribusinesses in Nigeria or China.

Finally, increased urban migration can be expected to varying extents in all scenarios. The strain on public services could be immense, as evidenced by Cape Town's recent issues with its





water supply. The impact on nutrition is significant because the urban poor have little choice but to buy food rather than grow it, which means incomes and food prices are important. Shocks in either of these will lead to many people being forced to eat less or eat poorer quality foods, and/or reduce their spending on other basic needs. This can have long-term health impacts (e.g. stunting) and slow down economic development as a whole.

A final word of caution. Taken together, the above scenarios are only a sample of possible futures. Therefore, a mix of policies that would work in all four scenarios would not ensure successful outcomes for other possible developments which might occur. COVID-19 illustrates just how unpredictable the world can be. The scenarios outlined here give some indication of the potential benefit for policymakers to produce and explore scenarios tailored to their own circumstances.



# 9 Transitioning food systems to achieve ambitious new goals

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**The Global Panel urges all nations, including low- and middle-income countries (LMICs) and their development partners, to take urgent action to change the ways in which food systems are currently managed, governed, and used. This is essential to achieve the goal of sustainable, healthy diets for all, which is vital for the health of millions of people and the health of the planet, but also for progress in almost all of the Sustainable Development Goals.**

**The starting point for this report (Part I – Chapters 2 and 3) was a call for policymakers to pay urgent attention to a set of inter-linked and deepening crises: the global nutrition crisis, the climate emergency, and the planet-wide natural resource crisis. Negative feedback loops run through and across these crises: from dietary patterns related to the ways that food is produced, processed and sold, to ecological damage, through to the impacts of climate volatility on food systems and the accumulating health effects of sub-optimal diets. Food systems are at the nexus of these crises. The economic impacts of compounding food system failures are profound, exposing systemic weaknesses and fragility in the face of a dangerous new threat in the form of the coronavirus pandemic.**

**It is LMICs and the poorest in all societies who are likely to suffer most from exposure to climate shocks, to the unsustainability of food systems, and to the livelihood threats posed by ill-health. These threats will only become more severe, and more difficult to rectify, in the absence of appropriate actions across the food system. They are already a reality. Today, a minority of the world's inhabitants eat well. Future food systems need to deliver healthy and sustainably produced diets to everyone. How the transition is managed will be critical, not least to ensure it is orderly and protects the poorest. This report has set out a framework for achieving that.**

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The goal of sustainable, healthy diets for everyone depends on the fundamental reform of the food system. The food system contributes to multiple aspects of planetary degradation and is in a spiral of decline with environmental systems. But reform will only take place if there is political will and commitment to turn aspiration into reality. Without decisive action, policymakers must expect increased inequalities in terms of incomes, health, and diet quality across and within countries, and increasingly fragile and risk-prone food systems degrading the planet's natural systems on a vast scale.

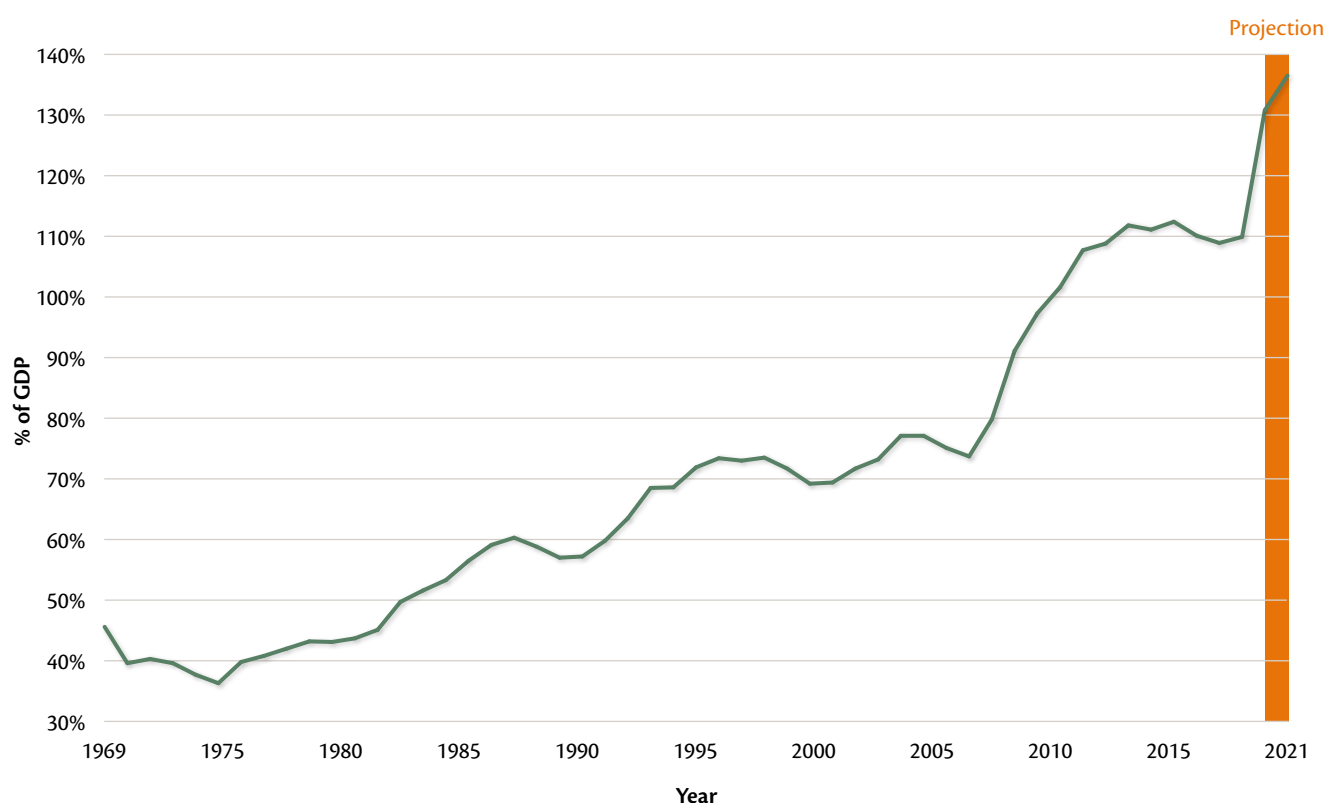
For a century or more, our food systems have been largely successful at delivering what they were primarily designed to deliver: an abundance of relatively cheap staples. That goal remains important, but the benefits fail to address many aspects of malnutrition or inequality, and the dominant business model

is one that has made itself unsustainable. The incentives and disincentives built into current production, marketing, processing, retail, and demand systems reflect the past and prevailing choices of policymakers, businesses, and the expressed demand of billions of food purchasers. This makes any food system transition complex and challenging, but the ways in which decisions are made today cannot be sustained. The choices that drive the interlocked climate and health crises have to change.

Delivering healthy and sustainable diets will require a re-engineering of each domain of the food system. The process of transition, which must start without delay, will not be without challenges. This report sets out a framework for that process (see Chapter 8), and a coherent set of actions (Part II – Chapters 4-7). Upcoming international summits on food systems and nutrition must promote greater donor support to enable all nations to



**Figure 9.1: General government gross financial liabilities, OECD countries**



Source: Financial Times (2020)<sup>480</sup>

move quickly through a transition phase. This chapter lays out the Global Panel's recommended actions, and proposed first steps to making the transition possible.

## 9.1 Turning crises into opportunities

The cost of inaction will rise so fast that no country, rich or poor, will easily cope with its negative impacts by 2030. Estimates of the health and economic burdens likely to beset countries around the world by the escalation of diet-related problems (human diseases, nutritional deficiencies, GHGs, failing food production systems, and more) are estimated at US\$16 trillion per year by 2050.<sup>6</sup>

Those estimates were made before the pandemic. In May 2020, the Organisation for Economic Development and Cooperation (OECD) estimated that wealthy nations alone (not including LMICs) could see government debt rise by US\$17 trillion as a result of collapsed tax revenues, a deep fall in economic output, and rising public sector borrowing.<sup>480</sup> Figure 9.1 illustrates the scale of rising indebtedness for OECD countries, showing the sharp rise that followed the 2007–2008 world food price crisis (the effects of which are still being felt). Debt levels are expected to rise just as sharply in LMICs, representing less total value in absolute terms, but are likely to be just as significant in relative terms.

The huge human and economic costs of the pandemic will be compounded every year by the growing human and economic

costs of unsustainable, unhealthy diets. The expanding deficit in most national budgets due to the continued healthcare costs post-pandemic, lost labour productivity, growing economic inequality and the unpredictable impacts of climate volatility will be highly destabilising for LMICs which already struggle to service high levels of debt.

While the growing debt burden due to the coronavirus is now inevitable, the future costs linked to failing food systems are not. Modelling undertaken for this report on dietary shifts towards food-based dietary guidelines (FBDGs) estimate savings in the range of 10–15% of global GDP, which represents roughly US\$8 trillion to US\$13 trillion (based on 2019 global GDP of US\$88 trillion).<sup>347,438</sup> Another study suggested an 'economic prize' from changing food and land use systems to avoid health and environmental costs at US\$10.5 trillion a year by 2050.<sup>6</sup>

Part of these gains would come from tackling malnutrition in all its forms. For example, there would be significant gains from finally resolving child undernutrition. Ending stunting for a single cohort of children (which would translate into improved schooling, productivity and wage rates) would generate an estimated US\$177 billion per cohort year (at nominal exchange rates), rising to over US\$616 billion per year if exchange rates are adjusted for purchasing power parity.<sup>481</sup> In South Asia, currently home to the highest number of stunted children, a 40% reduction by 2030 (the SDG target) would boost the earnings of the cohort of workers entering the workforce *not stunted* by US\$2,148 billion over their working life; the same calculation for sub-Saharan Africa suggests a net present value of earnings gained by 2030 at US\$588 billion.<sup>482</sup>



## 9.2 Food system transition: who needs to act?

Governments, donors, civil society, food companies and all other stakeholders must work together to deliver food systems which are safer, more resilient, and sustainable. The starting point for transforming food systems lies with global institutions and national governments. The Nutrition for Growth (N4G) Summit in Tokyo and the UN Food Systems Summit both offer important opportunities for governments and donors, but also businesses, to make not just new pledges for nutrition but to agree how to invest in actions which facilitate a transition towards enhanced food systems. The technical recommendations made in Part II of this report can be used to inform concrete proposals for action.

The 2030 SDG target year is, however, poorly aligned with the goals of food system transformation. Given the varied nature of food systems globally, and disparity in capacities and resources to enact necessary change across countries, it is infeasible that transformation could be completed in a single decade. The various transition steps chosen by policymakers in the context of their own specific needs must be clearly planned, feasible and proportionate in their ambition (see Section 9.5). They need to be initiated by assessment of appropriate actions location-by-location, identifying cost-effective instruments, re-purposing, re-balancing, and re-aligning incentives and disincentives across the food system, and establishing effective social protection mechanisms to protect the most vulnerable during the transition. The sequence of actions needs to be tailored to local needs, and be supported by wide stakeholder commitment.

### 9.2.1 Governments and their development partners

Governments have much to gain from the transition of food systems, and they have a lead role to play. The gains to governments will be employment created across the food system, reduced health care costs for both undernutrition and diet-related chronic diseases, and reduced environmental losses associated with ecological degradation and the economic impacts of climate change. The transition process will require wide and sustained support, and a mandate for change.

The principles that should guide government action on food systems are laid out in Chapter 8. These apply to all governments, and not just those in LMICs.<sup>483</sup>

**Specific government policy recommendations laid out in this report include:**

- 1. Rebalance subsidies going to the agriculture sector in ways that better support sustainable, healthy diets.** The challenge is to better align government support away from a narrow commodity focus towards national public health goals, while also shifting resource incentives towards climate-smart agricultural technologies, sustainable approaches to intensification and carbon sequestration, and support for innovations which can catalyse a rapid transition of investments and activities across the food system.
- 2. Rebalance agriculture-related research and development (R&D) to invest in ways that enhance sustainable intensification.** Specifically, this requires ensuring that national and global funding for crop research and other related food systems research be both increased in total, but with a much larger share dedicated to non-cereal crops than at present. This does not mean reducing research on the productivity and protection of staple grains and tubers, but it does mean significantly increasing funding towards similar work on the nutrient-rich foods needed to support sustainable, healthy diets. In other words, the quantity of research funding and support, as well as its balance, must both be improved.
- 3. Bolster research on food systems, not just foods.** An ambitious, forward-facing research agenda must pay close attention to joined-up system-wide investments, the cost-effectiveness of policy instruments used, scalability of innovations, and rigorous documentation of multi-win examples and best practices. The future needs and demands of citizens should be built into the research agenda from the outset. Achieving systemic change will require policymakers to adopt a perspective that encompasses all parts of food systems – from production through to processing, storage, transport, retail and households. This will enable governments to engage with and facilitate actions by all stakeholders, with a view to motivating integrated and concerted action. The economic and environmental feedback loops (positive and negative) associated with altered food product mixes in agriculture and trade, both nationally and globally, must be carefully modelled, measured, and managed.
- 4. Rebalance agriculture technology R&D towards efficiency gains which narrow the gap between higher- and lower-performing producers.** Existing gaps in productivity and output of both staple and non-staple foods must be significantly reduced. Local agroecological conditions, and the availability of (or constraints on) domestic factors of production, such as arable land, water, labour, and capital, must be addressed through new strategies aimed at shifting the product mix both in agriculture and in diets.
- 5. Rebalance relative market prices among foods.** Using a range of policy levers, including taxes and subsidies as appropriate, realign the price of nutrient-rich foods relative to the cheapest locally available staples, and ensure that ultra-processed foods (high in unhealthy fats, sugar and salt) are no cheaper than nutrient-rich foods. This also includes reducing transaction costs along supply chains through investments in market infrastructure and support for technology and innovations which cut food loss and waste.
- 6. Realign public procurement and institutional activities from the goal of feeding people to nourishing them.** The local purchase and programming of meals in schools, hospitals, and prisons should include nutrient-rich foods within healthy diet options.
- 7. Focus national job-creation strategies on enabling an efficient transition of the food system.** While income growth

within agriculture will still be important in the coming decade, the greatest potential for new jobs lies in post-production value-addition and services. Governments should ensure that job promotion, tax incentives, investment subsidies and the promotion of technology innovation are aimed at rapid increases in incomes associated with post-harvest activities in the value chain. One important aspect of this agenda is to facilitate improved hygiene and food safety conditions along all food value chains, especially in traditional informal markets.

8. **Significantly increase funding for effectively designed poverty reduction and pro-poor income growth policies, as well as social protection policies.** Cost-effective programmes are needed on a much larger scale to support the purchasing power and diet quality of the poorest households, and to ensure vulnerable people are much more resilient to crises (including lockdowns during global pandemics). LMIC government budgets are always constrained, but the scope and scale of social protection interventions enacted quite swiftly in the face of the coronavirus crises shows how valuable such programmes can be to protect people from food system disruptions of many kinds. Donor agencies should play a more active role in supporting the establishment and systematisation of effectively managed, diet-supporting safety nets in countries most vulnerable to global and local shocks of all kinds.
9. **Prioritise ecosystem regeneration and food system sustainability.** To first ‘freeze the footprint’ and then invest in reducing that footprint, governments must increase budgets relating to agriculture, health, natural resources, transportation and market development, dedicating these funds to coherent cross-sectoral activities required to sustain food system support for sustainable, healthy diets. This would include repurposing land for carbon sequestration and enhanced ecosystem services. The pandemic has also highlighted the need for all nations to conserve natural habitats and provide enough space for wild animals to live without overly close human interactions. Adequate protection from poaching and trapping is also important since this may increase the risk of zoonoses and related virus mutations.
10. **Invest in a next generation of enhanced food-based dietary guidelines (FBDGs).** These are needed as part of building a mandate for change, and they have the potential to inform and guide policymaker actions, not simply to inform or encourage individuals. They must contain much more information and evidence on the impacts of food choice on natural resources and climate, as well as the implications for human and planetary health of healthier, more sustainable dietary patterns.
11. **Promote data-driven accountability of SMART commitments made by actors in the run up to the Nutrition for Growth Summit in Tokyo, now scheduled for 2021.** A robust accountability mechanism that uses better data and measurement in nutrition is essential to drive equitable progress and leave no one behind. An important adjunct to this specific recommendation is the need for

much greater investment in evidence building, database management and dissemination of information relating to all aspects of national and local food system functions. The urgent need for robust science to answer key questions on appropriate policy actions to achieve sustainable, healthy diets cannot be over-stated.

12. **Use the upcoming summits to catalyse global support for a science-based policy agenda, including agreeing specific ways to improve and build on existing mechanisms to support science and policy engagement with sustainable food systems transformation.** Policy decisions based on the best available science and evidence will be more cost effective, better focused, and more readily accepted by key stakeholders (see Section 8.3.1 and also Box 9.1). Moves to ensure greater clarity and transparency in global and local actions towards sustainable, healthy diets should build on, strengthen, and complement existing inter-governmental mechanisms which influence the world’s agendas on agriculture, food, and climate.
13. **Strive to keep food trade functioning as seamlessly as possible.** This will be important in a post-pandemic world. Indeed “global supply chains and co-operation are themselves a source of resilience, allowing countries to focus on their strengths and share expertise”.<sup>459</sup> The supply chains and the co-operation must be significantly enhanced rather than disrupted to build resilience, equity and sustainability into their fabric. The potential exists – and should be urgently considered in the context of World Trade Organization negotiations – for stronger agreements on maintaining a smooth flow of food via global trade during multi-country crises as well as between crises.

It is important to highlight that while each of the 13 actions applies to every government in the world, in practice there are important additional recommendations which must be considered as primarily **high- and middle-income country responsibilities**. These include:

1. **Pay attention to how domestic actions in high-income countries are likely to influence food availability, accessibility and affordability in other settings.** This applies particularly to low-income food deficit countries, when designing and implementing domestic food policies of all kinds. Pursue a ‘do no harm’ principle by off-setting any negative impacts for those nations through targeted fiscal, trade or other mechanisms.
2. **Actively pursue politically viable conclusions to outstanding multilateral agriculture and food trade agreement issues.** Make binding commitments to resolving and avoiding future bilateral impediments to effective trade flows (and retaliatory measures).
3. **Realign donor policy priorities towards supporting actions which promote simultaneous achievement of planetary and human health goals.** Significantly increase funding support for cost-effectively changing

the mix of food products and technologies in agriculture. Ensure a wide understanding that sustainable, healthy diets are a key driver of success for the SDGs and beyond. Make major new commitments to accelerating progress in improving malnutrition in all its forms. Adjust international poverty lines to account for the affordability (or lack thereof) of sustainable, healthy diets and support national governments to update domestic poverty lines and public investments accordingly.

4. **Establish significantly increased funding for new research agendas focused on measuring ‘what works?’** This can improve sustainable, healthy diets across geographies, income groups, and cultures over time. The grand challenge of this decade is to link climate modelling with equivalent initiatives aimed at economic modelling and natural resource modelling to understand food system patterns, dynamics and trends. A range of innovative policy instruments and programmes must be rigorously assessed in terms of cost-effectiveness across multiple outcomes or ‘wins’ simultaneously (for example health and nutrition, incomes, resource use and climate impacts).
5. **Explore a dedicated Global Financing Facility for the transition of food systems.** Use N4G and the UN Food Systems Summit to discuss multilateral resource mobilisation which supports and incentivises increased allocations of domestic resources towards making food systems more resilient and diets more sustainable and healthy.

### 9.2.2 Commercial food companies

The food industry exerts very substantial influence throughout the food system. Commercial food companies need to have an improved evidence base upon which to make more informed decisions about investment patterns, their responsibilities to citizens, the impact of their products on human health and food system sustainability, product R&D, and retail and advertising strategies. At the same time, governments have a crucial role to play in leveraging business investments by providing more extensive and effective regulation, oversight, and responsibility and by incentivising best practice. This is likely to be most successful through the development of a trusted (rather than adversarial) relationship. The aim should be to agree a common agenda of promoting sustainable, healthy diets, while respecting that each operates under different constraints.

Companies must be persuaded to revise the ways in which they currently operate. Under a business-as-usual scenario, many companies profit from a food system that exploits natural resources and influences individual choice towards an increasingly wide range of ultra-processed foods. The benefits accrue mainly to industry stakeholders while the costs (population-wide ill health, ecological degradation, natural disasters) are mainly borne by the public sector and wider society. That imbalance will have to be addressed during the transition.

Many businesses will need to adapt. There will be costs involved in adjusting investment portfolios towards fresh strategies focused on providing diverse, perishable, nutrient-rich foods

to a much larger consumer base. There will also be costs involved in compromised market share for some ultra-processed foods as profitability falls in line with reduced demand, rebalanced relative prices, and greater government regulation (taxes and subsidies) across dietary goals.

Many companies stand to gain from the potential for innovation in business models, technologies, and product shifts. They will also gain from enhanced productivity through a well-nourished workforce. However, a transformed food system requires a shift away from reliance on ultra-processed foods as the bulk of the grocery bill. Profits and market share in that space will be squeezed and companies in the food product, retail or service space will have to accept the need for strategic investments aimed at supporting different future demand patterns. That represents a normal cost of doing business.

The following key actions are needed:

1. **CEOs lead this agenda**, ensuring that all employees understand each company’s links to and impacts on food systems, and their potential role in supporting change. The governing boards of companies should play a major role in monitoring and rewarding actions which translate aspirations into genuine results in the form of public goods.
2. **Support greater understanding of the source and hidden costs of all foods in the retail domain** through engagement with national and local business associations, including chambers of commerce. This will mean that governments must engage with all commercial stakeholders in defining how the businesses should be incentivised to play a much bigger role in achieving national goals in public health and food system sustainability.
3. **Support healthy diet choices.** Food industry stakeholders must accept responsibility for partnering with national governments to support a public health agenda which pursues sustainable, healthy diets.
4. **Commit to reducing the price of nutrient-rich, perishable foods relative to cheapest staples** to support the affordability of healthy food choices.
5. **Substitute sales of ultra-processed food products with nutrient-rich foods**, reformulate products to reduce levels of sodium and added sugars significantly, and phase out unhealthy ingredients (such as trans fats).
6. **Reduce food loss and waste in line with SDG goals.** This applies to commercial food companies (wholesalers, new product producers and retailers). In the case of producers, enhanced production and harvesting practices, as well as post-harvest gleaning<sup>xvii</sup> can make a large contribution to reduced farm-based losses.

<sup>xvii</sup> Post-harvest gleaning is the collection of discarded perishables (fish or fruits not meeting supermarket aesthetic quality standards) and the collection of ‘broken’ grain on the ground.



7. **Make perishable, nutrient-rich foods accessible year-round.** Increase the number of weeks each year during which nutrient-rich foods are available in the market. This will require innovations in packaging, cold storage, transportation, and retail distribution.
8. **Commit to clear targets and plans for reduced emissions/carbon footprints for all commercial food activities.** Each commercial entity must seek to lower their natural resource and/or climate impacts, while also seeking ways in which to support carbon sequestration and ecosystem regeneration through their activities.
9. **Commit to a significant reduction in energy and other inputs,** investing in production and processing efficiencies, reduced leakage of energy (heat/cold loss, water, and gas waste, etc.), and a significant adoption of renewable energy.
10. **Increase private R&D to support locally appropriate nutrient-rich foods and share related intellectual property with public research entities.** This would add huge value to the public research agenda and serve as a genuine contribution in terms of Corporate Social Responsibility (CSR) or blended financing models.
11. **Improve workplace canteen food choices to support healthy diet choices.** Increase the selection of nutrient-rich foods available to workers and use meal spaces to enhance people's knowledge and insight regarding the implications of dietary choices on health and the environment.

### 9.2.3 Civil society and citizens

The benefits of a transition towards a new food system will be an opportunity for most people to eat better, leading to improved health, less time lost at work due to sickness, reduced out-of-pocket costs for treatment of sickness, and less dependence on social safety nets. For children who would otherwise suffer one or more forms of malnutrition, their physical and mental development would be enhanced, leading to increased earning potential through life. There will be job opportunities across the food system in countries where governments choose to support innovation and growth across all value chains, as well as less exposure, particularly in LMICs, to climate-related shocks.

Reduced spending on ultra-processed foods and sugar-sweetened beverages (SSBs), and higher purchasing power deriving from higher and more equitable incomes, will be important goals to be promoted by advocacy groups and non-governmental organisations. These groups have important roles to play in supporting people's awareness, influencing patterns of demand, and protecting the rights of all individuals to high-quality diets.

Individuals have the potential to drive change, both through their own diets and through their collective demands on the food system. But they need to make informed decisions to shift food systems in different directions. The changes needed in diets will require enhanced awareness of the natural resource and health implications of food choices, supported by higher and more

equitable incomes, shifts in the relative prices of food products, and the management of supply chains to reduce loss and waste. Everyone should be able to demand sustainable, healthy diets for their own benefit and for the benefit of all. They need to be informed, capable of accessing nutrient-rich, sustainably produced foods, and have the purchasing power and desire to make these choices. Individuals have a primary responsibility for their own health, but they also have a responsibility for their contribution to public health challenges and to the planet's biological integrity.

The following are objectives and changes which are needed by civil society, action coalitions and advocacy groups:

1. **Promote and facilitate a vision for a food system transition.** Local and international civil society organisations and action coalitions should urgently engage with policymakers and other stakeholders to this end. Local governments, professional associations, private charities, and religious entities all have an important role in supporting national change agendas but also in mobilising grassroots engagement with, and support for, such change. Advocacy should always be based on rigorous science and seek to support cost-effective policy actions.
2. **Establish rigorous and transparent mechanisms for monitoring and reporting.** These mechanisms can track commitments made by governments and businesses, and actions and outcomes, to ensure strong accountability mechanisms.
3. **Advocate for institutional investors and asset managers to link human and environmental health goals to their core strategies.** The ethics-focused 'sustainable investing market' is growing fast, requiring that investment mechanisms pay increasing attention to longer-term societal goals beyond profit. Civil society has a potentially powerful role in advocating and monitoring the engagement of business actors and social enterprises supporting the goal of achieving co-benefits to people and planet of transformed sustainable food systems.

It is accepted that the various tasks set out in the previous subsections (9.3.1–9.3.3) may appear daunting. However, looking across all of these, 10 priorities are proposed which are considered to be generally applicable. These are set out in Box 9.2.

## 9.3 Improvements to facilitate science-to-policy action: inter-governmental backing is needed

Decisions regarding steps to be taken in a transition towards more sustainable, healthy food systems should be guided by the best available science and evidence. The coronavirus crisis once again exposed how mistrust and manipulation of science can sow confusion, lead to misplaced government spending, and risk lives. Appropriate policy actions must be based on a robust foundation of science and evidence of costs and benefits.

Governments will need to assess the impact of their policy choices relative to food system goals: human health supported by diets which are sufficient, diverse, nutrient-rich and safe, and environmental health via ecosystem restoration, repurposing of land use and vastly increased agricultural efficiencies. This assessment calls for multi-sectoral coordination across sectors which influence food systems. Each country has a responsibility to ensure that nutrient-rich foods are made available but with a reduced carbon footprint.

Government leaders and development partners should work together without delay to agree on concrete ways to improve and build on existing mechanisms to support science and policy engagement with sustainable food systems transformation (see Box 9.1). Such improvements would enhance what institutions such as the FAO are already mandated to offer in terms of normative guidance relating to agriculture and food. The aim would be to provide the robust foundation of science and evidence on which a transformative policy agenda for the global food system could move forward both with authority and efficiency.

The improvements should be underpinned by inter-governmental backing to help ensure the resulting science and evidence is driven

by the most pressing needs of policymakers, and to ensure uptake of the results. The improvements would build on, and be entirely complementary to, existing efforts and need to add value in three ways:

1. Establish a credible and authoritative consensus on the evidence, while reflecting diversity of opinion and lack of consensus across disciplines and countries. Resolve key issues with new research.
2. Improve efficiency in research by improving exchange and coordination among science disciplines and research efforts at scale as well as between science and policy domains. Specifically, better link science practice across climate, natural resources, food, health, and nutrition.
3. Increase transparency in the synthesis and assessment process based on rigorous peer cooperation and review. Raise the profile of food systems so that they are widely understood as a necessary focal point for policy action. Increase the legitimacy of assessments and recommendations, ensuring a more rounded and global evidence perspective, inclusive of research from different geographies.

### Box 9.1: Improved support for policy decisions: key tasks and functions of improved science and evidence mechanisms

**Resolving controversies.** Along with regular assessments on the state of science, an authoritative and trusted mechanism is needed to resolve controversial and conflict-laden assessments: on nutrition interventions, market stabilisation policies, technologies and innovations (potential, risks, regulation), land use change, land ownership (including land investments) and multi-level governance structures and responsibilities that often slow decision making.

**Identifying data and knowledge priorities.** This role would be critical in view of the very important gaps in current knowledge which urgently need to be filled. In particular, there are substantial data gaps in the current understanding of food systems. For example, many of the private enterprises operating in local and regional food systems are SMEs which are unlicensed and unregistered. Also, global, corporate food industries are generally extremely protective with their data. Exactly which people (by age, sex, residence, income level) eat which diets and why, is little understood. The relationship between diet and nutritional status in various settings also needs to be better studied. This is highly variable because of differences in access to water, sanitation and hygiene, nutritional beliefs, and social mores. The productivity ceiling for key commodities/foods is also unknown, especially with regard to the potential for greater dietary diversity.

**Modelling.** The same ambitious methods used in the past decade to model future climates and agricultural impacts must be matched by modelling the economics of diets, and

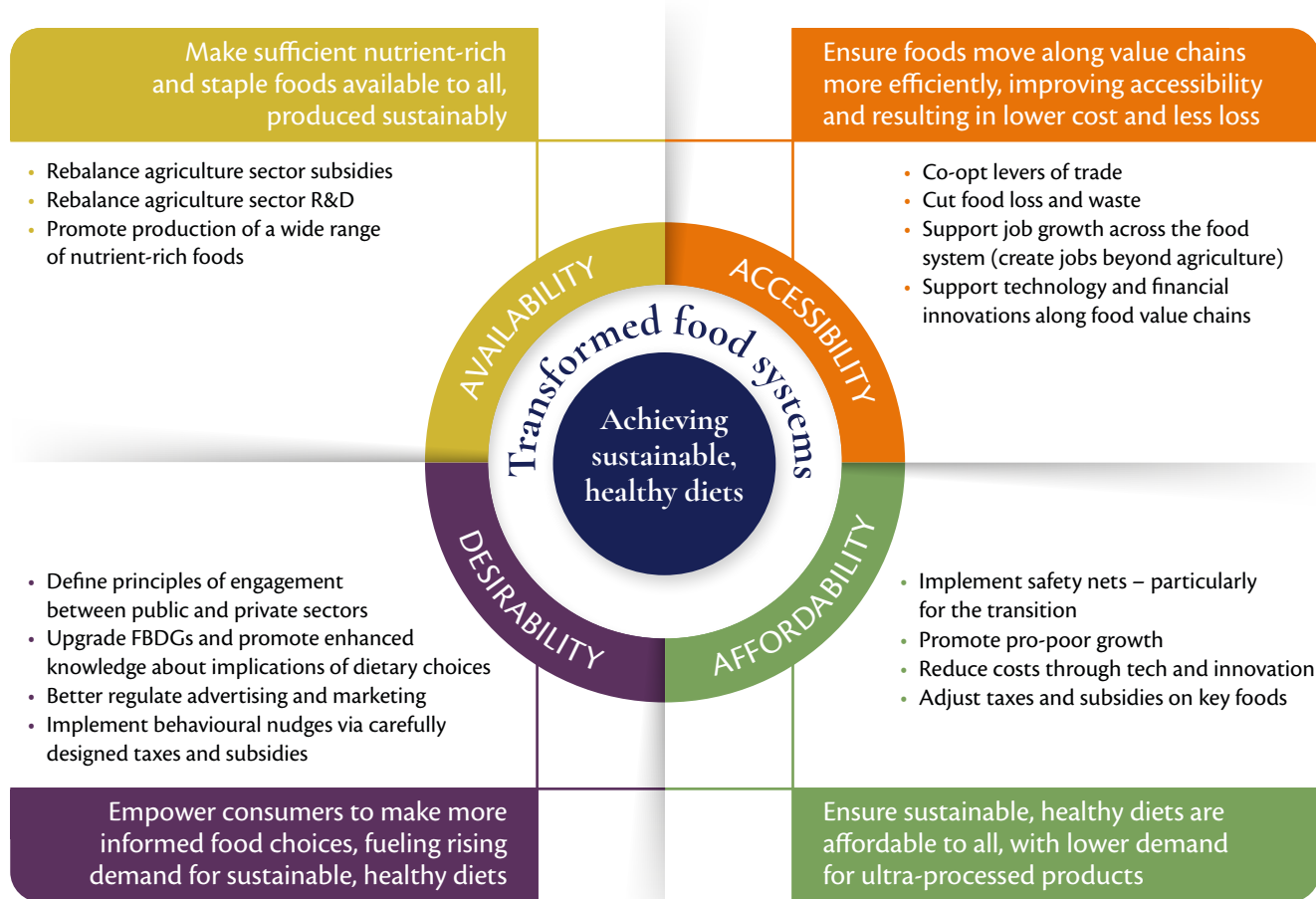
the multidirectional relationships among diet, human health and planetary boundaries.

**Streamlining and coordinating research.** There is a need to facilitate new divisions of research tasks and efforts, and to help overcome current duplications, as well as the limited scale of science engagement. The aim would be to improve the efficiency and cost effectiveness of existing research funding.

**Facilitating peer-reviewed assessments on food and nutrition security.** This is needed to deliver evidence-based analyses for action. This function goes far beyond any of the existing science advisory bodies for policy at national or international levels. The entire international science system related to food and nutrition security, and food production and harvesting, needs to be engaged in inclusive ways for the purpose. Policymakers need to carefully consider a set of criteria such as:

1. How to enhance the use of evidence across many sectors in decisions on policies and investments across the food system.
2. Political and organisational feasibility of actions proposed.
3. Costs, including transaction costs of actions including how these would change over time, who would bear them, and importantly, how the poorest could be protected from increased food prices during the transition.

**Figure 9.2: Priority policy actions to transition food systems towards sustainable, healthy diets**



Source: created by authors

The Global Panel notes that the idea for a creation of an organisation like the Intergovernmental Panel on Climate Change for sustainable food systems (an 'International Panel for Sustainable Food Systems', or IPSFS) has been mooted in recent years. This is one of a number of ideas that could be considered to deliver the necessary improvements in the support of science and evidence for policymakers. However, whatever organisational structure is used to deliver the improvements, Box 9.1 provides an outline of the proposed scientific tasks and functions which are needed. These functions are informed by the experience of the Intergovernmental Panel on Climate Change (IPCC).

## 9.4 Getting started: managing the transition

The set of actions recommended in this report may seem daunting, especially to LMIC governments burdened with many existing priorities, competing advice from donors, severe fiscal constraints, and limited space for political manoeuvre. This is a reality to be acknowledged and addressed. It is important, therefore, to spell out not just what should be done, but how policymakers should start engaging with this complex multifaceted agenda, and how their development partners can realign current economic and technical resources to more fully support new national priorities.

The transition process itself needs to move forward on multiple fronts simultaneously (Figure 9.2). It will never be enough to pick one or other domain of action, or one or other policy instrument alone. Put simply, if people are not empowered to spend more (through higher incomes and purchasing power) on diets that they know (through information and education) to be both sustainable and healthy, such foods will not become available to them because retailers will not stock them. Effective demand must therefore be better informed and incentivised, while different foods must be made more desirable and aspirational, primarily by commercial food companies.

The transition requires actions to promote both supply and demand, but also appropriate support for key interventions in the middle segments of supply chains where value addition through processing and marketing all take place. The four domains of intervention, associated with the four technical chapters that together comprise Part II of this report, are therefore inseparable. What must change remains clear:

- Sufficient nutrient-rich and staple foods produced sustainably must be *available* to all.
- Foods must move along value chains more efficiently, becoming more *accessible*, with lower costs of doing business and less food loss.
- Sustainable, healthy diets must be *affordable* to all.
- For sustainable, healthy diets to be *desirable*, individuals must be empowered to make more informed food choices, thereby fuelling rising demand.



Figure 9.2 lays out how the priority actions in this report's recommendations relate to the four critical domains of food systems. While there are highly significant benefits to be realised where fundamental change is achieved, the individual actions recommended in each of the figure's quadrants will be most effective when undertaken in concert.

The technical or political feasibility, and the need versus cost, of each of these recommended actions will vary depending on context. To achieve a particular outcome could entail a range of possible configurations of actions in one or more of the four action domains. Figure 9.3 illustrates this idea by suggesting that the actions required in each of the four domains can, under different contexts or scenarios, have more or less relevance to desired outcomes locally, and therefore must be selected based on the key parameters of cost relative to benefit (where benefits are determined in terms of natural resource and broader environmental terms, not just in economic or human health terms), as well as political and technical feasibility across alternative options.

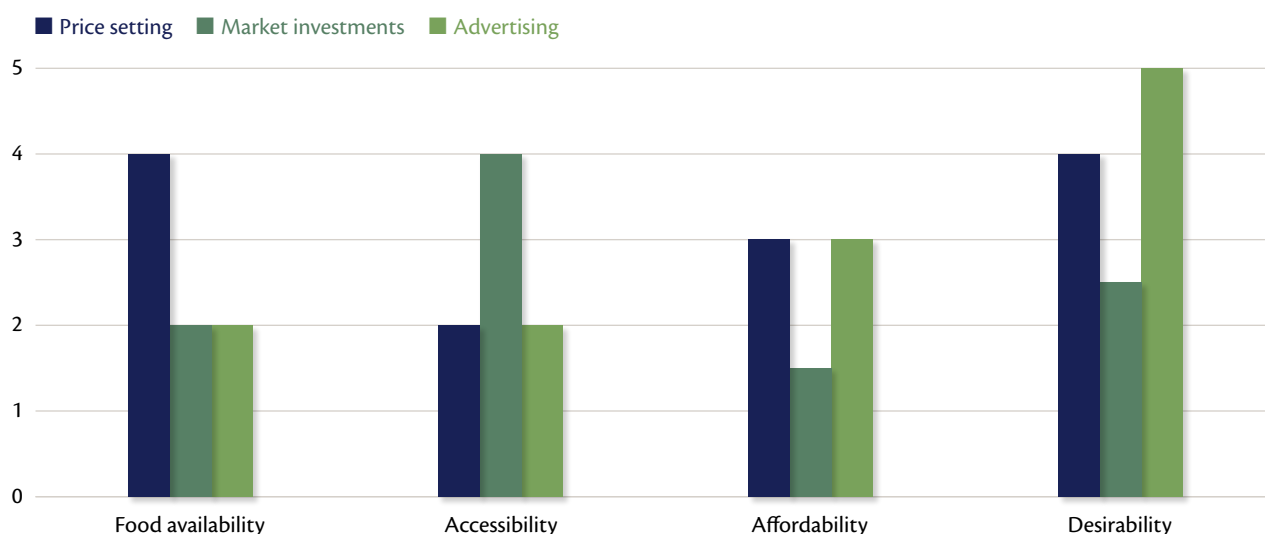
A number of important **first steps** are needed for initiating the process of policy and investment transition. In particular, the following are about establishing necessary governance structures as well as ensuring appropriate linkages are in place. They will apply in most contexts.

1. **Establish an independent high-level commission of trusted experts and thought leaders to 'make the case' for investing in the time and effort needed to transition domestic food systems to support fundamentally different outcomes than today.** They would:
  - distil evidence pertinent to local conditions,

- cost out bundles of policies, and estimate their benefits relative both to costs of intervention but also to the economic costs of inaction, and
- present domestic priorities for government as well as for food industry stakeholders.

2. **Empower cross-party and cross-ministerial working groups to identify ways to reconcile trade-offs across sectors, including agriculture, health, and environment, as well as balancing short-term gains against long-term losses for different constituencies.** The feasibility of adopting and implementing key policies depends heavily on how individual and group preferences are derived, and on the role of information in shifting those preferences.
3. **Establish linkages with the World Bank and other multilateral agencies to collaborate on modifying international poverty line and purchasing power parity (PPP) calculations.** The aim is to update the calculation of national poverty lines in ways that pay attention to the affordability of healthy diets as recommended by national guidelines and based on current national food prices. The new (higher) poverty thresholds would be used to enhance the value of income and other resource transfers through safety nets, minimum wages, and pro-poor growth policies to ensure that millions more people can afford at least minimally adequate diets.
4. **Empower subnational authorities to assume practical responsibilities for the transition.** Countries as diverse as Ghana, Kenya, Nepal, Pakistan, and Zambia have been devolving some sectoral responsibilities, in both agriculture and health, to elected sub-national authorities. These trends

**Figure 9.3: Illustration of how priority actions may differ across contexts and domains, but still lead to desired cumulative outcomes**



Note: The numbered Y axis suggests degree of impact of a chosen intervention from 0 (not effective) to 5 (highest impact). The actual examples of interventions are purely illustrative, not based on actual data or analysis.

Source: Created by authors

recognise the need for vertical coordinating mechanisms which reconcile variations across sub-national administrative units in capacity, finances, and political influence. It also means that global and regional commitments on climate change and food security need to be balanced by ongoing decentralisation processes which aim to prioritise local citizens' needs and priorities.

5. **Build engagement and momentum across all stakeholder groups about the gains associated with a food system transition through a series of national, regional, and local dialogues.** Gauge understanding of, and support for, change which promotes both human and environmental health.
6. **Establish specific responsibilities and accountability mechanisms to allow commercial and civil society entities to take ownership of various parts of the transition process.** They can be tasked with finding actionable solutions to challenges at the interface of consumer and the retail environment.
7. **Actively engage at regional and global levels with UN and other initiatives supporting the setting of targets for a successful food system transition.** This includes championing national scientists working in this space and promoting the need for independent consensus on priorities and appropriate practices.

Each of these steps is separately important, but collectively powerful; each can be initiated immediately. They can then be amplified in the context of upcoming global summits relating to food systems, climate change, and nutrition. A more granular identification and selection of locally viable and impactful policies and programmes would represent the next step. This involves implementing those actions carefully (well-designed and monitored), coherently (across domains and reconciled with existing policy frameworks) and effectively (measuring aggregate net benefits against detailed assessment of costs). These steps represent ways to promote government leadership for collective endeavour around commonly defined goals.

## 9.5 Concluding remarks

Today's food systems are in a spiral of decline, placing both human and planetary health in jeopardy. Millions of people are suffering from diseases, growth impairment and productivity deficits linked to inadequate diets, while food systems are operating beyond planetary boundaries. These negative trends put a brake on development, meaning that national governments, particularly in LMICs, face huge economic burdens and risk not achieving many of the Sustainable Development Goals. When current trends and the multiple impacts of the COVID-19 pandemic are taken into account, there is no real prospect of the SDG2 goal for 2030 being met. Failure to meet this and other SDG targets will lead to more people experiencing inequality and malnutrition, and cause even greater environmental damage. This report's recommendations offer a pragmatic way forward: if the right decisions and investments

are made today, there is potential to not only avert catastrophic damage to human health and the environment, but to secure massive benefits from positive change.

A strategic focus is needed on catalysing, supporting, and facilitating new business models, investments, technologies, and practices across the whole food system. This means ensuring appropriate government policies not only focus on a sector (such as agriculture or health), but also on a system of activities encompassing the complex value chains that convert commodities into food products which enter people's diets. The growth potential from investments in a future-facing food system is substantial. Already the food sector (agriculture, processing, wholesale/retail, institutional procurement, food service, and food-related R&D) is the single largest employer across most of the world. Modern approaches to production, transportation, packaging, and digital retail have already transformed an 'old sector' into a vibrant 'new' economy in countries as different as Senegal, Sri Lanka, and Singapore.

But a more fundamental transition toward sustainable, healthy diets is essential. As with the fossil fuel transition, it will eventually become so costly to *not* change, that change risks being forced upon us, leading to a transition that will likely be more unjust and challenging. An effectively managed transition, starting now, is critical. Box 9.2 provides 10 priorities for the transition which are considered generally applicable. However, local conditions are likely to be important. Locally tailored strategies are needed which pursue pathways toward multiple gains, incorporating the recommendations made here, bringing together the many actors through appropriate incentives and regulations, and more clearly articulating the benefits to be gained while being transparent about the costs.

This will require a major overhaul of the governance of the global food system, involving a move towards enabling different nations and communities to develop their own unique responses. It will enable a 'just' transition in which the poorest are protected and all stakeholders are involved in shaping a jobs-focused strategy which unleashes the compounding potential of the food system as a whole (not agriculture as a source of cheap calories and foreign exchange), and which involves climate-smart investments to make the entire system more resilient and nurturing of human and planetary health for current and future generations.

While the gains of the past must be respected and protected (feeding more millions than ever before in human history), the future focus must be on food systems which *nourish* all people in ways that respect the planet's boundaries.

This remains the paramount challenge. The outlook is bleak, but this report shows that the future is not set in stone. By casting the problems into their constituent parts, this report has set out a range of pragmatic and achievable actions which together, can reverse the current situation. The Global Panel believes that with renewed leadership and sustained action, these new opportunities can be grasped. The moment has come to commit to the challenge.

## Box 9.2: Ten priorities for transitioning food systems to protect human and planetary health

The report contains many recommendations for action by different classes of stakeholders, and which need to take account of local circumstances and constraints. However, the following priorities are considered to be generally applicable:

- 1. Policy makers must build on existing global development targets (such as the SDGs and the Paris Agreement on Climate Change) so they embody the goal of sustainable, healthy diets for everyone as a shared objective.** These targets need to recognise the central importance of sustainable, healthy diets as a key enabler for progress on diverse agendas – equality, economic growth, climate change, the environment, and job creation.
- 2. Policy makers in relevant government departments must address planetary and dietary challenges simultaneously, since they are so fundamentally interlinked.** The approach to date, involving tackling these issues piecemeal and in silos, simply will not work.
- 3. Donor agencies must support LMICs to ensure that the transition of food systems is socially and ethically just.** They have an important role to play to ensure that the poorest are protected during and after a period of food system transition.
- 4. Governments in countries at all stages of development must resolve policy distortions which could fundamentally impede change – or even drive food systems in the wrong direction.** Examples include: taxation and regulation, subsidies, and food-related research and development. The aim is to give much greater weight to the importance of nutrient-rich foods and to better support measures which further both human and planetary health simultaneously.
- 5. Relevant ministries (e.g., agriculture, health, transport infrastructure, environment) need to work together to implement policies to realign production systems so that they support healthy diets in sustainable ways.** Food systems today do not produce enough nutrient-rich foods to meet today's needs, let alone projected demand over coming decades, nor are they producing most foods sustainably. Narrow targets relating to productivity need to be replaced with broader measures valuing efficiency and sustainability.
- 6. Major trans-national businesses and local SMEs must work closely with the governments on more clearly articulated common agendas to deliver sustainable, healthy diets.** While already contributing much, the many diverse commercial actors too often pull in directions that are not conducive to health or to the sustainability of food systems. It is important for governments to incentivise businesses to make a much wider range of nutrient-rich foods affordable to the entirety of 'bottom of the pyramid' families. More generally, a comprehensive framework for food-industry engagement is needed.
- 7. Policy makers in relevant government departments need to prioritise building resilience of food systems – COVID-19 has highlighted their current deficiencies and vulnerabilities.** A broad approach is required which addresses: the causes of lack of resilience within food systems, the root causes of the threats, and mitigation measures which may be needed during times of stress.
- 8. Civil society advocacy groups and citizens need to play their part. The former have a major role in leveraging change in businesses operating across food systems and holding policy makers to account, and the latter have considerable influence to drive change through their purchasing power.** However, shifts in demand in favour of sustainable, healthy diets, will need encouragement and empowerment through information from trusted sources.
- 9. Policy makers in relevant ministries in LMICs should creatively target actions which can create multiple 'wins' across health and sustainability.** Opportunities need to be sought throughout food systems from farm-to-fork. Major projects in sub-Saharan Africa and South Asia have already shown that this is possible, creating substantial and lasting benefits in terms of jobs, equality, and the development and prosperity of individuals and regions. Technology innovations across food systems from production through processing, storage, and retail hold considerable promise.
- 10. Leaders and decision makers should capitalise upon upcoming global fora to agree to new commitments for making food systems more resilient and diets that are healthy and sustainable.** The Nutrition for Growth (N4G) Summit and the United Nations Food Systems Summit are important opportunities to explore the creation of a dedicated Global Financing Facility for food systems transformation and to secure national endorsements for change, including much improved capacity for research and evidence to better support policy decisions. A new vision for sustainable food systems delivering healthy diets for all must be supported through the best science and evidence of what works as informed by practical evidence.



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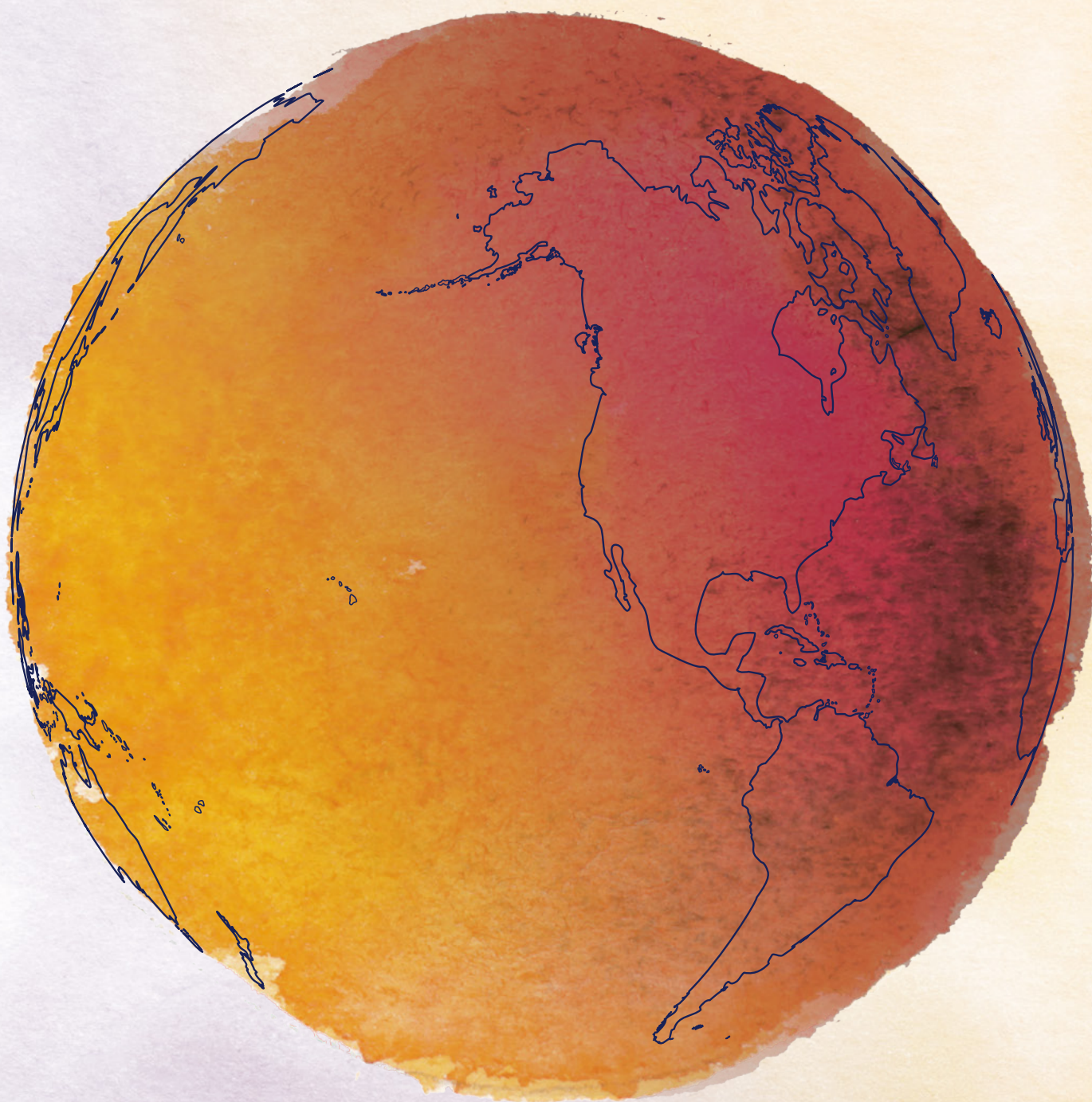
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